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PARENTAL FEEDING STYLE AND CHILDHOOD OBESITY

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ABSTRACT

This thesis examines the association between parental feeding and children's eating behaviour and adiposity. Past research is inconsistent, with some studies finding that higher parental control is associated with adverse effects in terms of unhealthy food choices, disordered intake regulation and obesity, and others indicating positive effects. Discrepancies may relate to variability in parental control measures, sample characteristics and research methods. Study 1 examined the factor structure of two existing measures of parental feeding in 190 parents of 3-5 year olds, and Study 2 added interview and diary data in a sub-sample of these parents. Several distinct dimensions of parental control emerged and a wide range of motivations underlying feeding practices was apparent. In Studies 3 and 4, control was assessed using an improved measure in a socio-economically diverse sample of 541 parents. Pressuring to eat and instrumental feeding were more common in lower socio-economic (SES) parents, while restriction was more frequent with higher SES. Child adiposity was unassociated with restriction or instrumental feeding but negatively associated with pressure to eat. This relationship could be partly explained by parents' putting more pressure on thinner children with less appetite for food, although other explanations also fit the data. Study 5 added to the longitudinal literature on parental control, finding a negative prospective association between pressure to eat and weight gain from 4 to 7 years. Study 6 assessed regulation of intake over a two-part meal in a sample of 4-5 year olds, and found some evidence for a negative association between regulation and parental monitoring. Study 7 showed that children with slower eating rates and lower meal intakes had parents who exerted more pressure to eat, but found negligible associations between parental feeding and eating without hunger. The importance of these findings for understanding how parents influence children's weight is discussed.

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CHAPTER 1
Obesity and the role of parents

1.1 The obesity epidemic

1.1.1 Prevalence and trends in overweight and obesity

Obesity in adults. Over the last 20 years, we have witnessed an unprecedented increase in population body weight, to the extent that the World Health Organisation has declared a global epidemic of obesity (WHO, 2000). The latest US figures, based on data from the National Health and Nutrition Examination Survey 1999-2002, estimate 30% prevalence of obesity in adults over 20 years, with a further 35% of individuals overweight (Hedley et al, 2004). These figures are more than double the prevalence recorded in 1976-1980 (Flegal et al, 2002). The situation for UK adults is similar, with data from the Health Survey for England (2003) putting obesity prevalence at 22% in men and 23% in women, and overweight at a further 43% in men and 33% in women. This represents a trebling of obesity prevalence since 1980.

Neither is the obesity problem confined to industrialised countries - international data demonstrates a steady mean increase in BMI across all regions of the developed and developing world (James et al, 2001), with recent figures suggesting that the prevalence of overweight exceeds the prevalence of underweight even in developing countries (Mendez, Monteiro & Popkin, 2005). Excess weight in the UK, US and other industrialised countries tends to be socially graded, with higher prevalence in lower socio-economic groups (Flegal et al, 1998; Sundquist & Johansson, 1998). There is also some evidence for ethnic differences, with higher obesity among Mexican-Americans and black Americans in the US (Hedley et al, 2004), and in Indian, Pakistani and Black-Caribbean groups in the UK (Rennie & Jebb, 2005).

Obesity in children. Less comprehensive prevalence data are available for children, in part because of a lack of consensus on how child adiposity should be measured. Defining overweight as at or above the 95th percentile on sex and age-specific BMI charts, Hedley et al (2004) report 16.1% overweight in 12-19 year olds, 15.8% in 6-11 year olds and 10.3% in 2-5 year olds in the US in 1999-2002, compared with

10.5%, 11.3% and 10.4% respectively in 1988-1994. When overweight is defined as >85th percentile, these figures swell to 30.9% excess weight in 12-19 year olds, 31.2% excess weight in 6-11 year olds and 22.6% excess weight in 2-5 year olds. Estimates for boys and girls are similar, but slightly higher for boys. Examination of trends since data were first gathered in the 1960s demonstrates that the combined prevalence of overweight and obesity among US children and adolescents has more than doubled, while the prevalence of obesity has increased fourfold (Flegal et al, 1998).

Other studies have adopted criteria developed by the International Obesity Task Force (IOTF) (Cole et al, 2000), which take the percentiles for BMI at 20 years that correspond to the overweight and obesity cut-offs in adults ($25kg/m^2$ and $30kg/m^2$) and use those same percentiles throughout the age range to specify overweight and obesity in childhood. Using this method, Lobstein, James & Cole (2003) reported excess weight (i.e. overweight and obesity combined) of 17.0% in 7-11 year old boys, and 23.6% in 7-11 year old girls surveyed in the Health Survey for England (1998), representing a 60% rise since 1994, and a 150% rise since 1984.

The problem also extends to younger children. Examination of figures from the Health Survey for England (2002) by age demonstrates around 22% prevalence of excess weight in 2-5 year old boys, and 30% in 2-5 year old girls (see Figures 1.1 and 1.2). Waist circumference has also been used as a more direct estimate of subcutaneous and internal adiposity, and two recent studies have shown a 6cm increase in the mean waist size of UK 11-16y olds over the last 10-20 years (McCarthy et al, 2003), paralleled by significant increases among 2-5 year olds (McCarthy et al, 2005).

Mirroring the pattern found in adults, overweight tends to be more common among children from low SES families (Wang ~~et al,~~ 2002), and is more common in black American and Hispanic groups than in whites in the US (Hedley et al, 2004), and more common in afro-Caribbean and South Asian children in the UK (Saxena et al, 2004). High prevalence estimates have also been described in countries throughout Europe (Lobstein & Frelut, 2003), and the latest IOTF figures estimate that 10% of 4-11 year olds in the world are now carrying excess body fat, with 2-3% obese (Lobstein, Baur & Uauy, 2004).

Figure 1.1: Overweight and obesity prevalence by age for UK boys (IOTF criteria)

Source: Health Survey for England, 2002

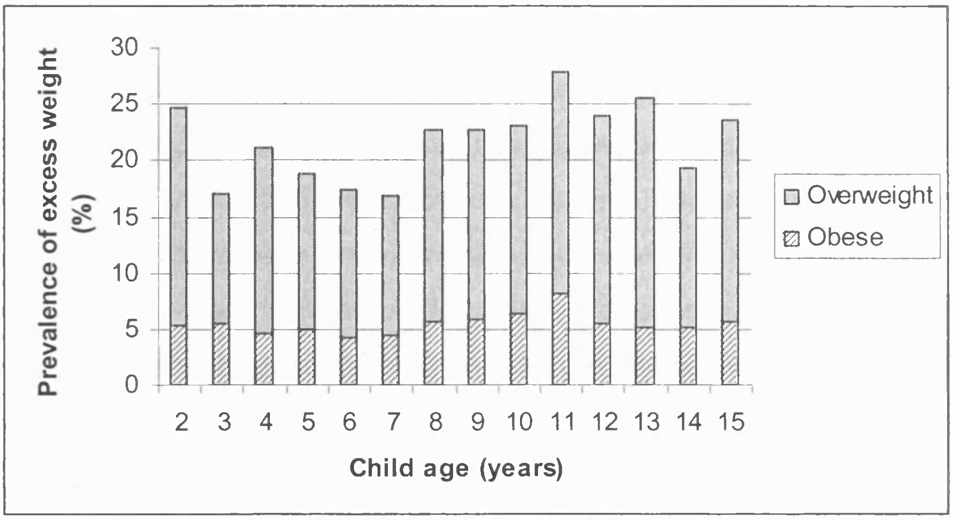
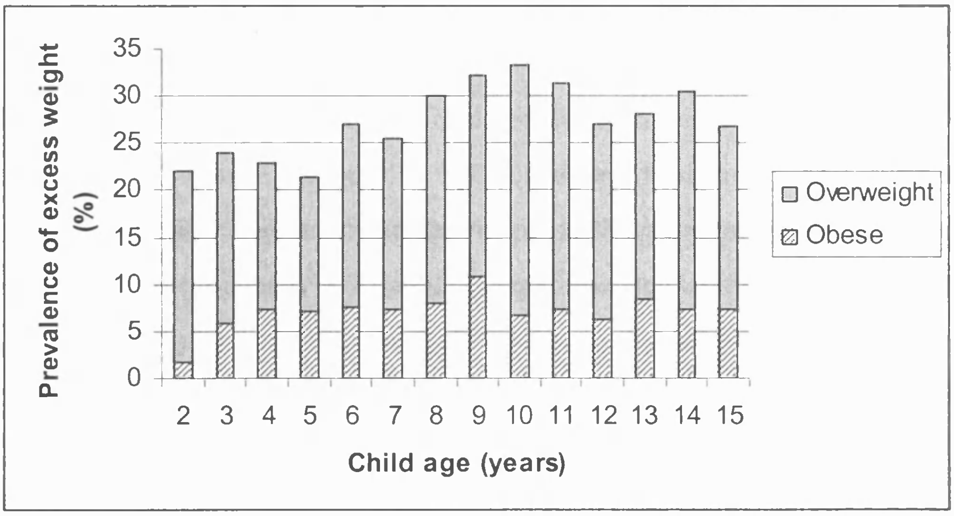


Figure 1.2: Overweight and obesity prevalence by age for UK girls (IOTF criteria)

Source: Health Survey for England, 2002



1.1.2 Negative consequences of overweight and obesity

Health risks for adults. A wealth of literature describes the catalogue of health and psychosocial problems that accompany adult obesity and to a lesser extent, overweight. Bray (2004) divides the health problems into those caused directly by increased fat mass, such as osteoarthritis and sleep apnea, and those caused by increased size and proliferation of fat cells, such as diabetes, liver abnormalities, gallbladder disease, hypertension, heart disease and cancer. Each of these health problems increases the risk of premature death, such that overweight status was associated with a 3 year decrease in life expectancy, and obesity with a 6-7 year decrease in US Data (Peeters et al, 2003).

Health risks for children. Obese children are highly likely to become obese adults (Fuentes et al, 2003; McTigue et al, 2002; Lake, Power & Cole, 1997), and hence to be vulnerable to the conditions outlined above. A prior history of obesity may even exacerbate the health problems experienced in adulthood. For example, population data from Finland suggest that obese adults who were obese as children are more likely to suffer from the metabolic syndrome, a cluster of cardiovascular risk factors including hypertension, low HDL cholesterol and hyperinsulinaemia (Vanhala et al, 1998).

A substantial body of literature also describes current weight-related conditions in obese children and adolescents. Must and Strauss (1999) review clinical evidence suggesting that obese children are at heightened risk of a range of orthopaedic, neurological, pulmonary, gasteroenterological and endocrine conditions. More recent studies have suggested that overweight children may also be at higher risk of impaired glucose tolerance (Sinha et al, 2002) and raised serum triglyceride levels (Freedman et al, 1999), and emerging data suggests that population increases in obesity may be creating cases of Type II diabetes among children (Ehtisham et al, 2004).

Psychosocial consequences. In addition to the myriad of associated health risks, the psychosocial impacts of excess weight at all ages are increasingly apparent. Cross-sectional and longitudinal studies of overweight and obese adults show some associations with low self-esteem and depression (Cooke & Wardle, in press), but present a mixed picture of the causal relationship, with some studies showing that weight problems precede depression and others suggesting depression leads to weight gain. However, Gortmaker et al (1993) have demonstrated poorer educational and social outcomes for adults who were obese in adolescence, suggesting that weight problems may indeed be antecedents of some negative psychosocial outcomes, and Wardle, Waller & Fox (2002) have shown that early-onset obesity confers worse body image and higher risk of binge eating in later life.

A significant number of studies also demonstrate that the majority of obese children experience teasing, social exclusion, discrimination and prejudice (Puhl & Brownell, 2001), and that discrimination comes from a range of sources, including peers, teachers, parents and even health professionals (Strauss & Pollack, 2003; Teachman & Brownell, 2001; Neumark-Sztainer, Story & Faibisch, 1998). Some commentators have suggested that population increases in weight might lead to normalisation of overweight and hence a reduction in the stigma associated with overweight. However, it seems that obese children are as stigmatised now as they were in the 1960s (Latner & Stunkard, 2003; Richardson et al, 1961).

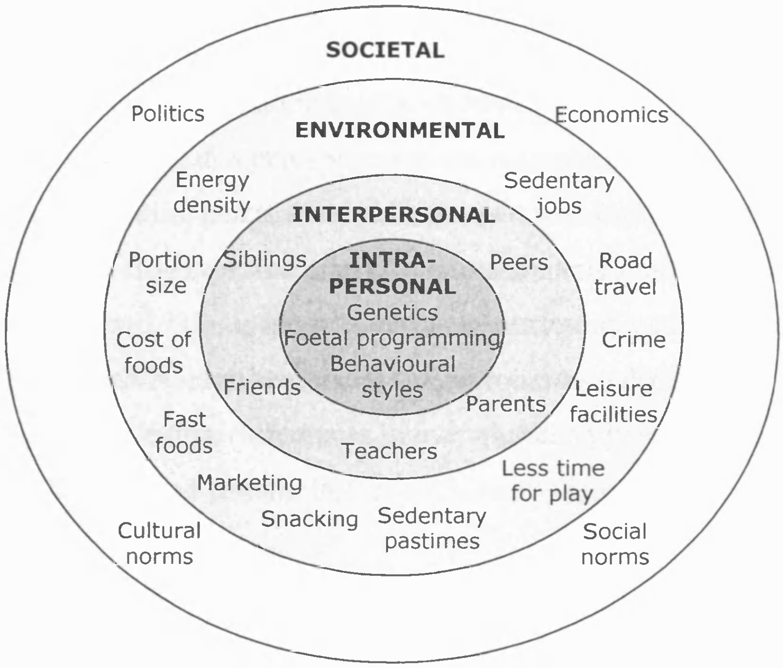
1.1.3 The causes of obesity

Obesity is a complex disease with a correspondingly complex aetiology. Researchers agree that common obesity is the result of a prolonged state of energy imbalance, where energy intake consistently exceeds energy expenditure, but different approaches have been taken to explain this imbalance. Story, Neumark-Sztainer & French (2002) divide influences on adolescents' eating behaviours into societal influences (e.g. social norms, cultural norms, advertising, mass media), environmental influences (e.g. shops, schools, fast food outlets), interpersonal influences (e.g. family, peers, teachers), and intrapersonal influences (e.g. food preferences, nutritional knowledge). A similar division can be made in the case of obesity, which shares many of the influences described by the model proposed by Story et al, and includes additional influences specific to energy expenditure. Influences which are of particular relevance to children are illustrated in Figure 1.3, and a brief summary of the other factors is given in this section.

1.1.4 Societal and environmental influences

Influences on energy intake. Politics, economics and cultural and social norms can be thought of as setting the environmental conditions for childhood obesity, and a growing body of research aims to link features of the social environment to increases in weight (Hill et al, 2003). This task is clearly difficult due to the multitude of competing factors involved, and the majority of these studies are weakened by a reliance on cross-sectional methodologies which simply correlate environmental

Figure 1.3: Influences on childhood obesity



change with observed population weight change. However, it is undisputed that factors such as increasing portion sizes (Young & Nestle, 2002), increased energy density of common foods (Drewnowski, 2004), increased snacking (Jahns, Siega-Riz & Popkin, 2001), increased access to fast food restaurants (Maddock, 2004), increased consumption of soft drinks (Nielsen & Popkin, 2004), and aggressive marketing of unhealthy foods to adults and children alike (Hastings et al, 2003), all contribute. Cost and availability of food is also likely to be important, and a series of studies by French and colleagues has neatly demonstrated how consumption of low-fat snacks can be increased when costs are reduced and availability is increased (e.g. French, 2003).

Influences on energy expenditure. Other research has focused on influences leading to decreases in physical activity, highlighting the move from manual to sedentary jobs, increases in road travel, labour-saving devices, and sedentary pastimes such as TV watching and computer games, and, particularly in the case of children, the decrease in time devoted to physical education in schools, and the erosion of play areas and school playing fields (for reviews of these factors see Lobstein, Baur & Uauy, 2004; Jeffery & Utter, 2003). More recently, a number of studies have begun to take this research beyond speculations about broad, societal factors, and are focusing on communities, examining possible links between obesity and factors such as types of food shops, availability of leisure venues and transport options in the case of adult obesity (Frank, Andresen & Schmid, 2004), and access to playgrounds, fast food restaurants and crime levels in the case of child obesity (Burdette & Whitaker, 2004). So far results suggest that perceptions of the environment may be a more important influence on eating and activity behaviours than its actual features (Timperio et al, 2005). However, the marked socio-economic gradient in obesity (Sundquist & Johansson, 1998), is likely to be partly attributable to variability in the environment experienced by each social class. Environmental differences may also contribute to some of the ethnic differences in overweight and obesity prevalence (Saxena et al, 2004), although genetic factors are also implicated.

1.1.5 Interpersonal and intrapersonal influences

Micro-environment. If societal and environmental factors form an individual's *macro-environment*, interpersonal factors may also be thought of as features of the *micro-environment*. For children, influences will come from the school and family environments, and for very young children the family will have by far the strongest influence. Family and school influences on children's adiposity could include the opportunities provided for physical and sedentary activities, and the impact of modelling from peers and family members on food and activity behaviours (Hendy, 2002; Hendy & Raudenbush, 2000). Parental feeding behaviours are also likely to be crucial. They form the topic of this thesis and are discussed in detail in Section 2.

Individual differences in weight. Intrapersonal influences may be thought of as all factors within the individual that determine his or her adiposity levels. These could include physiological factors of environmental origin. For example, mounting evidence suggests that features of the perinatal environment determined by maternal diet, diabetes, or weight during pregnancy, could explain differential susceptibility to obesity and associated comorbidities between individuals (Barker et al, 2002). Genetic factors are also important: a much cited meta-analysis of twin data on weight suggested that up to 70% of adult variation in BMI could be explained by genetic similarity (Grilo & Pogue-Geile, 1991). A more recent analysis has also found this to be true of 4-5 year old children, but that shared environment may also be important, especially for younger children (Koeppen-Schomerus et al, 2001).

Genetic basis of obesity. Given this evidence for a genetic influence on weight, a considerable amount of research funding has been dedicated to searching for its molecular basis. It is now clear that obesity is unlikely to be a monogenic disorder: mutations in leptin and melanocortin genes are thought to explain only a tiny proportion of cases of obesity (Bell et al, 2005; Montague et al, 1997; Zhang et al, 1994). Instead, the heritability of BMI across the distribution suggests that multiple genes are influential, each with tiny, cumulative effects on adiposity (Barsh, Farooqi & O'Rahilly, 2000). In the case of obesity, these could be genes influencing a variety of eating and activity behaviours, all of which contribute to overall energy balance.

Gene-environment interactions. Rather than taking the traditional view in which genetic explanations are competitors to environmental explanations, we may see genes as affecting how individuals interact with the environment in terms of energy intake and expenditure, i.e. their eating and activity behaviours. Epidemiological evidence supports this perspective. If broad changes in the environment were entirely responsible for weight increase, we would expect to see a simple shift of the entire BMI distribution to the right. In fact, increasing evidence in children and adults demonstrates that BMI has increased most markedly in the upper end of the distribution, and is virtually unchanged in the lowest quartile (Romon et al, 2005; Joliffe 2004a, Joliffe et al, 2004b; Hulens et al, 2001; Flegal & Troiano, 2000), suggesting that the heaviest, most 'at risk' individuals have put on the most weight in the face of environmental pressures. One interesting possibility is that parental feeding practices might interact with children's genetic tendencies to influence weight gain, such that 'obesogenic' feeding only causes weight gain in susceptible children.

1.2 The role of parents

1.2.1 Why look at parents?

Potential levels of explanation. It is clear that parental behaviour is likely to be an important influence on childhood adiposity levels. Parenting style could potentially explain why children in some families are fatter than those in other families (between-family effects, or 'shared environment'), and also why one child in the same family is fatter than his/her brother or sister (within-family effects, or 'non-shared environment') (Birch & Davison, 2001). Parenting factors could also contribute to adiposity differences at a societal level. For example, differences in parenting behaviours between different socio-economic, cultural and ethnic groups could help to explain group differences and geographical variation in body weight (Stearns, 2001). We might also speculate that population increases in childhood obesity are caused in part by population trends in parental behaviour. For example, several commentators have pointed towards the phenomenon of 'pester power' as leading to a cultural shift of the power balance between child and parent in terms of feeding, and others have suggested that the widespread decline in family meals may contribute to the obesity problem (Roberts, Blinkhorn & Duxbury, 2003).

Parents as agents of change. A criticism that is often made of research into parental feeding is that parents are only one small influence among many factors influencing childhood obesity. This may be true, but is also likely to be the case for other environmental influences on obesity, which is a complex, multi-factorial disease. In a sense, parental influence also constitutes a more likely candidate than some other factors, as there are known links between parent and child weight, and the problem is not whether or not parents influence their children's weights, but how risk of excess weight is transmitted from parent to child (Wardle et al, 2002; Birch & Davison, 2001). It is also the case that although they may be one of many influences on child weight, parents are in a uniquely powerful position to influence their children's lifestyle. A wealth of literature demonstrates that parental involvement is essential for the success of child obesity treatment (Wrotniak et al, 2004; Golan & Crow, 2004; Barlow & Dietz, 1998), and parents are likely to be equally as important for preventing the onset of overweight and obesity.

Another criticism that has been made of parental feeding research is that it is unfair to 'blame' parents for childhood obesity, when the prevailing causes are features of the broader social environment. One argument against this is that the aim of research into parental feeding is not to attribute blame, but to generate ideas that may ultimately be used to develop feeding advice for parents. Cross-sectional surveys show that the majority of parents report using a range of different feeding strategies in order to manipulate their children's eating, with varying degrees of success (Kaiser et al, 2001; Cousins et al, 1993; Burroughs & Terry, 1992; Stanek, Abbott & Cramer, 1990; Casey & Rozin, 1985), and many parents report frustration and difficulty with feeding their children (www.forparentsbyparents.com). It is clear, then, that advice on recommended feeding behaviours would be welcomed.

As this thesis focuses on parental feeding, the following discussion is confined to the influences that parents might have on children's eating, rather than on their activity levels. It is acknowledged that energy intake and expenditure both contribute to energy balance, and that an exclusive focus on feeding and eating risks giving an incomplete picture of how parents might influence child adiposity. However, the aim of this thesis was to build on the existing literature on parental feeding, and it was felt that an additional focus on physical activity would compromise the rigour with which parental feeding could be addressed.

1.2.2 Different types of parental influence on children's eating

The section above described why one might be interested in examining parental influences on children's eating behaviour. In the following sections, literature on various types of influence is briefly reviewed.

Availability and accessibility. Availability and accessibility of foods is necessary for their consumption. Cullen et al (1999) provide support for this, finding that children attending schools where more fruit and vegetables were served had higher fruit and vegetable intakes. In the home environment, parents are crucial determinants of the type and amount of foods which are made available and accessible to children, affecting what and how much they eat when in the family home. For example, a recent study by Hanson et al (2005) demonstrated a strong association between availability of fruits, vegetables and dairy foods in the home, and adolescents' intake of those foods.

There is also evidence to suggest that if parents provide bigger portions (i.e. more food is made available to the child), the child will eat more than when he/she is given a smaller portion. For example, McConahy et al (2004) found that portion size was the primary predictor of daily energy intake among 5447 preschool children surveyed as part of a national study of food intakes. Food type, frequency of eating and number of foods consumed were also of importance. There is a cause-effect problem with this study, in that it is unclear whether parents' choice of portion size is simply imposed by them, or driven by the amount of food the child wants to eat. However, using an experimental, within-subjects design, a study by Rolls, Engell & Birch (2000) also demonstrated that 5 year old children ate greater amounts when presented with larger portions than when presented with smaller ones.

Exposure. Provision of foods by parents may also have a longer-term impact on children's eating habits. A substantial literature demonstrates the effects of exposure on children's food preferences. For example, Birch et al (1987b) gave 51 2-5 year olds exposures to the taste of seven novel fruits and found significant improvements on taste judgements after 5-10 exposures. More recently, Wardle et al (2003b) successfully transferred this principle to a parent-led trial, and found significant increases in children's liking, ranking and consumption of a target vegetable after a 14 day schedule of tasting. These studies suggest that by exposing children to certain foods, parents may influence their food preferences. It is not clear how long these influences persist, or whether they influence children's energy intake and weight. However, heightened consumption of fruit and vegetables has been hypothesised to lead to lower weight by displacing more energy-dense foods in the diet (Epstein et al, 2001).

Associative learning. Related to the concept of exposure is the phenomenon of associative learning. It seems that children have an innate disposition to develop preferences for energy dense foods (Johnson, McPhee & Birch, 1991). This is likely to be the product of evolutionary selection of traits which would ensure survival in times of food scarcity, and occurs through learning an association between the taste of energy-dense foods and their positive post-ingestive effects on satiation and nutrition (Birch, 1992). This learning is more likely to occur in an environment where energy dense foods are readily available. Hence parental provision of these foods could heighten children's preferences for high fat and high energy of foods, with associated impacts on current and future energy intake.

A different form of associative learning might also occur where parents pair a particular environment with the presentation of a certain food. For example, Birch, Zimmerman and Hind (1980) found that pairing consumption of a target food with an attractive social experience could enhance preferences for that food for up to six weeks after the intervention. This suggests that presenting palatable, energy-dense snack foods in pleasant social contexts such as parties may heighten children's preferences for those foods.

Modelling. Core to the concept of social learning is that we learn by observing and imitating others (Bandura et al, 1963). Children, then, are likely to learn eating behaviours by copying those around them. This was neatly demonstrated by Harper & Sanders (1975), who presented 80 children aged 1-4 years with a novel meal (blue tortilla with ham and cheese, followed by a date or macadamia nut) in the context of their own homes. The food was not verbally introduced, but eaten as if it were a normal meal, and models did not display a reaction to the taste of the food. Children were significantly more likely to eat the unfamiliar food themselves if they witnessed an adult eating it; this effect was stronger for the younger children, and when their mother rather than a stranger modelled the food. Children's reports of parental modelling behaviours, as well as peer normative beliefs and availability of fruit and vegetables, have also been associated with increased consumption of these foods (Cullen et al, 2001).

Indirect evidence for the effect of parental modelling also comes from cross-sectional surveys showing that parents who report consuming more fruit and vegetables have children who consume more, although this is also likely to result from increased availability, accessibility and exposure to fruit and vegetables among these children (Cooke et al, 2004; Fisher et al, 2002). Similar results have also been found in the context of other food types, with girls whose mothers eat high fat foods being more likely to eat high fat foods themselves, and additional mother-daughter similarities in intakes of fibre, Vitamins A and C, riboflavin, folate and calcium (Lee et al, 2001). There is less work on how parents might influence the amount (rather than the type) of food consumed in terms of modelling. One might predict, however, that children would eat bigger portions if their parents do.

Other forms of influence. Parents could also influence their children's eating is by controlling where meals are eaten and with whom. The demise of the 'family meal' is much lamented in the media, and a limited number of research studies suggest that companionship at meal-times may improve children's eating in terms of intake of the four basic food groups (Stanek, Abbott & Cramer, 1990), increased intake of fruit and vegetables (Gillman et al, 2000), and decreased consumption of sweets and fast foods (Haapalahti et al, 2003). The effective elements of the family meal have not been established, but it is possible that foods served at a family dinner are more likely to be nutritionally well-balanced, and that family meals give opportunities for children to model their behaviour on parents and siblings. Eating together may also create a pleasant social atmosphere which reinforces consumption of meal foods.

1.2.3 Parental control over feeding

The parental behaviours described in section 1.2.2 could all occur without parental awareness. That is, they do not necessarily represent conscious attempts to exert control over children's eating. For example, parents may unwittingly act as models of eating behaviour or be in the habit of eating together as a family at mealtimes without engineering these practices specifically to influence their children's eating. The choice of food purchases, and hence the food available in the house, is likely to be determined in part by the parents' agenda of what the ~~parent~~ child should eat, but will also be influenced by other factors, such as the preferences of other family members (Steptoe & Wardle, 1999; De Bourdeaudhuij & Van Oost, 1998). The concept of what constitutes *parental control* over feeding has not been thoroughly characterised in the literature, but may be operationally defined as the direct attempts that parents make to influence their children's eating behaviour. These could, therefore, include the use of modelling and exposure, but only when they are done in a deliberate effort to manipulate children's eating behaviour.

Birch and colleagues have conducted the largest body of studies in the area and have delineated two main types of parental control: pressure to eat (parents' attempts to increase the child's intake of 'healthy foods' by pressure to eat more food, typically at mealtimes), and restriction (limiting the child's access to 'unhealthy' foods, particularly the type and amount of energy-dense snack foods). In the Child Feeding

Questionnaire (CFQ, Birch et al, 2001), 'Pressure to eat' is assessed with items such as "My child should always eat all the food on his/her plate" and "If my child says he/she is not hungry, and try to get him/her to eat anyway". 'Restriction' is represented by items such as "I intentionally keep some foods out of my child's reach", and "If I did not guide or regulate my child, he/she would eat too much of his/her favourite foods".

Pressure to eat. The concept of encouragement to eat has been explored in a number of studies from different research groups. For example, observational studies have coded maternal encouragements and discouragements to eat into physical and verbal influences (Drucker et al, 1999; Klesges et al, 1983) and whether commands described negative or positive consequences (Iannotti et al, 1994). Psychometric parental feeding measures other than the CFQ have included items not included in Birch et al's 'Pressure to eat' scale (Birch et al, 2001), describing more sharply defined types of encouragement to eat, such as encouraging the child to try new things and to enjoy his/her meal (Wardle et al, 2002), or using foods the child likes as a way to get him/her to eat disliked foods (Baughcum et al, 2001). Meanwhile, studies coming from the nutrition literature have assessed an even broader range of methods to encourage eating, including providing the child with reasons why he/she should consume the food offered, negotiating with the child to agree the amount that must be eaten, and verbally praising the child for eating (Vereecken, Keukelier & Maes, 2004; Cullen et al, 2000).

Restriction. Studies examining parental restriction have also operationalised the concept in different ways. The CFQ itself contains an additional scale measuring restriction, known as 'Monitoring'. Monitoring is conceived as a more covert form of restriction, and items describe 'keeping track' of the sweet things, snack food and high fat foods the child eats. Some studies have quantified restriction in terms of the number of foods that are restricted (Hupkens et al, 1998; Fisher & Birch 1999b). Others have examined the impact of particular instances of restriction or permissiveness, such as monitoring of sweet consumption (Lissau, Breum & Sorensen, 1994), habitual responses to children's requests for food (Sallis et al, 1995), and allowing the child to choose what food to eat at breakfast and lunch (Faith et al, 2003).

In a series of experimental studies, Birch and colleagues have also used a behavioural analogue of parental restriction, where children's access to a desired snack food is visibly restricted (i.e. placed in a transparent, closed container next to the children), and they may eat the food for a limited period only (Fisher & Birch, 1999a). The measure developed by Cullen et al (2000) breaks restriction down into individual restriction behaviours, for example, explaining to the child why the food is unhealthy, providing the child with an alternative distraction, telling the child it will make him/her fat, giving the child a small portion of the food, or simply not buying it. All these types of restriction are considered instances of parental control in this thesis.

Instrumental feeding. Birch and others have also conducted a number of experimental studies examining the effects of using foods within a means-end contingency (i.e. instrumental feeding). Healthier and less-liked foods most frequently form the 'means' in such a contingency. For example, a parent might promise a reward to their child if they finish their peas ('means' food). In contrast, less healthy, well-liked foods are more likely to form the 'end' or reward. For example, a parent might promise an ice-cream ('reward' food) to their child if they clean their room or perform another desired behaviour. These processes can also be contained within the same contingency. A parent might, for example, promise their child an ice-cream if they finish their peas. It is unclear how this type of 'instrumental feeding' relates to the concepts of restriction and pressure to eat. Using a less-liked food as a means to end could certainly be considered a form of pressure to eat that food. Although using well-liked foods to reward behaviour is primarily an effort to manipulate the child's behaviour rather than their eating behaviour, it may indicate that the 'reward' food is normally restricted, or it would not function as well as a reward. Since instrumental feeding has been proposed to play a role in the development of obesity, and because items describing instrumental feeding items feature in all of the prominent measures of parental feeding (Wardle et al, 2002; Birch et al, 2001; Baughcum et al, 2001), it is considered to be an aspect of parental control for the purposes of this thesis.

Other types of parental control. Other attempts to manipulate children's eating have also been considered under the banner of parental control over feeding. For example, a short-form of the CFQ, used in several studies (Duke et al, 2004; Robinson et al, 2001; Johnson & Birch, 1994), contains items describing not only restriction and pressure, but also general control of the meal occasion, e.g. "My child should be told off for playing or fiddling with food". Baughcum et al (2001) also include a 'Structure during feeding interactions' scale, containing the items "Did your child watch TV at meals?", "Did your child have a set mealtime and snack routine?" and "Did you sit down with your child during mealtimes?", along with items relating specifically to encouragement of eating, e.g. "Did you make your child finish all his dinner before he could have dessert?". Given the inclusion of this type of feeding within existing parental control studies, they were also considered within the definition of parental control used here[1].

Relationship between parental control and general parenting style. It is unclear how parental feeding style relates to general parenting style in terms of the warmth and responsiveness of the parent-child interaction. A set of global parenting styles was outlined by Baumrind (1971) and extended by Maccoby and Martin (1983). Under this scheme, an authoritative parent is one who makes high demands of his/her child but shows a high level of responsiveness and warmth towards the child; an authoritarian parent makes high demands but shows low warmth and responsiveness; a permissive parent makes low demands and is high in warmth and responsiveness; while an uninvolved parent is low in 'demandingness', warmth and responsiveness. These styles have been associated with a range of different outcomes in children and adolescents, including independence, cooperation and academic success, with the most successful style being authoritative parenting, and the least successful neglectful parenting (Baumrind, 1989). We might therefore expect the demandingness, warmth and responsiveness involved in the parent's style of feeding to affect children's eating and weight.

Researchers have taken two approaches to assess the extent of this effect. One is simply to see general parenting style as a predictor of parental feeding style. Costanzo & Woody (1985) suggest that parental feeding is domain-specific and no such relationship should be seen. However, Francis, Hofer & Birch (2001) found a

[1] Although a distinction has been drawn in this chapter between general types of *parental feeding* and specific instances of *parental control*, the two terms are used interchangeably from hereon to denote ways in which parents actively attempt to influence their children's eating behaviour.

small but significant positive association between authoritarian feeding and 'Pressure to eat' scores, and Hughes et al (2005) extended this positive association to the 'Restriction' scale. The other approach is to categorise feeding behaviours into different parenting styles on the basis of face validity and examine child outcomes. For example, in a review of parental feeding studies, Nicklas et al (2001) categorised behaviours into three types. Permissive feeding was defined as 'letting the child eat what he wants'; authoritarian feeding as parents' attempts to 'one-sidedly control the child's food intake and eating practices, through commands, instructions, directives or coercion' including 'using food to pacify, reward or punish, and prompting children to eat when not hungry'; and authoritative feeding as 'using questions, negotiation and reasoning in an attempt to shape or guide a child's behaviour, thereby facilitating the development of the child's dietary control'. Drawing on a large body of studies, the review concluded that better outcomes were associated with authoritative styles of feeding.

In this thesis, parenting style is used only as a form of validation for the parental feeding scales, on the basis that authoritarian parenting will be associated with authoritarian feeding strategies and the character of feeding strategies may therefore be inferred from their relationship with general parenting style.

1.2.4 Prevalence of parental control

It is evident from studies in a variety of populations that the majority of parents employ a range of different control strategies to influence their children's eating. Casey and Rozin (1989) surveyed 76 American parents for their spontaneous suggestions about ways to create food likes and dislikes, and found that 42% thought that telling the child an unhealthy food was bad for them would decrease their liking for it, and 41% thought that restricting or forbidding the food would have the same effect. Meanwhile, 15% thought that cajoling their child to consume a food was a good way to increase their liking for it, and 11% thought that rewarding the child for eating the target food would have a similar effect. Results from another parental survey found that 67% of parents encouraged their child to eat everything on their plate always or most of the time, and that under 15% of parents allowed their children to snack freely between meals (Burroughs & Terry, 1992). A study of 427 families in

Nebraska found that 56% of parents reported promising a special food for eating a meal, 55% withheld food as a punishment, and 48% reported using food to reward good behaviour (Stanek, Abbott & Cramer, 1990).

1.2.5 Parental control and child obesity

These findings indicate a considerable interest in child feeding among parents, and also suggest a route by which parents might affect children's adiposity levels, which could provide a valuable point of intervention for obesity prevention. My choice of parental control as the topic for my thesis was additionally motivated by an extensive review of the literature around parental feeding in relation to childhood obesity, which revealed a very mixed picture of results. Since each research question addressed within this thesis draws on a different body of studies within the parental control literature, it was thought clearest to give a detailed review of the relevant literature for each chapter in the introduction to each chapter. However, research findings are reviewed briefly below and summarised in the table found in Appendix I.

Study selection criteria. Selection criteria for inclusion in the table and the brief review below were that studies should i) assess or manipulate one or more of the forms of parental control described above, and ii) examine the association between parental control and at least one child outcome with potential relevance to obesity, e.g. eating behaviour, dietary intake, food preferences, adiposity. Studies that simply described control practices among certain population groups, or examined influences on parental feeding (e.g. maternal weight, dietary restraint) are not included. Studies with inadequate measurement of control, or with insufficient information available in the paper to evaluate measurement, were also excluded. Three key studies specifically examined parent feeding by childhood obesity risk as indicated by maternal weight, and are incorporated into the table with obesity risk as the child outcome.

<u>Experimental and observational studies</u>

Pressure to eat. A number of the studies which were reviewed suggested that attempts to exert control could lead to changes in eating behaviour which could in turn promote weight gain. One obvious consequence of parental pressure to eat, for example, is that children might eat more than is necessary to maintain energy balance, and hence gain weight. In support of this, several observational studies have suggested that parental encouragement to eat is associated with increased meal intake (Koivisto, Fellenius & Sjoden, 1994; Iannotti, O'Brien & Spillman, 1994; Klesges et al, 1986). However, there have also been some negative findings (Drucker et al, 1999), and the association was dependent on the type of pressure being exerted, with softer techniques such as negotiation being more successful than commands or negative comments (Koivisto, Fellenius & Sjoden, 1994; Iannotti, O'Brien & Spillman, 1994; Drucker et al, 1999).

Restriction. The consequences of parental restriction have also been explored using experimental and observational methods. One might predict that parental restriction should lead to lower intake of restricted foods and hence to lower child adiposity. Consistent with this, maternal monitoring of children's food choices led them to make a healthier selection of lunch foods with lower overall energy content (Klesges et al, 1991). However, at least one experimental study has suggested that restricting a target food could paradoxically lead to enhanced preferences for and intake of the restricted food when it is freely available (Fisher & Birch, 1999a), with the implication that parental restriction could ultimately lead to weight gain rather than weight maintenance.

Instrumental feeding. Other studies have used experimental designs to look at the consequences of using food instrumentally on children's eating, and have demonstrated that using a food as a means to achieve a reward leads to a decreased preference for that food in combination with an increased preference for whatever stimulus constitutes the reward (Birch, Marlin & Rotter, 1984; Birch, Zimmerman & Hind, 1980). In reality, the 'means' food is most frequently a disliked, 'healthy' food, while the reward is a well-liked, 'unhealthy' food. Using foods like this can therefore simultaneously decrease preferences for healthy foods and increase preferences for unhealthy, energy-dense foods, with possible implications for adiposity (Newman & Taylor, 1992).

Cross-sectional surveys

Control and children's eating behaviour. Another approach to studying the impact of parental control has been to examine cross-sectional correlations between measures of parental control and child outcomes such as eating behaviour (reported and observed) and adiposity. These studies have demonstrated associations between higher parental control and a number of 'obesogenic' eating behaviours. For example, parent-report measures of parental control and restriction have been associated with poorer regulation of intake in the caloric compensation paradigm, where the energy content of a preload is varied and effects on subsequent meal intake are recorded (Birch & Fisher, 2000; Johnson & Birch, 1994). Parental restriction has also been linked to greater intake in an 'eating in the absence of hunger' paradigm, where children are presented with a range of palatable snack foods when in a satiated state, and intake is recorded (Birch & Fisher, 2000; Fisher & Birch, 1999b).

Control and dietary composition. Other studies have examined cross-sectional associations between parental control and eating outcomes which may be more distally associated with adiposity. For example, studies correlating control with measures of dietary composition have suggested that pressure to eat may be associated with lower intake of fruit and vegetables (Wardle, Carnell & Cooke, 2005; Fisher & Birch, 2002) and higher fat intake (Lee et al, 2001), and that restriction may be associated with higher fat intake (Lee et al, 2001). This kind of dietary profile has been associated with weight gain (Guo et al, 2004). However, studies using other measures of control and intake have shown that practices such as modelling healthy eating, exposing the child to healthy foods, and using reasoning to negotiate intake, have been associated with more healthy diets in children in terms of a greater number of servings consumed from the basic food groups (Stanek, Abbott & Cramer, 1991), greater vegetable intake (Vereecken, Keukelier & Maes, 2004; Bourcier et al, 2003), greater fruit intake (Bourcier et al, 2003), higher intake of fruit juice (Cullen et al, 2001), and lower fat intake (Bourcier et al, 2003). Meanwhile, permissiveness, or a lack of control has been associated with greater consumption of soft drinks and sweets (Vereecken, Keukelier & Maes, 2004) and less healthy family food choices (De Bourdeaudjuij & Van Oost, 1998).

Control and psychosocial outcomes. Another strand of research has proposed that parental control may have negative psychosocial effects on children which could ultimately disregulate eating and lead to overweight. For example, studies have suggested that parental pressure to eat may be associated with negative self-evaluation of eating and with higher scores on dietary restraint and disinhibition in girls as young as 5 years old (Fisher & Birch, 2000; Carper, Orlet Fisher & Birch, 2000). High scores on these scales indicate eating styles characterised by a lack of responsiveness to internal hunger and satiety cues, have been associated with overweight, body dissatisfaction, binge eating and depression in other populations (Hill, Oliver & Rogers, 1992), and may be markers for future obesity. Another study failed to find an association between parental restriction and children's body esteem, but found that higher maternal restriction was associated with lower perceived physical and cognitive ability among girls with higher weight status (Davison & Birch, 2001).

Control and adiposity. Finally, a large body of cross-sectional studies has explored direct associations between parental feeding and child adiposity. Intuitively one might predict that higher levels of parental control would be associated with healthy weights in children. However, consistent with the mixed nature of the results described above, results have differed between studies. For example, studies measuring restriction and pressure to eat as separate dimensions of parental control have shown that restriction is actually associated with higher rather than lower weight, while pressure to eat is associated with lower weight (Spruijt-Metz et al, 2002). In contrast, Robinson et al (2001) found a negative correlation between parental control and adiposity in 8-9 year old girls, and a more recent, population-representative study also demonstrated an association between higher general control and lower BMI (Faith et al, 2003). Hughes et al (200~~4~~5) found that BMI was highest in children whose parents had an indulgent feeding style, characterised by being highly responsive to children's requests, and making few eating-related demands.

Baughcum et al (2001) found no significant differences between overweight and normal weight children in terms of any type of parental control, whereas Wardle et al (2002) found slightly higher prompting to eat among the heavier children (with heavier mother). However, using a cross-sectional, discordant siblings design, Saelens, Ernst & Epstein (2000) found no differences in parental control between obese and non-obese siblings, and studies looking for differences in parental control among obese and non-obese mothers (whose children will be at higher or lower risk of obesity), have found either no differences in parental control (Sallis et al, 1995), or slightly lower control in the obese mothers (Wardle et al, 2002).

<u>Prospective and retrospective studies</u>

Control and weight gain. Very few systematic longitudinal studies on parental control have been conducted. However, some studies have suggested that parental control may be protective against unhealthy eating and weight gain. For example, a 10 year prospective study demonstrated higher weight among children whose mothers did not monitor their sweet consumption in childhood (Lissau, Breum & Sorensen, 199~~7~~3), and De Bourdeaudhuij (1997) found that higher parental control in childhood predicted healthier eating in adolescence, although this study relied on adolescents' retrospective reports.

Control and eating style. Other studies have suggested that early parental control may have a negative impact on the way individuals eat later in life. For example, Batsell et al (2002) found that undergraduates who recalled instances of forced consumption in childhood were likely to have an aversion to the target food, and more likely to be picky eaters in adulthood. Puhl & Schwartz (2003) found that adults who recalled their parents using food as a reward had higher levels of binge-eating and restraint, both of which behaviours have been associated with higher weight elsewhere. Other prospective studies have shown that parental restriction at 5 years predicts eating in the absence of hunger at 7 years and 9 years, particularly among children who are already overweight (Faith et al, 2003; Birch, Fisher & Davison, 2003; Fisher & Birch, 2002).

1.2.6 Methodological issues

Closer examination of the studies above revealed that there were a number of methodological differences which could underlie some of these contradictory results. First, there is substantial variation in the choice of the samples used. Whereas the majority of studies have focussed on affluent, white Americans (e.g. Spruijt-Metz et al, 2002; Lee et al, 2001; Birch & Fisher, 2000), others have used samples specifically recruited to include low income parents (e.g. Baughcum et al, 2001), or used data from large community or population samples (e.g. Faith et al, 2003; Robinson et al, 2001).

Although strong associations between higher pressure to eat and lower child adiposity, and between high restriction and high adiposity, have consistently emerged in the affluent white samples, associations with control have generally been far weaker in the more population-representative studies, or have shown a negative rather than a positive relationship between restriction and child weight. This suggests that sample characteristics could be influencing results. Possible demographic differences in parental control are discussed further in Chapter 4.

There has also been diversity in parental control measures. While most studies have used variations on Birch et al's (2001) Child Feeding Questionnaire (Spruijt-Metz et al, 2002; Lee et al, 2001; Birch & Fisher, 2000, Robinson et al, 2001), others have used different measures (Baughcum et al, 2001; Wardle et al, 2002), or made use of very brief measures included within population surveys (Faith et al, 2003; Lissau, Breum & Sorensen, 199~~4~~3). This lack of consensus in the operationalisation of parental control has made it difficult to tell whether discrepancies in results are attributable to genuine differences in results between samples, or to method variance. For example, Wardle et al (2002) and Baughcum et al (2001) failed to replicate the negative association between pressure to eat and child adiposity that has frequently been demonstrated in other samples. It is very likely that the different aspects of pressure measured in each study are responsible for this lack of relationship. The distinctiveness of different measures of parental control is explored in Chapters 2, 3 and 4.

A third problem, common to all the cross-sectional studies, is that they do not permit conclusions about cause and effect. That is, they do not give an insight into whether the associations result from parental behaviour impacting on the child's eating behaviour and weight, or parental behaviour being a response to the child's characteristics. Testing different theoretical models within the constraints of cross-sectional data may be of some use. For example, partial correlations and regression methods can be used to test the effects of potential mediating and confounding variables on the relationship between parental feeding and child outcomes. This approach is described in more detail and utilised in Chapter 5. Prospective data may also help to illuminate causal mechanisms, but is at the moment limited to just a few small or non-systematic studies (Faith et al, 2004, Lissau, Breum & Sorensen, 1994) which are reviewed more thoroughly in Chapter 6.

Other issues relate specifically to the behavioural studies of children's eating. For example, studies assessing intake regulation have tended to use a one-off behavioural measure of caloric compensation and typically have small samples. The association between parental control and caloric compensation has yet to be replicated outside one laboratory in the US (Birch & Fisher, 2000; Johnson & Birch, 1994). Studies measuring dietary intake have used free-living data from children whose consumption is largely determined by their parents, and frequently relies on parental reports of intake, which may be prone to social desirability bias (Fisher & Birch, 2002; Lee et al, 2001). Measuring intake under *ad libitum* eating conditions may give different results. These issues are discussed in greater detail in Chapters 7 and 8.

1.3 The current thesis

The studies in this thesis are designed to address one or more of the methodological limitations in the literature described above, and thus to replicate and expand upon published findings. A more comprehensive critique of the literature relevant to each study is given in the Introduction of each chapter and the material is not therefore repeated here. However, the research questions I address with each study are given below.

1.3.1 Research questions

1) *Measurement of control.* A number of psychometric measures of parental control have been used in the literature. These contain factors which nominally measure the same constructs, but examination of the items and mixed research findings suggests they may tap distinct aspects of parental control. My first question was therefore, do

existing measures of parental control capture distinct aspects of parental feeding behaviour, and are these types of behaviour evident in a socio-economically diverse sample of UK parents? (Study 1, Study 2, Study 3)

2) *Demographic predictors of parental control.* At the time of conception, only a limited number of studies had assessed control practices in different socio-economic and ethnic groups, and even fewer had systematically assessed demographic predictors of parental control over feeding. However, there is some evidence to suggest that authoritarian feeding practices might be more common in lower SES groups, and that restriction may be more common in higher SES parents. My second question was, do the demographic associations indicated in existing studies replicate in the UK, and could there be other predictors of parental control? (Study 3)

3) *Association between parental control and weight.* Studies assessing the association between parental control and child weight have used different measures of parental control, making it difficult to compare results. For my third research question I asked, what were the associations between child adiposity and a comprehensive, multi-dimensional control measure within a socio-economically diverse UK sample? (Study 4)

4) *Causal relationship between parental control and weight.* A problem with existing cross-sectional studies is that they fail to control for possible mediators and confounders of the relationship between parental control and child weight, making it unclear whether associations are best explained by the parent responding to certain child characteristics. As part of Study 4, I therefore asked: Do perceptions/concern about child weight or parents' reports of child eating behaviours explain relationships with weight? In order to further explore the underlying causal relationship I also analysed longitudinal data from a large twin study. This study extended the findings of the small number of existing longitudinal studies by using a population-representative sample, and enabled me to ask the question, is there a prospective relationship between control and weight? (Study 5)

5) *Association between parental control and children's eating behaviour.* For my sixth study, I was interested in whether the reported association between restriction and children's performance in a caloric compensation paradigm would replicate in a UK sample, and whether any other associations would emerge when using a more differentiated measure of parental control (Study 6). Using data gathered during the same experimental protocol, I also examined associations between parental control

and other behavioural measures of children's eating that have previously been associated with feeding practices: energy intake, dietary composition, speed of eating and eating in the absence of hunger (Study 7).

1.3.2 Choice of sample and measures

I chose to address these questions using families with 3-5 year old children. This age group was selected for a number of reasons. First, the over-riding aim was to compare my results with existing research, much of which has been conducted on preschool children. Second, focusing on a younger age group meant that children still had high levels of contact with parents, while the inclusion of 5 year olds would allow comparisons between children who were fed primarily in the home (nursery children) and those who ate lunch at school five times a week (primary school reception class children). Third, it was assumed that the lower levels of overweight in younger children would reduce the confounding of relationships between parental control and child adiposity by reactions to children's weight, thereby increasing the chance that associations would reflect a direct relationship between parental feeding and outcome variables. Fourth, the rapidly rising prevalence of obesity in children of all ages demands that we should extend our knowledge of aetiology in younger as well as older children in order to facilitate early intervention.

Despite the increased attention some studies have given to parental control in girls, a decision was also made to include both sexes in these studies. Excess weight is increasingly common in both sexes and it was therefore felt that a parsimonious theory of obesity aetiology should not confine itself to explaining overweight in only one half of the afflicted population. As a result of this choice of sample, dieting and eating disordered behaviours were not considered to be the most salient outcomes and were therefore not measured here. However, the problems of dieting among young girls (Hill, Weaver & Blundell, 1990), the potential impact of parental control on these behaviours, and their associations with weight-related are acknowledged. Parental control over feeding in infants and in older children is also a topic of interest, but was beyond scope of this thesis.

CHAPTER 2

Study 1: Validation of parental feeding measures in a UK sample - factor analytic study

2.1. Introduction

2.1.1 Rationale

In order to explore the possible impacts of parental control it is essential to have a comprehensive, multi-dimensional method of assessing parental feeding behaviour. Most large-scale research studies have used psychometric methods to do this, but have employed a range of different feeding questionnaires. Each of these questionnaires ostensibly captures different types of feeding behaviour, making it difficult to compare results between studies, and suggesting that a combination of items from each may be necessary to fully characterise parental control. Alternatively, the differences may be superficial, with apparently distinct scales and items representing different aspects of the same underlying dimensions. This study aimed to validate two existing parental feeding questionnaires in a sample of parents of 3-5 year old boys and girls in Outer London schools. Given the suggestion of sex differences in the literature, child sex differences in scale scores and in inter-scale relationships were also examined.

2.1.2 Measuring parental feeding

Observational, child report and parent report measures have all been employed to assess various aspects of parental feeding. Following a coding method developed by Klesges et al (1983), encouragements and discouragements to eat were the focus of several early observational studies. Drucker et al (1999) further sub-divided these into physical influences (e.g. presenting the food, helping the child to cut the food) and verbal influences (e.g. telling the child "You should finish what's on your plate"). Iannotti et al (1994) coded parental behaviour according to whether commands using negative or positive consequences were used or rationales were provided. Another study assessed whether non-directive statements about food, eating or the parent's eating were made and whether these were positive, negative or neutral (Koivisto, Fellenius & Sjoden, 1994).

Although informative, the labour-intensive and time-consuming nature of observational research has meant that the majority of recent studies have used psychometric measures instead. Together, these encompass a wide variety of behaviours such as imposing a structure on eating occasions, rewarding consumption of particular foods, restricting types or amounts of food consumed, and pressuring the child to eat more (Birch et al, 2001; Baughcum et al, 2001; Wardle et al, 2002). Perceptions of and concerns about the child's eating and weight status have also been included in some measures (Birch et al, 2001; Baughcum et al, 2001). One study used five year old girls' reports to obtain a limited assessment of parental feeding (Carper et al, 2000), but the prevailing method of measurement is by parental report.

Two parental report measures were selected for validation in the present study: the Child Feeding Questionnaire (CFQ, Birch et al, 2001), and the Preschooler Feeding Questionnaire (PFQ, Baughcum et al, 2001). The CFQ is the most widely used questionnaire measure of parental feeding, and was designed to be relevant for mother and fathers of children of all age groups. The PFQ was designed specifically for 3-5 year olds and was recently validated on a large, socio-economically diverse sample of mothers in the US. The Parental Feeding Style Questionnaire (PFSQ, Wardle et al, 2002) has already been validated on several British samples and had a large number of items which overlapped with the CFQ and PFQ so was omitted from the current study.

2.1.3 The Child Feeding Questionnaire (CFQ)

The CFQ is based on Costanzo & Woody's (1985) parent interview, which was designed to assess parental factors hypothesised to relate to childhood obesity according to a 'domain-specific' theory of obesity proneness. The theory posits that parents will exert higher control over their child's eating when they i) are highly invested in health, fitness, or child weight issues, ii) perceive the child to be at risk for eating and/or weight problems based on family history or other perceived risk factors, or iii) do not believe the child to be capable of self control over feeding. To test this, the parent interview assessed attitudes to and beliefs about child feeding and weight and concerns about the child's weight status, as well as parental feeding practices and the balance of power within the feeding relationship. Costanzo and Woody (1985) further hypothesised that use of control could impede children's development of self-control over feeding by compromising their attention to internal satiety cues, thus beginning debate over whether control might be a harmful influence.

The CFQ assesses parents' perceptions of their own and their child's weight as well as their concerns about the child's overweight, alongside three kinds of control practices: 'Restriction', 'Pressure to eat' and 'Monitoring'[2]. The 'Restriction' scale includes items such as "I have to be sure that my child does not eat too many sweet things", "I intentionally keep some foods out of my child's reach" and "If I did not guide or regulate my child's eating, s/he would eat too much of his/her favourite foods". It also incorporates two items about using food to reward behaviour (e.g. "I offer sweet things to my child as a reward for good behaviour"). 'Pressure to eat' items include "My child should always eat all of the food on his/her plate", and "I have to be especially careful to make sure my child eats enough". The 'Monitoring' scale includes items such as "How much do you keep track of the sweet things that your child eats?" In addition, a scale of 'Perceived responsibility' for feeding the child was included, delineating the areas which parents might exercise control over (e.g. "How often are you responsible for deciding if your child has eaten the right kind of foods?", "How often are you responsible for deciding your child's portion sizes?").

Birch and colleagues used structural equation modelling to test the 7-factor structure of the CFQ, and found good fit in two samples of predominantly white, well-educated American parents with children ranging from 5 to 11 years old (n=394; n=148) (Birch et al, 2001). Two items from 'Pressure to eat' and one 'Restriction' item had to be removed to achieve comparable fit in a less well-educated, more overweight sample of Hispanic parents with 7-11 year old children (n=126). The CFQ has subsequently

[2] Given the frequent reference to different questionnaire scores in the current chapter and others, it is necessary to use a consistent nomenclature to distinguish discussion of scales from general discussion of the constructs to which they refer. Henceforth, parental feeding scales will be denoted by inverted commas, and more general concepts will be entirely in lower case and will lack inverted commas, e.g. 'Pressure to eat' (scale), pressure to eat (general concept).

been used successfully with American parents of younger children (3-5 yrs, Fisher et al, 2002; Lee et al, 2001; Birch & Fisher, 2000; Fisher & Birch, 1999a; Fisher & Birch, 1999b), but has yet to be validated outside of the United States. This is important because there is a growing body of evidence for cultural differences in child feeding attitudes and practices (Sherry et al, 2004; Kaiser et al, 2001; Stearns, 1999; Dettwyler, 1989; Fischler ~~& Chiva~~, 1986) which could limit the cross-cultural generalisability of parental feeding scales.

2.1.4 The Preschooler Feeding Questionnaire (PFQ)

The Preschooler Feeding Quesionnaire (PFQ, Baughcum et al, 2001) was designed for younger children. This questionnaire was developed from an initial item list obtained from focus group data, existing child feeding questionnaires, published ideas about the parent-child feeding relationship, and the clinical experience of the researchers. The items were pilot tested and confusing items were eliminated to produce the final list of items. Exploratory factor analysis was conducted on data from a socio-economically and ethnically diverse sample of American mothers of 2-5 year olds (n=634), and the following factors were extracted: 'Concern about the child overeating or being overweight', 'Concern about the child being underweight', and five types of control practice: 'Push to eat' (e.g. "Did you make your child finish all his/her dinner before s/he could have a dessert?"), 'Using food to calm the child' (e.g. "Did you ever give your child something to eat or drink if s/he was upset, even if you thought s/he was not hungry?"), 'Child control of feeding interactions' (e.g. "At dinner, did you let your child choose the foods s/he wanted from what was served?"), 'Structure during feeding interactions' (e.g. "Did your child watch TV at meals?", and 'Age-inappropriate feeding' (e.g. "Did you feed him yourself if he did not eat enough?". A factor appearing to measure child eating behaviour, 'Difficulty in feeding', also emerged, including items such as "Did your child have a poor appetite?" and "Was it a struggle to get your child to eat?". The 'Push to eat' factor also included items about the use of food to reward consumption of healthy food (e.g. "Did you use foods your child liked as a way to get him/her to eat healthy foods s/he didn't like?").

2.1.5 Combining the CFQ and PFQ

The PFQ and CFQ share two concepts – concern about overweight, and 'pressing' or 'pushing' the child to eat more, but the other factors appear to be different, albeit with some slight overlap at the item level. Notably, the CFQ contains scales measuring 'Restriction' and 'Monitoring', whereas the PFQ contained factors assessing 'Concern about underweight', 'Using food to calm the child' and 'Child control of feeding interactions'.

There are also some important differences in question wording both within and between questionnaires. For example, several of the CFQ items seem to describe the parent's perception that she must impose control over the child or they would not eat in a balanced, desirable way (e.g. 'If I did not guide or regulate my child's eating, she would eat much less than she should', 'If I did not guide or regulate my child s/he would eat too much of her favourite foods'), while others express more specific, dogmatic attitudes, with no obvious indication of response to the child, e.g. 'My child should always eat all of the food on her plate'. Other items speak more generally about a need to limit the child's consumption of 'junk' foods (e.g. 'I have to be sure my child does not eat too many sweet things'). Five- point response scales elicit various degrees of agreement with these statements (disagree, slightly disagree, neutral, slightly agree, agree). In contrast, PFQ items ask more directly about parental behaviour, with only 'Difficulty in feeding' items assuming child characteristics. Items are phrased as questions about behaviour rather than statements of obligation or policy, e.g. 'Did you make him eat all the food on his plate?' Response categories mostly express frequency (never, rarely, sometimes, often, always) rather than agreement. The time frame of each questionnaire is also different, with the PFQ asking parents to recall the child's eating from when they were 18 months old to the present, and the CFQ asking about the present.

Differences in the factors included in each questionnaire suggest that there may be wider range of facets to parental control over feeding than are included in either questionnaire alone. Alternatively, the differences may be superficial, with apparently distinct scales and items representing different aspects of the same underlying dimensions. Administering both the CFQ and the PFQ in the same sample should therefore give a more comprehensive coverage of parental attitudes and practices.

To summarise, this study had three main aims: 1) To test the replicability of the factor structures of two feeding questionnaires in a non-American, heterogeneous sample of parents with pre-school aged children; 2) To examine whether each scale identified distinct aspects of parental feeding when administered concurrently; and 3) To test the construct validity of each questionnaire scale. In the current study it was only possible to do this by a) testing the correlation between a certain scale (e.g. CFQ 'Pressure to eat') and others measuring similar constructs (e.g. PFQ 'Push to eat'), and b) testing correlations with other factors we would expect to show a relationship with that scale (e.g. 'Perceived child weight'). As many of the American studies have included girls only, boys were included in this sample in order to examine sex differences.

2.2 Methods

2.2.1 Participants and procedures

Greater London schools with nursery (3-4 years old) and reception (5 years old) classes that were located within an hour of the research centre were identified using local government lists. Schools with 50% or more pupils for whom English was a second language or with very high pupil mobility were excluded to avoid low response rates. Head teachers of schools which met the criteria were contacted by letter.

Bryant and Yarnold (1995) recommend that the subjects-to-variables ratio for factor analysis should be no lower than 5. As the CFQ contains 27 items, and the PFQ 28 items, a minimum of 140 subjects was therefore required for each analysis. However, these authors also endorse the rule of 200, i.e. there should be at least 200 cases, regardless of the subjects-to-variables ratio. The first four schools to respond had enough 3-5 year old pupils (n=306) to exceed the necessary sample size of 200, given an anticipated response rate of 70% (n=214).

Based on recommendations to increase response rates given in Edwards et al (2002), questionnaires were distributed directly to parents as they delivered or collected their children from school for completion at home. If the person collecting the child was not the mother, they were asked to pass the questionnaire on to the child's mother, or whoever fed the child most of the time. One round of 'reminder' questionnaires was distributed to non-responders through school teachers after four weeks had elapsed.

2.2.2 Questionnaire measures

Basic demographic and socio-economic information was requested (parental age, marital status, ethnicity, occupation, educational level, car ownership, home ownership). Participants were also asked to report their own and their child's height and weight in order to calculate body mass index (BMI). The CFQ was then presented in full, followed by the final PFQ (Baughcum et al, 2001). The PFQ scales 'Structure during feeding interactions' and 'Age-inappropriate feeding' were omitted because they had low Cronbach's alpha scores, but the 'Age-inappropriate feeding' item "Did you feed him yourself if he did not eat enough?" was retained because it also loaded on other factors.

Some minor changes were made to the wording of both questionnaires to suit a British sample. For example, the examples for 'sweet things' in the CFQ were changed from 'candy, ice-cream, cake or pastries' to 'sweets, ice-cream, cake, biscuits or chocolate', and the examples for 'snack foods' from 'potato chips, Doritos and cheese puffs' to 'crisps, cheesy crackers'. The PFQ item "When he got fussy, was giving him something to eat or drink the first thing you would do?" was changed to "When he became agitated...". Where a PFQ item was almost identical to a CFQ item, this item was included only once, in the CFQ section (e.g. PFQ "I am worried that my son will become overweight" → CFQ "How concerned are you about your child becoming overweight?").

Additional questions on motivations for food purchases and a shortened measure of child food neophobia (Child Food Neophobia Scale, Pliner, 1994; Cooke et al, 2004) were also included for other purposes. Appendix II contains the questionnaire in full.

2.2.3 Data analysis

Questionnaire data were analysed using SPSS for Windows Version 10.1. Following Birch et al (2001), Principal Components Analyses were used to analyse the factor structure of a) the CFQ, b) the PFQ and c) parental feeding items from the CFQ and PFQ combined. A direct oblimin rotation was selected to allow expected correlations between factors (Tabachnik & Fidell, 1996), and all factors with eigenvalues over one were retained to explain maximum variance. An exploratory rather than a confirmatory model was chosen as it was not clear how the questionnaire items would factor together in this population. Relationships within and between CFQ and PFQ scales were tested using non-parametric, bivariate correlations (Spearman's rho) to avoid distortion from the skewness of some of the variables. Sex differences in mean scale scores were tested using independent t-tests. Confidence intervals for inter-scale correlations were generated using Power and Precision Version 2.0.44 (2000, Biostat Inc), and used to examine theoretically predictable sex differences.

2.3 Results

2.3.1 Response rates

Of the 306 questionnaires distributed, 190 were returned, representing a 62% response rate. The total of 190 available cases satisfied the subjects-to-variables ratio requirement, but fell just under the 200 minimum cases recommended by Bryant and Yarnold (2000). Given the low level of missing data (182 to 190 cases were available for each variable and major variables had 188 or more cases), it was not necessary to test for differences between the sample for analysis and the remaining sample.

2.3.2 Sample characteristics

Parent characteristics

Tables 2.1 and 2.2 give demographic characteristics for parents and children. Compared with mothers with 2-15 year old children (N>18,000) sampled in the Health Survey for England 2002 (Sproston & Primatesta, 2002), a population-representative study of health-related outcomes, the current sample was better-educated, slightly younger, more likely to be married or living as married, had a higher proportion of ethnic minorities, and were more likely to own their home or have a car. Consistent with the sample recruitment strategy of mothers with young children, there were fewer employed participants.

96% of parents were female and most were the mother of the child. Although 6% of participants were not mothers (e.g. fathers, grandmothers, caregivers), there were no differences in perceived responsibility for feeding the child; all respondents are therefore described as parents from hereon. About two thirds of the parents (67%) were aged between 31 and 40 years with a mean age of 35.2 years (SD 5.83) and a range from 18 years to 68 years (n=185). 89% were married or co-habiting. Nearly 60% were white British, and 44% were full-time homemakers, whereas 48% were in full- or part-time employment. 43% were educated to GCSE level of below, and 26% had a degree or higher qualification. Only 7% of the sample did not own a car, and 72% owned or were buying their house.

BMI was calculated on the basis of self-reported height and weight. Data were incomplete and likely to be underestimates (Larson, 2000). Consistent with this, only 20.5% of parents were categorised as overweight, and only 8.4% as obese, which amounts to only 2/3 of the levels of excess weight we would expect from nurse-measured data for this sector of the population. BMI ranged from 15.8 to 39.9 (n=176), with a mean of 24.7 (SD 4.71), compared with a range of 15.2 to 53.8 and mean of 26.7 (SD 5.5) in a similar sample measured for the Health Survey for England (2002). However, our respondents were likely to be thinner than national averages due to their higher socio-economic status.

Table 2.1: Parent characteristics

	n	%
Gender		
Female	182	95.8
Male	8	4.2
Age group		
25 or under	7	3.7
26-30	22	11.6
31-35	71	37.4
36-40	57	30.0
41-45	21	11.1
46 or over	12	6.3

Table 2.1: Parent characteristics (contd.)

	n	%
BMI group (based on self-report height and weight)		
Underweight (<18.5)	13	6.8
Normal weight (18.5-24.99)	108	56.8
Overweight (25-29.99)	39	20.5
Obese (≥30)	16	8.4
Missing	14	5.3
Relationship with child		
Mother	178	93.7
Father	7	3.7
Other (Grandparent / Guardian)	4	2.2
Missing	1	0.5
Marital status		
Married	141	74.2
Living as married	28	14.7
Separated / Divorced / Widowed	14	7.4
Single	7	3.7
Ethnicity		
White British	113	59.5
White European	15	7.9
Indian / Pakistani / Bangladeshi	23	12.1
Black African / Black Caribbean	10	5.3
Chinese	5	2.6
Other (inc Mixed race)	9	4.7
Missing	15	7.9
Occupational status		
Full-time employment	47	24.7
Part-time employment	44	23.2
Full-time homemaker	79	41.6
Self-employed	3	1.6
Unemployed	6	3.2
Disabled / too ill too work	4	2.1
Retired	1	0.5
Student	5	2.6
Missing	1	0.5
Highest educational qualification		
None	21	11.1
GCSEs / O-levels / school certificate	60	31.6
A-levels	23	12.1
National diploma	35	18.4
Degree / Further degree	49	25.8
Missing	2	1.1
Car ownership		
No car	13	6.8
One car	111	58.4
More than one car	63	33.2
Missing	3	1.6
Home ownership		
Own / buying	136	71.6
Rent	47	24.7
Other	4	2.1
Missing	3	1.6

Child characteristics

Table 2.2 shows child characteristics. Slightly more of the children (53%) were female and the majority (63%) came from nursery classes rather than reception classes. The mean age of the sample was 4.4 years (SD .74) and ranged from 3.0 to 5.8 (n=189). Children's dates of birth were not available with which to calculate weight status according to IOTF categories, so weight groupings for children were allocated with reference to standard UK reference curves (Cole, Freeman & Preece, 1995). Under 6% of the children were overweight according to parent-reported height and weight, and under 5% were obese, compared with around 15% overweight and 6% obese in similar age children sampled for the Health Survey for England (2002). Mean BMI was 16.1 (SD 3.27) and ranged from 8.5 to 29.6 (n=105), compared with figures of 16.6 (SD 2.0) and a range of 8.0 to 42.5 in the Health Survey for England (2002) data. However, nearly half the data (45%) were missing.

Table 2.2: Child characteristics

	N	%
Gender		
Female	101	53.2
Male	89	46.8
School class (age)		
Nursery (3-4 yrs)	120	63.2
Reception (4-5 yrs)	70	36.8
BMI group (based on parent-report height and weight)		
Underweight	14	7.4
Normal weight	69	36.3
Overweight	11	5.8
Obese	11	5.8
Missing	85	44.7

2.3.3 Principal components analyses

Child Feeding Questionnaire

Factor structure. Results of principal components analysis of the CFQ with direct oblimin rotation are presented in Table 2.3. Listwise deletion of missing cases was chosen in order to give the best representation of the data, and meant that the analysis reported was based on 166 cases, representing 87% of the full 190 cases. 'Perceived responsibility for feeding the child', 'Perceived parent weight', 'Perceived child weight' and 'Concern about child weight' replicated original CFQ factors.

There was more variation in the feeding behaviour scales. The 'Pressure to eat' item "My child should always eat all of the food on his/her plate" did not load with the remaining items, instead forming a weak factor with "If I did not guide or regulate my child's eating, he/she would eat too many junk foods." As the latter item had a factor loading of only -.41, "My child should always eat all the food on his/her plate" was considered a single-item factor, as it was conceptually important.

The factor containing the remaining 'Pressure to eat' items seemed to contain items reflecting parents' perceived obligation to respond to under-eating in their child by encouraging them to eat, (e.g. "If I did not guide or regulate my child's eating, he/she would eat much less than he/she should"). As the alpha score for this three item scale (α=.81) was substantially higher than for the original four items (α=.73), the shortened scale was used in subsequent analyses.

Additionally, the 'Restriction' scale split into two sub-factors. The first contained the majority of the items and was re-named 'General restriction' (α=.69); the second contained two items describing the use of food to reward good behaviour in the child and was re-named 'Food to reward behaviour' (α=.67).

Table 2.3: Factor loadings for Child Feeding Questionnaire†

	Factor loadings on new CFQ solution								
Factor and items in original CFQ solution	1) Monitoring	2) Pressure to eat	3) Perceived responsibility	4) Perceived parent weight	5) Concern about child weight	6) Using food to reward behaviour	7) General restriction	8)Perceived child weight	9) Miscellaneous
Factor 1: Perceived responsibility									
How often responsible for deciding child eaten right kind of foods	-	-	**-.81**	-	.11	.16	-.13	-	-
How often responsible for deciding child's portion sizes	-	-	**-.81**	-	-.11	.12	-	-	-.18
When child at home, how often responsible for feeding him/her	-	-	**-.81**	-.10	-.11	-	.11	-	-

Table 2.3: Factor loadings for Child Feeding Questionnaire (contd.)

Factor and items in original CFQ solution	1) Monitoring	2) Pressure to eat	3) Perceived responsibility	4) Perceived parent weight	5) Concern about child weight	6) Using food to reward behaviour	7) General restriction	8)Perceived child weight	9) Miscellaneous
Factor 2: Perceived parent weight									
Your twenties	.24	-	.14	**.76**	-	-	.17	-	-
Currently	-	-	-	**.75**	-.18	-	.12	-.14	-
Your adolescence	-.24	-	-.11	**.70**	-	-.15	-.19	-	-
Your childhood (5-10 yrs)	-.23	-	-	**.42**	.20	-	-.30	.28	-
Factor 3: Perceived child weight									
As toddler	.11	-.10	-	.10	-	-	-	**.83**	-
During first year	-	-	.16	-.17	-	.14	.11	**.77**	-
At the moment	.13	-	-	-	-.12	-	-	**.75**	-
Factor 4: Concern about child weight									
Concern re child becoming overweight	-	-	-	-	**-.88**	-	-	.11	-.12
Concern re child having to diet to maintain desirable weight	-	-	-	.11	**-.86**	-	.11	-	-
Concern re child eating too much when you are not around him/her	-	-	-	-.13	**-.64**	-	-.18	-	.19
Factor 5: Pressure to eat									
If did not guide or regulate, child would eat much less than should	-	**.91**	-	-	-	-	.12	-	-
Have to be especially careful to make sure child eats enough	-	**.83**	-	-	-	-	-	-.11	-
If child says not hungry, try to get to eat anyway	-	**.70**	-	-	.21	.10	-.11	-	.11
Child should always eat all food on plate	-	-	.13	-	-.14	.21	-.17	-	**.73**
Factor 6: Restriction									
Intentionally keep some foods out of child's reach	-	-.11	-	-	-	.20	**-.67**	-	-
If did not guide or regulate would eat too much of favourite foods	.13	-	.23	-	-.14	.22	**-.61**	-.20	-
Have to be sure child does not eat too much of favourite foods	-	.11	-.11	-	-.12	-.25	**-.58**	-	.27
Have to be sure child does not eat too many sweet things	-	.16	-.12	-	-	-	**-.57**	-	-.47
Have to be sure child does not eat too many high fat foods	.22	.16	-	-.12	-	-.30	**-.55**	.19	-.15
If did not guide or regulate would eat too many junk foods	.20	-	.24	-	-.27	.35	-.28	-	**-.41**
Offer sweet things as reward for good behaviour	-	-	-.15	-	.14	**.79**	-	.11	-
Offer child favourite foods in exchange for good behaviour	-	-	-	-	-.15	**.76**	-	-	-
Factor 7: Monitoring									
Keep track of the sweet things your child eats	**.90**	-	-.11	-	-	-	-	-	-
Keep track of the snack food your child eats	**.89**	-	-	-	-	-	-	-	-
Keep track of the high fat foods your child eats	**.72**	-	-	-	-	-.21	-	.17	-

†Only factor loadings over .1 are listed.

Table 2.4 gives variance explained by each factor. No one factor explained substantially more variance than any other. The one item factor "My child should always eat all of the food on his/her plate" explained the least variance, and the two item factor 'Food to reward behaviour' explained only slightly more. As an oblique rotation was used, it was not possible to estimate how much variance was explained by the model in total.

Table 2.4: Variance explained by generated CFQ factors

Factor name	Variance explained (%)
1) Perceived responsibility	2.38
2) Perceived parent weight	2.00
3) Perceived child weight	2.29
4) Concern about child weight	2.55
5) Pressure to eat	2.43
6) 'Eat all on his plate'	1.27
7) General restriction	2.56
8) Food to reward behaviour	1.85
9) Monitoring	2.92

Descriptive statistics. Table 2.5 gives Cronbach's alpha scores, item means, and skewness and kurtosis statistics for each generated scale. Cronbach's alpha scores were acceptable for all scales, with only 'Perceived parent weight', 'General restriction' and 'Food to reward behaviour' scoring under 0.7. Scores were calculated as item means and therefore ranged from 0-4, with lower scores indicating disagreement with items, higher scores indicating agreement, and scores near to 2 representing neutral attitudes on average.

Missing items. Tabachnik & Fidell (1996) recommend that a scale should not be calculated unless 70% or more of the items have been completed. However, a higher threshold (80%) was used here and throughout the thesis, as it was felt that if participants omitted over 20% of the items this was likely to reflect a general misunderstanding of items within the whole scale. Very little data was missing on parental feeding scales, allowing item means to be calculated for the majority of parents.

On average, participants gave neutral ratings on 'Pressure to eat' items. Scores on 'General restriction' were slightly higher, and 'Monitoring' scores were higher again.

"My child should always eat all of the food on his/her plate" and 'Food to reward behaviour' had the lowest item means and two of the largest standard deviations.

In the case of 'Perceived parent weight' and 'Perceived child weight', lower scores represented perceived underweight, higher scores represented perceived overweight and scores near to 2 indicated that parents generally perceived their child to be normal weight, across a range of ages. On average, participants described themselves as slightly overweight and their children as slightly underweight. Scores on 'Concern about child weight' tended towards zero (i.e. unconcerned).

Table 2.5: Descriptive statistics for calculated CFQ scales

Factor name	No. of items	Alpha	n	Mean (SD)	n	Skewness (SE)	Kurtosis (SE)
1) Perceived responsibility	3	0.79	189	3.4 (0.7)	189	-1.21 (0.2)	-1.21 (0.2)
2) Perceived parent weight	3	0.62	180	2.1 (0.4)	187	0.10 (0.2)	0.10 (0.2)
3) Perceived child weight	3	0.73	188	1.9 (0.3)	188	-1.11 (0.2)	-1.11 (0.2)
4) Concern re child weight	3	0.78	185	0.7 (1.0)	187	1.40 (0.2)	1.40 (0.2)
5) Pressure to eat	3	0.81	188	2.0 (1.3)	189	-0.12 (0.2)	-0.12 (0.2)
6) 'Eat all on his plate'	1	-	-	1.3 (1.4)	186	0.64 (0.2)	0.64 (0.2)
7) General restriction	6	0.69	184	2.4 (0.7)	187	-0.27 (0.2)	-0.27 (0.2)
8) Food to reward behaviour	2	0.67	187	1.7 (1.3)	187	0.05 (0.2)	0.05 (0.2)
9) Monitoring	3	0.83	187	2.9 (0.9)	196	-0.52 (0.2)	-0.52 (0.2)

Normality of variables. Skewness and kurtosis statistics were generated using SPSS (see Table 2.5). The closer these statistics are to 0, the more normal the distribution of the variable.

Variables whose skewness was greater than twice their standard error were considered to be skewed. Using these criteria, 'Perceived responsibility' and 'Monitoring' were considered to be negatively skewed. 'Perceived child weight' was also negatively skewed, reflecting the fact that the majority of parents perceived their child as normal weight, a few saw them as underweight, and hardly any described their children as overweight at any stage. In contrast, 'Concern about child weight' and "My child should always eat all of the food on his/her plate" were positively skewed, also reflected in their low item means. The distributions of 'Perceived ~~self~~ parent weight', 'Pressure to eat', 'General restriction' and 'Food to reward behaviour' were approximately normal.

Kurtosis is a measure of the extent to which values cluster around a central point. Positive values indicate that values cluster more and have longer tails; negative values indicate that values cluster less and have shorter tails. Kurtosis was also considered to be significant if values were greater than twice their standard error. By this criterion, 'Perceived responsibility' and 'Perceived child weight' showed significant negative kurtosis, while 'Concern about child weight' and 'My child should always eat all the food on his/her plate' showed significant positive kurtosis. Skewness and kurtosis in variables limit the reliability of p values arising from parametric tests, which assume a normal distribution. To account for this, non-parametric correlations were used in the following analyses.

<u>Preschooler Feeding Questionnaire</u>

Factor structure. The PCA presented in Table 2.6 was based on a total of 168 (88%) cases. Two changes to the original factor 'Concern about child overeating or being overweight' were apparent: 1) Items specifically describing parental responses to the child's overeating loaded on a separate factor ('Concern about overeating, α=.78); 2) 'Concern about underweight' items did not form an independent factor as in the PFQ but loaded with three 'Concern about overweight' items ('General weight concern', α=.86). Despite these results, individual scales were also generated for 'Concern about overweight' (α=.85), and 'Concern about underweight' (α=.81) items separately, in order to test specific hypotheses.

There were also changes to the 'Push to eat' and 'Child control' scales. The 'Push to eat' items loaded on two separate factors. The first contained items describing rule-driven behaviour, mainly involving mealtimes, e.g. "Did you make your child eat all the food on his/her plate?", and so was named 'Meal-time rules' (α=.65). The alpha score for this scale was improved when dropping the lowest loading item "Did you punish or remove privileges to get your child to eat more?" (α=.77). This item was dropped from further analyses. The second 'Push to eat' factor contained items describing the use of food to reward the child's consumption of healthy food and was therefore named 'Food to reward food' (α=.50). The 'Age-inappropriate feeding' item, Did you feed your child yourself if he/she did not eat enough" did not load strongly with any of the other factors and was dropped from further analyses.

'Food to calm' (α=.73) replicated the original PFQ scale. 'Difficulty in feeding' was largely similar but the 'Child control' item "If your child did not like what was served, did you make something else?" also loaded on this factor (.51). As the addition of this item did not improve the alpha score, the 'Difficulty in feeding' scale was generated using the original six items (α=.90). The remaining 'Child control' items loaded together on a separate scale ('Child's control of feeding interactions', α=.50).

Table 2.6: Factor loadings for Preschooler Feeding Questionnaire†

	Factor loading on new PFQ solution							
Factor and items in original PFQ solution	1) Difficulty in feeding	2) General weight concern	3) Concern about overeating	4) Pushing to eat	5) Use of food to calm	6) Child control	7) \use of food to reward food	8) Miscellaneous
Factor 1: Difficulty in child feeding								
Child was a picky eater	**.91**	-	-	-.14	-	-	-	-
Child had a poor appetite	**.88**	-	-	-	-	-	-	-.18
Struggle to get child to eat	**.86**	-	-	-	-	-	-	-
Hard to get child to eat new foods	**.72**	-	-	-	-	-	.15	.24
Get upset that child did not eat enough	**.71**	-	-	.20	-	.12	-	-.18
Made special meals for child because was picky eater	**.66**	-	-	-	-.11	-	-	.35
Factor 2: Concern about child overeating or being overweight								
Concern re child being overweight at moment	-	**.84**	-	-.10	-	-	.12	-
Concern re child becoming overweight	-.16	**.84**	.15	-.13	-.15	-	-	-
Concern re child having to diet to maintain reasonable weight	-	**.83**	-	-	-	-.13	-.14	-
Had to stop child from eating too much	-	-	**.87**	-	-	-	-	-
Get upset if child ate too much	-	-	**.83**	-	.10	-	.11	-
Worried child was eating too much	-	-	**.81**	-	-	-	-	-
Thought about putting child on diet to keep from becoming overweight	-	-	**.43**	.23	-.10	-	-.39	.21
Factor 3: Pushing the child to eat more								
Made child eat all the food on the plate	-	-	-	**.89**	-	-	-	-
Made child finish all dinner before could have dessert	-.24	-	-	**.86**	-	-.12	.18	.16
Punished or removed privileges to get child to eat more	.31	-	-	**.37**	-.29	-	.11	-.23
Offered child dessert after meal to get to eat foods good for him/her	-	-	-	.10	-.13	-	**.79**	-
Used foods liked as way to get to eat healthy foods didn't like	.17	-	-	.21	-	.11	**.56**	-

Table 2.6: Factor loadings for Preschooler Feeding Questionnaire (contd.)

Factor and items in original PFQ solution	1) Difficulty in feeding	2) General weight concern	3) Concern about overeating	4) Pushing to eat	5) Use of food to calm	6) Child control	7) \use of food to reward food	8) Miscellaneous
Factor 4: Using food to calm the child								
Gave something to eat/drink if child was upset	-	-	-	-.18	**-.79**	-	.16	-
Gave something to eat/drink if child was bored	-	-	-	-	**-.76**	-	.15	-.15
When agitated, first gave something to eat/drink	-	-	-	.14	**-.69**	-	-	.36
Offer something to eat to stop temper tantrums	.20	-	-	.21	**-.55**	.18	-.24	-.13
Factor 5: Concern about child being underweight								
Concern re child becoming underweight	.18	**.76**	-.11	.14	.16	-	-	-
Concern re child being underweight at moment	.20	**.72**	-	.20	-	.16	-	-.10
Factor 6: Child's control of feeding interactions								
Allowed child to eat snacks whenever wanted	-.11	-	-	-	-.10	**.86**	-	-.13
At dinner, let child choose foods wanted from what was served	-	-	.11	-.12	-	**.74**	.10	.34
If child did not like what served, made something else	**.51**	-	-	-	.23	.30	.13	-
Factor 7: Age-inappropriate feeding								
Feed child yourself if did not eat enough	.38	-	-	-	-	.14	-	**-.64**

†Only factor loadings over .1 are listed.

Variance explained is given in Table 2.7. 'Difficulty in feeding', a six-item scale measuring problematic eating behaviour, explained the most variance (6%), with 'General weight concern' explaining the next most (3%). The one-item factor 'If child did not like what was served, served something else' explained least variance (1%) and the two-item factor 'Food to reward healthy food' also explained only 1%.

Table 2.7: Variance explained by generated PFQ factors

Factor name	Variance explained (%)
1) Difficulty in feeding	5.56
2) General weight concern	3.34
3) Concern about overeating	2.76
4) Meal-time rules	2.64
5) Food to calm	2.91
6) Child control	2.14
7) Food to reward food	1.96
8) 'If child did not like what was served, served something else'	1.23

Descriptive statistics. Descriptive statistics are given in Table 2.8. Item means were calculated for each participant, providing that 80% or more items were completed on the scale in question. Means each had a possible range of 0-4. 'Difficulty in feeding' (M=1.5), 'Food to reward food' (M=1.5) and 'Child control' (M=1.5) had the highest item means. On average, means were below the mid-point of the scale (2), reflecting the fact that response scales were unipolar, with item scores of one or above representing some endorsement of the item. 'Concern about overeating' (M=0.2) and 'Concern about overweight' (M=0.7) had the lowest means and means for 'Food to calm' (M=0.7) and 'Concern about underweight' (M=0.9) were only slightly higher.

Table 2.8: Descriptive statistics for calculated PFQ scales

Factor name	No. of items	Alpha	n	Mean (SD)	n	Skewness (SE)	Kurtosis (SE)
1) Concern re overweight	3	.85	182	0.7 (1.1)	186	1.70 (0.2)	1.85 (0.4)
2) Concern re overeating	4	.78	189	0.21 (0.4)	190	2.84 (0.2)	9.38 (0.4)
3) Concern re underweight	2	.81	182	0.93 (1.2)	183	1.25 (0.2)	0.45 (0.4)
4) Difficulty in feeding	6	.90	186	1.50 (1.0)	190	0.59 (0.2)	-0.23 (0.4)
5) Meal-time rules	2	.50	187	1.46 (1.0)	188	0.20 (0.2)	-0.58 (0.4)
6) Food to reward food	2	.50	187	1.47 (0.8)	186	-0.03 (0.2)	-0.76 (0.4)
7) Food to calm	4	.73	186	0.72 (0.6)	190	0.64 (0.2)	-0.25 (0.4)
8) Child control	2	.50	188	1.47 (0.8)	188	0.35 (0.2)	-0.20 (0.4)

Normality of distributions. Scales measuring concern relating to the child's weight and eating showed heavily positively skewed distributions (1.70, 2.84 and 1.25 respectively). 'Difficulty in feeding' and 'Food to calm' also showed positive skews. 'Meal-time rules', 'Food to reward food' and 'Child control' had distributions that approached normality. ‘Concern about overweight’, and ‘Concern about overeating’ showed marked positive kurtosis; ‘Food to reward food’ showed some negative kurtosis. Implications of the non-normality of CFQ and PFQ variables were discussed in previous sections and will be addressed again in Chapters 4 and 5.

2.3.4 Inter-scale correlations

Inter-scale correlations were examined for three purposes: 1) Associations between sub-scales of the CFQ and between sub-scales of the PFQ were examined to see if they were consistent with associations found in studies using the original versions. If they were this was taken as evidence that the feeding scales behaved similarly in a

UK population; 2) As a test of construct validity, correlations between all CFQ and PFQ scales measuring parental feeding behaviour were considered to see if theoretically-predictable clusters of behaviours emerged. For example, if 'Pressure to eat' and 'Push to eat' were correlated, this was taken as evidence of validation for each scale; 3) Finally, new factors that had emerged separately in this analysis were correlated with other CFQ and PFQ sub-scales. If they showed differential patterns of associations with other scales, this was taken as support for their distinctiveness as feeding scales. As we were interested in differences in the overall pattern of correlations for each scale rather than having specific hypotheses about particular relationship differences, the significance of differences between correlations was not tested.

Each set of analyses was carried out for the whole sample, then separately for boys and girls to examine any sex differences in correlations. As the study was not powered to detect sex differences in correlations, these analyses were considered as preliminary, with the main purpose of hypothesis generation. The minimum sample size achieved for each analysis is given at the top of each column.

Correlations between CFQ sub-scales

Correlations between all CFQ sub-scales are shown in Table 2.9. However, differential patterns for each sub-scale and evidence for clustering of scales are discussed in following sections.

Table 2.9: Correlations between CFQ sub-scales

	1)PR n≥87	2)PPW n≥185	3)PCW n≥186	4)CCW n≥185	5)PTE n≥187	6)GR n≥185	7)FRB n≥185
1) Perceived responsibility	-						
2) Perceived parent weight	-.04	-					
3) Perceived child weight	-.04	-.04	-				
4) Concern re child weight	.04	.04	-.01	-			
5) Pressure to eat	-.13	-.09	-.26**	-.05	-		
6) General restriction	.12	.02	.06	.21**	.16**	-	
7) Food to reward behaviour	.01	-.04	.04	.02	.19**	.64**	-
8) Monitoring	.25**	-.04	.05	.14	.01	.30**	.02

**p<.01 *p<.05

Correlations between perceptions/concerns and feeding behaviours. 'Perceived responsibility' was positively associated with 'Monitoring' (r=.25, p=.001), and there was a negative association between 'Perceived child weight' and 'Pressure to eat' (r=-.26, p<.001).

Correlations among feeding behaviours. There were small positive correlations between 'Pressure to eat' and both restriction sub-scales ('General Restriction' r=.16, p=.027, 'Food to reward behaviour' r=.19, p=.009), but no correlation between 'Pressure to eat' and 'Monitoring'.

Correlations between PFQ scales

Correlations between all PFQ scales are given in Table 2.10. Again, differential patterns of associations for similar sub-scales and evidence for clustering of sub-scales are discussed in following sections.

Table 2.10 Correlations between PFQ sub-scales

	1)COW n≥182	2)COE n≥183	3)CUW n≥180	4)DF n≥183	5)MTR n≥185	6)FRF n≥184	7)FC n≥188
1) Concern re overweight	-						
2) Concern re overeating	.37**	-					
3) Concern re underweight	.43**	.02	-				
4) Difficulty in feeding	-.10	-.14	.40**	-			
5) Meal-time rules	-.06	.09	.15*	.13	-		
6) Food to reward food	-.06	-.05	.17*	.43**	.27**	-	
7) Food to calm	.11	.20**	.11	.31**	.14	.29**	-
8) Child control	.09	.08	.09	.23**	-.12	.10	.21**

**p<.01 *p<.05

Correlations between perceptions/concerns and feeding behaviours. 'Concern about underweight' was positively associated with both scales measuring pushing to eat ('Meal-time rules' r=.15, p=.049, 'Food to reward food' r=.17, p=.021), and additionally with 'Difficulty in feeding' (r=.40, p<.001).

Correlations among feeding behaviours. Although the 'Difficulty in feeding' scale is arguably better considered as a measure of child eating behaviour or a parental attitude towards child eating behaviour than as a style of parent feeding, maternal feeding practices and child eating behaviours are somewhat conflated by original authors, and the scale is therefore addressed within this section. There were positive associations between 'Difficulty in feeding' and both of 'Food to calm' (r=.31, p<.001) and 'Child control' (r=.23, p=.002), and between 'Food to calm' and 'Child control' (r=.21, p=.004).

Correlations with sub-scales assessing restriction

The 'General restriction' and 'Food to reward behaviour' scales were derived from CFQ 'Restriction' items, and appeared very different on the basis of face validity. For example, whereas 'General restriction' items assessed specific attempts to restrict children's intake of energy-dense snack foods, 'Food to reward behaviour' specifically assessed use of food rewards to manipulate children's behaviour. Although foods used as rewards are usually restricted (giving greater reinforcing value), restriction is not necessarily the motive of 'Food to reward behaviour'. As an initial check on the distinctiveness of each scale, the correlation between scales was examined. r was .64, representing a medium to large effect size (Cohen, 1992), and suggesting that sub-scales were similar, but not identical.

As a second check on distinctiveness, correlations with other feeding scales were examined with the hypothesis that distinct scales would show a different pattern of inter-correlations. The presence of predicted associations with restriction depended on the sub-scale used. 'General restriction' was positively associated with both measures of concern about overweight and with 'Monitoring' (r=.30, p<.001), but 'Food to reward behaviour' showed no association with either variable (r=.04, p=.629; r=.02, p=.834) (see Table 2.11).

Table 2.11: Correlations between restriction sub-scales and other CFQ/PFQ scales

	CFQ General restriction n≥185	**CFQ Food to reward behaviour** n≥181
CFQ scales		
1) Perceived responsibility	.12 (p=.110)	.01 (p=.910)
2) Perceived parent weight	.02 (p=.828)	-.04 (p=.600)
3) Perceived child weight	.06 (p=.454)	.04 (p=.586)
4) Concern about child weight	.21 (p=.004)	.02 (p=.782)
5) Pressure to eat	.16 (p=.027)	.19 (p=.009)
6) General restriction	-	.64 (p<.001)
7) Food to reward behaviour	.64 (p<.001)	-
8) Monitoring	.30 (p<.001)	.02 (p=.834)

	CFQ General restriction	CFQ Food to reward behaviour
PFQ Scales		
1) Concern about overweight	.22 (p=.003)	.04 (p=.629)
2) Concern about overeating	.04 (p=.627)	-.02 (p=.777)
3) Concern about underweight	.10 (p=.194)	.10 (p=.167)
4) Difficulty in feeding	.03 (p=.702)	.13 (p=.067)
5) Meal-time rules	.21 (p=.005)	.19 (p=.010)
6) Food to reward food	.18 (p=.013)	.29 (p<.001)
7) Food to calm	.23 (p=.001)	.28 (p<.001)
8) Child control	-.04 (p=.603)	.13 (p=.079)

Correlations with sub-scales assessing pressure to eat

'Meal-time rules' and 'Food to reward food' were derived from the original PFQ 'Push to eat' scale, and 'Pressure to eat' was a 3-item version of the original CFQ 'Pressure to eat' scale. Given that 'Meal-time rules' contained the item, "Did you make your child eat all the food on his/her plate?" it was not considered necessary to include the single CFQ item "My child should always eat all of the food on his/her plate" as a separate scale. Again, scales appeared to be distinct. Whereas 'Pressure to eat' assumed a reluctance to eat which compelled the parent to encourage eating, 'Meal-time rules' specifically described rules about meal-times, and 'Food to reward food' described promising certain foods to encourage the consumption of others. Although all strategies are intended to increase the child's eating, a parent could plausibly adopt one or two of these behaviours without adopting the others. There were only moderate positive correlations between all three scales, with the strongest correlation between 'Pressure to eat' and 'Food to reward food' ($r=.33$, $p<.001$) and the weakest correlation between 'Food to reward food' and 'Meal-time rules' ($r=.27$, $p<.001$). 'Pressure to eat' and 'Meal-time rules' were also positively correlated ($r=.29$, $p<.001$) (see Table 2.12).

Table 2.12: Correlations between scales describing pressuring the child to eat

	Pressuring to eat sub-scales		
	CFQ	PFQ	
	Pressure to eat	**Meal-time rules**	**Food to reward food**
CFQ Pressure to eat	-		
PFQ Meal-time rules	.29 (p<.001) n=187	-	
PFQ Food to reward food	.33 (p<.001) n=185	.27 (p<.001) n=185	-

The PFQ 'Meal-time rules' scale showed a distinctive pattern of correlations with other scales (see Table 2.13). Most notably, it showed no association with 'Perceived child weight' (r=.01, p=.911), despite the existence of strong negative correlations between 'Perceived child weight' and both of 'Pressure to eat' (r=-.26, p<.001) and 'Food to reward food' (r=-.15, p=.039). Positive associations with 'Difficulty in feeding' (r=.13, p=.080) and 'Food to calm' (r=.14, p=.050) were also weaker than the associations with 'Pressure to eat' and 'Food to reward food'. 'Pressure to eat' and 'Food to reward food' displayed similar patterns of correlations with the exception that only 'Pressure to eat' showed a trend towards negative associations with 'Perceived responsibility' and 'Concern about overeating'.

Table 2.13: Correlations between pressure to eat sub-scales and other CFQ/PFQ scales

	CFQ Pressure to eat n≥182	**PFQ Meal-time rules** n≥181	**PFQ Food to reward food** n≥182
CFQ scales			
1) Perceived responsibility	-.12 (p=.091)	-.05 (p=.536)	-.03 (p=.721)
2) Perceived parent weight	-.09 (p=.219)	-.07 (p=.346)	-.10 (p=.197)
3) Perceived child weight	-.26 (p<.001)	.01 (p=.911)	-.15 (p=.039)
4) Concern re child weight	-.05 (p=.546)	-.05 (p=.495)	-.08 (p=.290)
5) Pressure to eat	-	-	-
6) General restriction	.16 (p=.027)	.21 (p=.005)	.18 (p=.013)
7) Food to reward behaviour	.19 (p=.009)	.19 (p=.010)	.29 (p<.001)
8) Monitoring	.01 (p=.907)	.08 (p=.290)	.04 (p=.551)
PFQ Scales			
1) Concern re overweight	-.04 (p=.623)	-.06 (p=.389)	-.06 (p=.447)
2) Concern re overeating	-.12 (p=.091)	.09 (p=.232)	-.05 (p=.532)
3) Concern re underweight	.48 (p<.001)	.15 (p=.049)	.17 (p=.021)
4) Difficulty in feeding	.60 (p<.001)	.13 (p=.080)	.43 (p<.001)
5) Meal-time rules	-	-	-
6) Food to reward food	-	-	-
7) Food to calm	.190 (p=.009)	.14 (p=.050)	.29 (p<.001)
8) Child control	-.04 (p=.630)	-.12 (p=.093)	.10 (p=.202)

Correlations with sub-scales assessing concern about weight/eating

Table 2.14 shows correlations between scales describing concern about overweight and overeating. 'Concern about underweight' is also included here for the sake of comparison and because 'Concern about underweight' items factored with 'Concern about overweight' items in the Principal Components Analysis. Correlations with the PFQ scale 'Concern about overweight' are not reported here because of the strong correlation with the equivalent CFQ scale, an artefact of high item overlap (r=.96, p<.001). Analyses were conducted separately using both PFQ and CFQ scales and produced nearly identical results. CFQ 'Concern about overweight' showed a strong association with 'Concern about overeating' (r=.42, p<.001). 'Concern about overweight' also showed a sizeable correlation with 'Concern about underweight' (r=.43, p<.001). However, 'Concern about underweight' was not associated with 'Concern about overeating' (r=.02, p=.781).

Table 2.14 Correlations between scales describing concern about weight/eating

	Concern about weight sub-scales		
	CFQ	PFQ	
	Concern about overweight	Concern about overeating	Concern about underweight
CFQ Concern about overweight	-		
PFQ Concern about overeating	.42 (p<.001) n=187	-	
PFQ Concern about underweight	.43 (p<.001) n=183	.02 (p=.781) n=183	-

Each scale displayed a different pattern of associations with other variables (see Table 2.15). 'Concern about child weight' showed stronger associations than 'Concern about overeating' (COE) and 'Concern about underweight' (CUW) for two scales: 'General restriction' (r=.21 cf COE r=.04, CUW r=.10), and 'Monitoring' (r=.14 cf COE r=.05, CUW r=.04). For 'Food to calm' the direction was reversed such that 'Concern about overeating' was more strongly associated (r=.~~12~~ 20) than either 'Concern about overweight' (r=.11) or 'Concern about underweight' (r=.11). 'Concern about underweight' showed a unique positive correlations with 'Pressure to eat' (r=.48 cf COW r=-.05, COE r=-.12) and a moderate negative correlation with 'Perceived child weight' (r=-.31 cf COW r=.01, COW r=.13).

Table 2.15: Correlations between concern about weight/eating scales and other CFQ/PFQ scales

	CFQ Concern re child weight n≥183	PFQ Concern re overeating n≥187	PFQ Concern re underweight ≥180
CFQ scales			
1) Perceived responsibility	.04 (p=.600)	-.01 (p=.866)	-.11 (p=.126)
2) Perceived parent weight	.04 (p=.590)	-.03 (p=.704)	-.13 (p=.075)
3) Perceived child weight	-.01 (p=.908)	.13 (p=.070)	-.31 (p<.0001)
4) Concern about child weight	-	-	-
5) Pressure to eat	-.05 (p=.546)	-.12 (p=.091)	.48 (p<.0001)
6) General restriction	.21 (p=.004)	.04 (p=.627)	.10 (p=.194)
7) Food to reward behaviour	.02 (p=.782)	-.02 (p=.777)	.10 (p=.167)
8) Monitoring	.14 (p=.052)	.05 (p=.501)	.04 (p=.643)

Table 2.15: Correlations between concern about weight/eating scales and other CFQ/PFQ scales (contd.)

	CFQ Concern re child weight n≥183	PFQ Concern re overeating n≥187	PFQ Concern re underweight ≥180
PFQ Scales			
1) Concern re child overweight	.96 (p<.001)	.37 (p<.001)	.43 (p<.001)
2) Concern re child overeating	-	-	-
3) Concern re child underweight	-	-	-
4) Difficulty in feeding	-.11 (p=.130)	-.14 (p=.051)	.40 (p<.001)
5) Meal-time rules	-.05 (p=.495)	.09 (p=.232)	.15 (p=.049)
6) Food to reward food	-.08 (p=.290)	-.05 (p=.532)	.17 (p=.021)
7) Food to calm	.12 (p=.105)	.20 (p=.005)	.11 (p=.144)
8) Child control	.07 (p=.319)	.08 (p=.261)	.09 (p=.235)

Sex differences in correlations between scales

Although the study was not powered to detect significant sex differences in correlations between scales, differences were examined for the purpose of hypothesis generation and are reported here. Confidence intervals for each r value were calculated using Power and Precision Version 2.0.44 (2000, Biostat Inc), and are presented in square brackets and used to evaluate the significance of the sex differences observed.

Sex differences in correlations within CFQ. The negative association between 'Perceived child weight' and 'Pressure to eat' was significant in girls (r=-.43 [95% CI .58 to -.25]) but not boys (r=-.07 [-.27 to .15]). As these confidence intervals did not overlap, this was taken as strong evidence for a genuine difference in feeding determinants for boys and girls. Similarly, the relationship between 'Concern about weight' and 'General restriction' was stronger in girls (r=.24 [.05 to .42]) than boys (r=-.03 [-.24 to .19]). Although these confidence intervals overlapped, the value of each correlation coefficient did not fall within the confidence limits of the value for the opposite sex, so this was taken as a trend towards a genuine sex difference. The positive association between 'Concern about weight' and 'Monitoring' was significant in girls (r=.24 [.05 to .42]) but not boys (r=.10 [-.11 to .31]). However, there was substantial overlap in confidence intervals for each coefficient, suggesting that the difference may have been due to chance.

Sex differences in correlations within PFQ scales. The positive association between 'Concern about underweight' and 'Meal-time rules' was substantially greater in girls (r=.30 [.11 to .47]) than boys (r=-.04 [-.25 to .18]). This was also true for the association between 'Child control' and 'Food to calm' (r=.31 [.12 to .48] cf r=.08 [-.13 to .29]). Other inter-scale correlations did not differ with child sex.

Sex differences in correlations between CFQ and PFQ. In terms of sex differences in correlations between questionnaires, higher 'Perceived child weight' was associated with lower 'Difficulty in feeding' for girls (r=-.26 [-.44 to -.07]) but not boys (r=.11 [-.11 to .31]), with comparison of confidence intervals suggesting that a real sex difference may exist. In contrast, the negative relationship between 'Concern about overeating' and 'Pressure to eat' was substantially stronger for boys (r=-.24 [.43 to -.03]) than for girls (r=-.03 [-.22 to .17]). This pattern also held for the associations between 'Difficulty in feeding and 'Monitoring' (Boys r=-.22 [-.40 to -.02] cf Girls r=-.06 [-.27 to .15] and for the association between 'Concern about overeating' and the CFQ measure of 'Concern about weight' (Boys r=.44 [.26 to .58] cf Girls r=.14 [-.08 to .34]). The stronger association between concerns about overweight and overeating in girls is also likely to underlie the stronger association between CFQ and PFQ measures of concern about overweight in girls (r=.93 [.90 to .96] cf r=.23 [.02 to .42]), as the CFQ scale also assesses concern about overeating. A further sex difference was apparent for the correlation between 'Concern about underweight' and CFQ 'Concern about weight', which was substantially larger for girls (r=.42 [.24 to .57]) than for boys (r=.07 [-.15 to .28]).

2.3.5 Combined factor analysis of parental feeding items

Combined factor structure. Finally, a combined principal components analysis of the parental feeding items in the CFQ and PFQ was conducted to see whether factors emerging in individual analyses were truly independent (n=170, see Table 2.16). The two lowest loading items on the individual PFQ analysis ("Did you feed your child yourself if he/she did not eat enough?", "Did you ever punish or remove privileges to get your child to eat more?") were excluded, and all 'Child control' items were omitted, as they did not form a clear factor and similar constructs were included in other scales (e.g. 'General restriction') in a reversed form. Most factors were retained in the presence of items from the other questionnaire (CFQ 'Pressure to eat', 'Monitoring', 'Food to reward behaviour' and PFQ 'Food to calm', 'Food to reward food'). Two main changes were also apparent:

1) The CFQ item, "My child should always eat all the food on his plate" loaded with the two strongest 'Meal-time rules' items from the PFQ ("Did you ever make your child eat all the food on his plate?", "Did you ever make your child finish all his/her dinner before he/she could have dessert?") to produce a 3-item factor (α=.79).

2) 'General restriction' items split into two further sub-scales. The first of these contained four items (α=.63); the second contained the items "If I did not guide or regulate my child he/she would eat too many junk foods" and "If I did not guide or regulate my child he/she would eat too much of his/her favourite foods" (α=.70). However, as the six-item 'General restriction' scale generated in the CFQ analysis had comparable internal reliability (α=.69), this version was used in subsequent analyses for greater parsimony.

Table 2.16: Factor loadings for CFQ and PFQ parental feeding behaviour items†

Factor and items in solution	1) Meal-time rules	2) Monitoring	3) Use of food to calm	4) Pressure to eat	5) General restriction	6) Use of food to reward behaviour	7) Rule-based feeding	8) Use of food to reward healthy food
Factor 1: Meal-time rules								
Made child eat all the food on the plate	**.85**	-	-	-.20	-	-	.11	-
Child should always eat all food on plate	**.80**	-	-		.13	-	-.17	.13
Made child finish all dinner before could have dessert	**.78**	-	-	.11	-.16	-	-	-.25
Factor 2: Monitoring								
Keep track of the sweet things your child eats	-	**.93**	-	-	-	-	-	-
Keep track of the snack food your child eats	-	**.92**	-	-	-	-	-	-
Keep track of the high fat foods your child eats	-	**.78**	-	-	-	.10	-	-
Factor 3: Use of food to calm								
Gave something to eat/drink if child was upset	.16	-	**.77**	-	-.15	-	-	-.20
Gave something to eat/drink if child was bored	-	-	**.74**	-	-	.21	-	-.22
When agitated, first gave something to eat/drink	-	-	**.73**	-	-	-.16	-	-
Offer something to eat to stop temper tantrums	.10	-	**.65**	.11	-	-	-	.19

Table 2.16: Factor loadings for CFQ and PFQ parental feeding behaviour items (contd.)

Factor and items in solution	1) Meal-time rules	2) Monitoring	3) Use of food to calm	4) Pressure to eat	5) General restriction	6) Use of food to reward behaviour	7) Rule-based feeding	8) Use of food to reward healthy food
Factor 4: Pressure to eat								
If did not guide or regulate, child would eat much less than should	-	-	-	**-.89**	-	-	-	-
Have to be especially careful to make sure child eats enough	-	-	-	**-.88**	-	-	-	-
If child says not hungry, try to get to eat anyway	.11	-	-	**-.73**	-	-	-	-
Factor 5: General restriction								
Have to be sure child goes not eat too many high fat foods	-	.19	-	-	**-.75**	.13	-	-.15
Have to be sure child does not eat too many sweet things	-.16	-	-	-.11	**-.70**	-.11	-	.11
Intentionally keep some foods out of my child's reach	-	-	-	-	**-.67**	-.25	-.22	.16
Have to be sure child does not eat too much of favourite foods	.18	-	-	-.14	**-.55**	.20	-	.27
Factor 6: Use of food to reward behaviour								
Offer sweet things as reward for good behaviour	-	-	-	-	-	**-.82**	-	-.16
Offer child favourite foods in exchange for good behaviour	-	-	-	-	-	**-.81**	-	-
Factor 7: Rule-based feeding								
If did not guide or regulate would eat too many junk foods	-.11	.12	-	-	-	-	**-.89**	-
If did not guide or regulate would eat too much of favourite foods	.22	-	-	-	-.16	-	**-.76**	-
Factor 7: Use of food to reward healthy food								
Offered child dessert after meal to get to eat foods good for him/her	-	.11	-	-	-	-	-	**-.76**
Used foods liked as way to get to eat healthy foods didn't like	.10	-.13	.12	-.18	-	-	-.11	**-.57**

†Only factor loadings over .1 are listed. Constrained to 8-factor solution

Variance explained by factors arising from the combined analysis was broadly similar to the variance explained by similar factors in the separate analyses (see Table 2.17). 'Monitoring' explained the most variance (3%), and the two-item scales 'Food to reward behaviour' and 'Food to reward food' explained under 2% of variance each.

Scale characteristics. Alpha scores were generally unchanged as most factors were retained in the combined analysis. The alpha for 'Meal-time rules' rose from .77 to .79, benefiting from the addition of the extra CFQ item "My child should always eat everything on his/her plate". Alphas for the further sub-scales created from the original CFQ restriction scale ('General Restriction' α=.63, 'Rule-based feeding' α=.70) were broadly worse in comparison with α=.69 for all six items together (see Table 2.18).

Table 2.17: Variance explained by combined CFQ/PFQ factors

Factor name	Variance explained (%)
1) Monitoring	2.82
2) Pressure to eat	2.74
3) Food to calm	2.59
4) Meal-time rules	2.56
5) General restriction	2.49
6) Rule-based feeding	2.08
7) Food to reward behaviour	1.84
8) Food to reward food	1.61

Table 2.18: Alpha scores and item means for final CFQ/PFQ scales

Factor name	Number of items	Alpha
1) Meal-time rules	3	0.79
2) Monitoring	3	0.83
3) Food to calm	4	0.73
4) Pressure to eat	3	0.81
5) General restriction	4	0.63
6) Food to reward behaviour	2	0.67
7) Rule-based feeding	2	0.70
8) Food to reward food	2	0.50

2.4 Discussion

This study shows good replication of the factor structures of the CFQ and PFQ in a sample of British parents with 3-5 year old children. Separate principal components analyses produced factors that were broadly in line with the CFQ and PFQ scales derived during development of each measure, and a combined analysis demonstrated that these factors were maintained even in the presence of each other. There was also some evidence for further subscales within existing questionnaires, and the differential patterns of associations for each sub-scale were further support for the existence of distinct aspects of parental control. Although caution should be applied when comparing the direction and size of the inter-scale correlations found in this study with those from other studies which used different samples and statistical methods, results were largely consistent with those predicted by previous research, suggesting that the CFQ and PFQ are valid instruments for application in a UK population. Results are discussed in more detail below.

2.4.1 Replication of CFQ and PFQ

CFQ Restriction scales. Several departures from the original scale loadings were apparent with important implications for the measurement of parental control. First, there were two sub-factors of 'Restriction' which showed differential relationships with other variables. Consistent with previous research reporting positive correlations between concern about overweight and restriction (Spruijt-Metz et al, 2002; Francis, Hofer & Birch, 2001; Birch et al, 2001), higher scores on 'Concern about child overweight' were associated with higher scores on 'General restriction', but this association was not evident for 'Food to reward behaviour'. This suggests that whereas 'General restriction' may reflect parents' concerns to limit certain foods, possibly motivated by concerns about child overweight, the use of 'Food to reward behaviour' may be more influenced by other factors such as parental attitudes towards the instrumental use of food, the need for disciplining the child, and the child's responsiveness to this form of bribe. Given the evidence for the distinctiveness of each type of restriction, it is possible that treating all types as equal may obscure meaningful relationships between restriction, child eating behaviour and weight.

CFQ Pressuring to eat scales. A second finding in relation to the CFQ was that the item, "My child should always eat everything on his/her plate" did not load with the other 'Pressure to eat' items. This behaviour is often treated as the quintessential demonstration of pressuring one's child to eat greater amounts of food, and has been specifically associated with children's inability to regulate their food intake (e.g. Birch et al, 1987a). The 'clean up your plate' item has featured strongly throughout the development of the CFQ (Johnson & Birch, 1994; Birch et al, 2001). However, scores on this item were very low in this sample, and in the combined analysis of the CFQ and PFQ it loaded with items describing 'Meal-time rules' rather than with the other 'Pressure to eat' items. This suggests that this type of parental feeding may be different in nature to that expressed by the other 'Pressure to eat' items. Most likely, the new, three-item 'Pressure to eat' factor captures parents' responses to perceived under-eating and underweight in the child, whereas 'Meal-time rules' captures more authoritarian behaviours motivated by achieving a diet which is balanced rather than necessarily greater in volume. The latter behaviours might be expected to be most common in the current sample of mothers of pre-school children, for whom concern about under- and over-weight was low. Notably, there was also a division within PFQ pushing to eat items ('Meal-time rules' and 'Food to reward food'). 'Food to reward food' showed a similar correlation matrix to 'Pressure to eat', suggesting that behaviours captured by each of these scales spring from similar motivations.

PFQ factor structure. There was also some evidence for a different PFQ factor structure in the current sample. Firstly, three items were dropped on the basis of low correlations with other items: "If your child did not like what was served, did you make something else?", "Did you feed your child yourself if he/she did not eat enough?" and "Did you punish or remove privileges to get your child to eat more?" Their omission here does not imply that these behaviours are not of importance, but ~~may~~ they may represent additional types of feeding that were not well characterised here. They may also be poorly operationalised. For example, the item "Did you punish or remove privileges to get your child to eat more?" has since been found to be confusing to parents (Jain et al, 2004), and social desirability bias is likely to produce low levels of endorsement.

Concern about weight scales. In a second deviation from the original factor structure, PFQ 'Concern about underweight' items failed to load on a separate factor, instead loading with 'Concern about overweight' items. This suggests that, within this sample, parents who are more concerned about overweight were also more concerned about underweight, and that these items tap a generalised concern about weight. Notably, concern about both underweight and overweight were very low: the majority of participants were not concerned about underweight or overweight. This may mean that concerned subjects in this study were different in character to those in the study by Baughcum et al, perhaps representing a group who had anxieties in a number of parenting domains. The measure may have produced more variance if a less loaded term than 'concern' was used, or if items reflecting different types and levels of concern (e.g. How concerned are you about your child 'becoming overweight in the future' vs. 'being overweight at the moment'?) were examined separately.

Despite the dual loading of 'Concern about overweight' and 'Concern about underweight', each scale showed different patterns of inter-scale correlations when treated separately, lending substantial support for maintaining this conceptual distinction. For example, 'General restriction', 'Monitoring' and 'Child control' were related to 'Concern about overweight' but not 'Concern about underweight'. In addition, 'Concern about underweight' was negatively correlated with 'Perceived child weight'. Other associations also replicated those found by Baughcum et al (personal communication). For example, 'Concern about underweight' was positively associated with push to eat scales ('Meal-time rules' and 'Food to reward healthy food'), supporting the hypothesis that parents who are concerned their children are underweight are more likely to push them to eat.

There was a further division of 'Concern about overweight/overeating' items, providing some evidence for a distinction between a more long-term worry about weight gain and a more immediate worry about over-eating. This distinction may be quantitative, such that 'Concern about over-eating' expresses a less pronounced worry that is likely to develop into 'Concern about overweight' at a later stage. This seems plausible as both factors relate to other factors in a similar way, although associations with 'Monitoring' and 'Child control' were much stronger for 'Concern about overweight' than for 'Concern about over-eating', and associations with 'Food to calm' were stronger for 'Concern about over-eating' than for 'Concern about overweight'. Alternatively, 'Concern about over-eating' may uniquely capture a desire to socialise the child into a more moderate, socially acceptable way of eating, or to guard against the child making him or herself ill. The disjunction between these factors requires further investigation, as differences in phrasing and item clustering may be responsible. For example, the separate loading of the very similar items "How concerned are you about your child having to diet to maintain a desirable weight?" and "Did you think about putting your child on a diet to keep him/her from becoming overweight?" suggests that question format may have been an influential factor. Alternatively, the first question may have assessed parents' fears that the child might develop eating-disordered behaviour, while the second question may have assessed parental fears that the child is too fat.

2.4.2 Comparison of associations with previous results

Inter-scale correlations were compared with those found in previous studies to see if associations in American results were also apparent in the UK, and to provide a form of construct validity testing. Consistent with other studies (Birch et al, 2001; Frances, Hofer and Birch, 2001), significant positive correlations between 'Concern about child weight' and both 'General restriction' and 'Monitoring' were found, but only in girls. However, there were no sex differences in mean scores for each feeding behaviour. This finding could be interpreted as resulting from mothers responding to societal pressures for girls to be thin and for boys to be big, strong and healthy (Garner et al, 1980; McCabe & Ricciardelli, 2004).

The negative association between 'Perceived child weight' and scales measuring pressure to eat was consistent with other studies showing a link between lower child weight and higher pressure to eat (Spruijt-Metz et al, 2002; Lee et al, 2001). However, the negative associations between 'Perceived child weight' and 'Pressure to eat' were stronger in girls, and higher 'Concern about underweight' predicted higher 'Meal-time rules' for girls alone. Moreover, there was also a stronger link between concern about underweight and concern about overweight/overeating for girls. This supports the more general interpretation that mothers feel girls need more guidance to control weight in either direction. Where mothers pressure their sons to eat, motivations such as limiting unhealthy food choices or overcoming distractability at meal-times may be more salient.

In contrast to Birch et al's (2001) findings in well-educated US mothers of 5-9 year olds we did not find a relationship between 'Perceived child weight' and 'Concern about overweight'. Neither did 'Perceived child weight' relate to either restriction sub-scale. This discrepancy may arise partly because parents are less concerned about their children's weight at younger ages, seeing heavier children merely as 'solid', ‘stocky’ or 'healthy-looking' (Jain et al, 2001; Baughcum et al, 1998). Additionally, the majority of parents in the current study described their children as normal weight, which may have limited the possibility of detecting a significant linear relationship.

The associations between parental feeding and 'Perceived child weight' have important implications for causal theories. For example, if parental feeding behaviour is purely a response to perceptions of child weight we would predict relationships between child weight and feeding strategies to disappear when controlling for perceived child weight (or if perceived weight is constant). However, if parental feeding behaviour influences child weight, or if it is due instead to a third factor (e.g. genetically or externally determined child eating behaviour), we would expect the relationship to persist, independent of perceptions (see Chapter 5).

Also in contrast to Birch et al (2001), there was no relationship between 'Perceived parent weight' and 'Concern about overweight' in this diverse sample of UK parents of 3-5 year olds for either boys or girls. Why 'Perceived parent weight' should relate to 'Concern about overweight' has not yet been addressed empirically. One possibility is that parents correctly perceive an increased risk of overweight in their children if they are themselves overweight. Another is that the negative consequences of being overweight are more salient to such parents. In order to exclude a third possibility - that they are simply more concerned because their children are more likely to be overweight - it is necessary to measure and control for children's weight (see Chapter 5). The absence of a relationship in the current data may arise partly because parents are less likely to link their own weight to their children's weight at this early age.

2.4.3 Study limitations

Limitations of the study design mean that the parental feeding scales tested here require further development before use in a UK population. As each questionnaire was presented in its original format it is difficult to tell whether separation of factors resulted from genuine conceptual distinctions or superficial differences. For example, the conceptual grouping of CFQ items may have promoted higher agreement of responses within factors. However, the comparable strength of the factors within the PFQ suggests this was not a significant problem. The CFQ and PFQ also had different response categories, with the PFQ assessing frequency of behaviours when the child was younger, and the CFQ predominantly assessing attitude agreement regarding the child at the present time. However, the joint loadings of some items across questionnaires in the combined factor analysis (e.g. The CFQ item, "My child should always eat everything on his/her plate" loaded with PFQ items), suggest that this did not limit correlations across questionnaires.

Indeed, the difference in formatting may be crucial to some of the divisions between factors. For example, the CFQ items assessing parents' attitudes to 'pressure to eat' (e.g. "If I did not regulate my child, he/she would eat much less than he/she should") contain more assumptions than PFQ items assessing behaviours parents employ to push their child to eat (e.g. "Did you make your child finish all his/her dinner before he/she could have dessert?"). Another weakness of the design was the small number of items on some of the factors. This occurred because only items existing in the CFQ and PFQ were used; the factors in question may have been stronger if drawing from a greater item pool. Possible ways to address the joint loading of 'Concern about overweight' and 'Concern about underweight' items were discussed earlier.

The current sample size was adequate for testing the factor structures of the published questionnaires used here. However, greater numbers would be needed to provide enough power to draw firm conclusions about sex differences. The response rate was high, but subsequent interviews with parents suggested that there may have been some inaccurate reporting and missing items due to social desirability effects. The current sample may therefore not be entirely representative of the majority of parents in each school in that participants may have been more interested and concerned about children's eating and more inclined to give what they consider to be socially desirable responses. In defence against this, it is unclear what ~~would~~ the socially desirable response would be for each item as parents themselves express a lack of knowledge about how to feed their children. Additionally, participants had a higher educational level and a much more varied ethnic mix than the average UK population.

2.4.4 Conclusions

Despite the limitations, this study represents a first step towards validation of a parental feeding scale that can be used in a diverse, non-US population. The independence of the CFQ and PFQ scales, and sub-factors within these scales, suggest that there may be more facets to parental control than have commonly been considered, and the distinctive patters of inter-scale correlations for each of these scales suggest they may have different associations with variables such as parent weight, child weight and child eating behaviour. A more detailed model of parental feeding may help to explain previous contradictory results and enable more precise predictions to be made about parental feeding style and predictor and outcome variables.

CHAPTER 3

Study 2: Validation of parental feeding measures in a UK sample - Qualitative study

3.1 Introduction

3.1.1 Rationale

Study 1 demonstrated broad replication of individual parental feeding scales from the Child Feeding Questionnaire (CFQ) and Preschooler Feeding Questionnaire (PFQ) in a British sample. However, additional sub-scales also emerged within certain factors, reflecting distinctions between types of parental feeding behaviour. For example, there were two components of restriction – 'General restriction' and 'Food to reward behaviour' - and "My child should eat everything on his/her plate" loaded separately from other 'Pressure to eat' items on a separate factor assessing rules surrounding meal-times. In order to check whether these items reflected UK parents' spontaneously reported feeding behaviours and whether scales reflected naturally occurring clusters of behaviours, Study 2 used telephone interviews and two-day diaries to generate descriptions of feeding interactions and to explore the motivations behind parents' practices. Framework analysis was used to categorise feeding behaviours and motivations into themes and sub-themes. Reports of each type of behaviour were counted and motivations are discussed. The relevant parental feeding scores for parents reporting different feeding behaviours were examined for face validity. Implications for the measurement of parental feeding are discussed.

3.1.2 Qualitative studies of parental feeding

Quantitative studies dominate the literature on parental feeding, but a small number of recent American studies have successfully used focus group methods to generate qualitative data, giving a fuller picture of parental feeding. For example, Kaiser et al (1999) conducted 11 focus groups with American Latino parents. Questions put to the group for discussion included: "What do you do at mealtime if your child does not want to eat?" and "How much should a parent try to decide what a 3-5 year old child eats?" Comments were hand-coded and sorted by theme, group, and participant, to look for trends. A total of 21 different child feeding strategies were apparent, the most common of which were bribes of various sorts, employed predominantly to increase consumption of specific foods. A high acceptance of child-initiated snacking was also in evidence.

Two other studies have used focus groups to generate qualitative data on maternal beliefs about childhood overweight in low income populations (Jain et al, 2001; Baughcum et al, 1998). One of these also asked about feeding strategies and found frequent use of food as a tool to shape behaviour and a reluctance to set behavioural limits on children's eating (Baughcum et al, 1998). Sherry et al (2004) compared results from white, African-American and Hispanic-American, and both low- and middle-income focus groups of mothers of 2-4 year olds. Examples of questions (Q) and probes (P) designed to elicit feeding behaviours are tabulated below.

Table 3.1: Focus group questions and probes

Source: Sherry et al (2004)

Question	Probe/s
What goals do you have when you are feeding your child?	What strategies do you use to reach these goals?
Think about the typical meal time you share with your child. What happens?	What is the mood? Is there any interaction between you and your child?
What do you think your child is telling you when he/she says he/she is full?	What do you do when your child eats nothing or not very much at a meal?
How do you feel about food left on your child's plate?	When your child leaves food on his/her plate, what do you do?
Are there foods that you don't want your child to eat too much of?	Do you try to keep your child from eating too much of these foods? If yes, how?
When are special snacks or treats given to your child?	Reward or bribe for good behaviour? Reward or bribe for eating foods that you want them to eat? Are special snacks or treats given to your child to help him/her feel better, to keep them quiet, when bored, to stop crying?

The authors found that the majority of parents wanted to provide good nutrition for their children, wanted to avoid their children eating too many sweets and processed foods, tried to prepare foods their children liked, accommodated specific requests for food, used bribes and rewards to encourage eating and did not believe their children when they said they were full. The results also highlighted several differences between groups and between ethnicities meriting further investigation. For example, more lower income than middle income groups accommodated children's requests for food, and Hispanic mothers had a stronger focus on persuading their children to eat enough. In the only similar British study, Hart et al (2003) recruited groups of varying socio-economic status and found that higher SES groups of mothers were more likely to report limiting carbonated drinks and crisps. Lower SES groups were more likely to allow their children more control over what they ate within and outside the home, and placed more importance on the social aspects of eating, and providing a good quantity of food.

3.1.3 Qualitative methods

These studies demonstrate the diversity of parents' concerns, attitudes and strategies relating to child feeding. They also illustrate the richness of the qualitative data that can be generated with the use of pertinent questions and probes. Focus groups are generally used in order to explore participants' attitudes and perceptions in a social context (Kreuger, 1994). They are able to generate a great deal of data and sample a large number of opinions, with other participants' responses providing naturalistic probes which bring more information to the surface. However, the effects of social desirability are likely to be marked in samples of mothers when sensitive issues such as child feeding are tackled, and may have the effect of exaggerating group similarities and obscuring individual differences. For this reason, one-on-one interviews may be equally, if not more appropriate (Millward, 1995). It is unclear whether or not face-to-face interviews have an advantage over telephone interviews. It is possible to pick up and respond to more nuances when face-to-face, but telephone interviewing has also been reported to make the interviewee more comfortable and encourage a more honest account of events.

Another way of gaining rich data on parental feeding might be to use experience sampling methods, which aim to generate participants' descriptions of relevant, recently occurring events, without requiring them to generalise or estimate the frequency of certain behaviours, as is common in psychometric measures (Breakwell and Wood, 1995). One way of doing this is to use a diary methodology. Self-complete diaries have been widely used within psychology and particularly health psychology to sample individuals' experiences, and put only limited constraints on participants' responses. Much nutrition research uses diet diaries which subjects complete throughout, or at the end of each day. In a study with similar aims to ours, Makela et al (1999) used telephone interviews to elicit reports of all eating events occurring that day. The main advantage of experience sampling over methods requiring the subject to reflect on past or habitual behaviour, is that recall is improved, giving a more accurate illustration of participants' behaviours. Data are not ostensibly generalisable, but may be less prone to social desirability bias than scales requiring subjects to tell the researcher how they generally behave. Furthermore, generalisability can be increased by asking participants to complete a number of diaries over a range of situations. One disadvantage of using diaries to sample experiences is that they demand a high level of literacy from participants, which may bias response to high SES individuals. Despite this limitation, the diary methodology is well suited to measure actual instances of parental feeding behaviour in an ecological fashion. As yet, no studies have used diaries specifically to measure parental feeding practices

3.1.4 Combining quantitative and qualitative approaches

Parental feeding research has tended to take either a quantitative or qualitative approach. In some studies, qualitative interviews have been used as a source of information to develop psychometric measures (e.g. Wardle et al, 2002), but the analysis presented has been entirely quantitative. It is evident that qualitative approaches have the potential to enrich the study of parental feeding, which is still in its infancy in the UK, and would benefit from work aiming to map the range of feeding strategies displayed as well as to quantify and explore associations with behaviours that have already been described elsewhere.

One way of integrating qualitative and quantitative methods is to consider each as a form of validation of the other. 'Methods triangulation' is as a comparison of data generated by different methods (e.g. quantitative and qualitative) which can be employed not only to provide diverse ways of looking at the same phenomenon but also to add to the credibility of the findings by strengthening confidence in whatever conclusions are drawn (Denzin & Lincoln, 2000). Researchers disagree on the value of this approach, some arguing that the epistemological difference between qualitative and quantitative methods makes it impossible to integrate them

(Richardson, 1996). However, the qualitative study here is used largely to confirm and illustrate the quantitative results in Study 1 and to generate hypotheses for testing in future quantitative surveys. As such, it is taken to inform the main quantitative analysis rather than to alter or replace it.

3.2 Methods

3.2.1 Participants and procedures

Recruitment to the main study is described in Chapter 2. At the end of the questionnaire, participants were asked to tick a series of boxes if they would be interested in participating in one or both of: a) a telephone interview, b) a two-day diary study about their child's eating. 45 interview volunteers were selected to represent a range of socio-economic backgrounds. These volunteers were organised into a random list, contacted systematically and interviews were conducted until saturation point was reached, i.e. no new information was being produced. All those volunteering to fill in a diary were sent a diary in the post, and one reminder letter with another copy of the diary if they had not responded one month after the initial contact.

3.2.2 Interview protocol

Interview volunteers were telephoned in the evening and asked to participate in a 30-60 minute interview about how they had fed their 3-5 year old child that day. If it was not convenient to talk at the time of the call a later date for the interview was arranged. A Topic Guide was created following guidelines from the National Social Research Council (Ritchie & Lewis, 2003) with the main objective of sampling parental feeding behaviour over a range of situations, and used to guide the course of the interview (see Table 3.2).

To establish the context of the interview and accustom the individual to the procedure, participants were first asked to give a brief account of their day and how their child was involved. With the aid of probe questions from the interviewer, the parent was then encouraged to describe chronologically all food-related events that occurred with their child. These were defined as any occasion when something was eaten or drank, when food was requested or discussed, or when food was bought. Additional general questions were used to probe for further details of each event, such as what the child ate, how much they ate, what was said, and reasons for their own and their child's behaviour. In order to sample a range of experiences participants were asked if the events described were typical, and if they could describe an occasion when things had happened differently. Given the timing of the study, plans for feeding the child over the Christmas break were explored as an additional situation where feeding issues might arise. Where parents began to generalise rather than describe specific situations, they were asked to describe an example of the behaviour.

Table 3.2: Summary of interview topic guide

1. Introduction Introduce self and project about eating habits in young children. Request interview or alternative time. If OK to go ahead, explain that will ask interviewee to talk through day, interested in anything to do with feeding their 3-5 year old child - mealtimes, snacks, any occasion food requested or discussed, shopping trips. Interested in what actually happened and what thinking at the time. Also very helpful if can remember what was said by parent and child during interaction. Mainly interested in subject of questionnaire, but fine to refer to siblings and other family too. Main aim is to remember as much as possible, so if remember something out of context, please mention and can resume previous discussion later. Check that OK to record interview and guarantee anonymity and confidentiality.
2. Discussion of day - General Summary "Can you tell me a bit about what you and [child's name] did today?" • PROBES Child at school or home? Other people looked after child, e.g. babysitter, grandparent?
3. Discussion of day - Breakfast, Snacks, Drinks, Lunch, Evening meal "Can you tell me about the first time food was mentioned or your child had something to eat or drink? And after that, when was the next time your child had something to eat?" • GENERAL PROBES Did you mention eating? Did child say was hungry? Predetermined snack time? Did child eat anything else before lunch? Lunch? Anything else when came home from school / before evening meal? Evening meal? • SPECIFIC PROBES What did child have to eat? How were foods chosen? How much did child eat? Normal amount for them? Describe how decided meal was over - when child felt had enough? When parent felt had enough? If any disagreement, remember what you were thinking at the time? What do you think child was thinking? Think of any examples where similar event occurred? If strategy/rule described, remember when started applying the rule and why? Any exceptions? If specific to certain foods, any other foods do this with? Any times when wouldn't apply? Anything else remember about the event, e.g. what you or child said? Was event typical or unusual in any way? If so, how and why?
4. Discussion of day - Food-related discussions "Do you remember talking about food or eating with your child at any point?" • PROBES About what foods your child liked? About foods you thought your child should or shouldn't eat? Any requests for food? Discussions of eating arrangements at Christmas? Remember what you and child said? Remember what you were thinking, ideas about what child was thinking?
5. Discussion of day - Shopping trips "Did you go shopping for food at any point today?" • PROBES Alone or with child/ren? What bought for children to eat and what was thinking behind buying those things?

Table 3.2: Summary of interview topic guide (contd.)

6. Close of interview

- ADDITIONAL PROBES Typical day for you and child in terms of eating? If so, what typical? If not, how was it different? Did you behave how normally behave? Did child behave normally? Think of any recent days where things different? Some parents say children eat differently around Christmas - expect this to be true for their child? If so or if not, how and why.
- Felt remembered most of events? Discuss any omitted events. Anything else want to add or discuss? If not, thank interviewee very much for their time.

3.2.4 Diary protocol

All volunteers were sent diaries in December 2002 and those who had not responded were sent reminders in January 2003. Diary instructions followed the interview protocol, with the difference that in order to sample a range of experiences, participants were asked to complete the diary for one week-day and one weekend-day. An example of a completed section of the diary was given and a contact telephone number and email address were provided for parents to use if they had any queries about how to complete the diary. Freepost envelopes were included for return of the diaries. A summary of the diary contents is presented in Table 3.3 and a sample of the diary may be found in Appendix III.

Table 3.3: Summary of diary contents

1. Instructions

Please use this diary to record all food- or drink- related interactions you have with your child on two days: once during the ***week***, and one during the ***weekend***. These might include your response to your child's request for a snack, an overall account of a particular mealtime, or an occasion where you gave your child some food. Remember we are interested in ***all food- or drink- related interactions***, so please record any time food is eaten or mentioned by your child. An example is given below:

Time of day: 18.00

Food/drink involved: Roast chicken, peas, carrots and chips

What happened? We were having our evening meal. Ben left his vegetables on his plate so I asked him to finish them. He ate a few then refused to eat any more.

Why do you think you and your child behaved in this way? He left the vegetables because he doesn't like them. I asked him to finish his veg because I think they are good for him.

Please try to record each event as soon as it has happened, as this will help you to remember it more accurately. Feel free to use more paper or write on the back of the diary if necessary.

Thank you very much for your help with our research!

2. Sections to complete for each day

Day: __________ Date: __________

Time of day: __________

Food / drink involved:

____

What happened?

____

Why do you think you and your child behaved this way?

3.2.5 Data analysis

Interviews were transcribed and a thematic framework was developed in which to enter summaries of the data (Framework Analysis; Ritchie & Lewis, 2003). This framework was guided by i) in-depth analysis of a sub-set of five transcripts, and ii) categories of parental feeding behaviour that emerged in the questionnaire study. Each case corresponds to one line in the framework so that data can be analysed either by case (by reading across the framework) or by theme (by reading down the framework). The framework outline may be found in Appendix IV and a sample of one completed framework is given in Appendix V.

The interviews were a rich source of data, and covered many topics beyond the scope of the current study. The analysis undertaken focused on the spontaneously produced examples of different parental feeding behaviours that emerged. In order to facilitate comparison of reported behaviours with questionnaire factors, descriptions of behaviours are presented according to broad PFQ and CFQ constructs: pressuring the child to eat, restrictive behaviours, meal-time rules, use of food to reward food, and use of food to calm the child.

3.3 Results

3.3.1 Response rates

Of the 190 questionnaire respondents, 79 (42%) parents expressed interest in completing a diary, and 74 (39%) expressed interest in being contacted for an interview. All of those expressing interest in the diary were sent a diary, and 22/79 diaries were returned, giving a response rate of 28%. Of a total of 17 interview volunteers who were contacted, 14 granted interviews, giving an 82% rate of response.

3.3.2 Sample characteristics

Tables 3.4 and 3.5 give parent and child characteristics of the interview and diary samples together with those of the complete questionnaire sample. Due to the small number of participants in each cell, it was not thought meaningful to test for significant differences, but face differences are considered below. One individual completed both an interview and a diary so is included in both columns.

Parent characteristics

Table 3.4 gives parent characteristics of interview and diary participants compared to the full questionnaire sample. Reflecting the composition of the sample as a whole, the vast majority of interview and diary participants were the mother of the child. Diary participants showed a similar age distribution to the wider sample. The majority (12/14) of interview participants were between 31 and 40 years old. Most of the diary and interview participants were categorised as normal weight on the basis of self-report height and weight. 29% of interview participants and 23% of diary participants fell into the overweight or obese categories compared with around 29% for the whole sample. In line with proportions in the main sample, around 3/4 of diary respondents were married and around 14% were living together. Almost all (12/14) of interview participants were married. Similarly, whereas diary participants roughly reflected the proportion of White British individuals in the whole sample (64% cf. 60%), almost all (13/14) interview participants were White British.

There were slightly more full-time home-makers (57%) in the interview sample than in either the diary sample (41%) or the full questionnaire sample (42%). Interview participants were less educated than the general sample but diary participants were more educated, with nearly half (10/22) possessing a degree or higher. Car ownership in interview and diary participants was representative of the main sample, with the majority of respondents owning one or more cars. There was a greater proportion of individuals owning or buying their house in interview/diary samples (86%, 82%) than in the main sample (72%).

Table 3.4: Parent characteristics

	Interview participants		**Diary participants**		***Total sample***	
	n	**%**	**n**	**%**	*N*	*%*
Gender						
Female	13	92.8	22	100	*182*	*95.8*
Male	1	7.2	0	0	*8*	*4.2*

Table 3.4: Parent characteristics (contd.)

Age group						
25 or under	0	0	1	4.5	*7*	*3.7*
26-30	0	0	2	9.1	*22*	*11.6*
31-35	6	42.9	6	27.3	*71*	*37.4*
36-40	6	42.9	7	31.8	*57*	*30.0*
41-45	1	7.1	4	18.2	*21*	*11.1*
46 or over	1	7.1	2	9.1	*12*	*6.3*
BMI group (calculated from self-reported height and weight)						
Underweight (<18.5)	0	0	2	9.1	*13*	*6.8*
Normal weight (18.5-24.99)	8	57.1	15	68.2	*108*	*56.8*
Overweight (25-29.99)	4	28.6	2	9.1	*39*	*20.5*
Obese (≥30)	0	0	3	13.6	*16*	*8.4*
Missing	2	14.3	0	0	*14*	*5.3*
Relationship with child						
Mother	12	85.7	22	100	*178*	*93.7*
Father	1	7.1	0	0	*7*	*3.7*
Other (Grandparent / Guardian)	1	7.1	0	0	*4*	*2.2*
Missing			0	0	*1*	*0.5*
Marital status						
Married	12	85.7	16	72.7	*141*	*74.2*
Living as married	1	7.1	3	13.6	*28*	*14.7*
Separated / Divorced / Widowed	1	7.1	3	13.6	*14*	*7.4*
Single	0	0	0	0	*7*	*3.7*
Ethnicity						
White British	13	92.9	14	63.6	*113*	*59.5*
White European	0	0	4	18.2	*15*	*7.9*
Indian / Pakistani / Bangladeshi	0	0	2	9.1	*23*	*12.1*
Black African / Black Caribbean	1	7.1	0	0	*10*	*5.3*
Chinese	0	0	0	0	*5*	*2.6*
Other (inc Mixed race)	0	0	1	4.5	*9*	*4.7*
Missing	0	0	0	0	*15*	*7.9*
Occupational status						
Full-time employment	3	21.4	4	18.2	*47*	*24.7*
Part-time employment	1	7.1	6	27.2	*44*	*23.2*
Full-time homemaker	8	57.1	9	40.9	*79*	*41.6*
Self-employed	0	0	1	4.5	*3*	*1.6*
Unemployed	0	0	0	0	*6*	*3.2*
Disabled / too ill too work	1	7.1	0	0	*4*	*2.1*
Retired	1	7.1	0	0	*1*	*0.5*
Student	0	0	2	9.1	*5*	*2.6*
Missing	0	0			*1*	*0.5*
Education						
None	0	0	1	4.5	*21*	*11.1*
GCSE/O-level/school certificate	8	57.1	5	22.7	*60*	*31.6*
A-level	2	14.3	6	27.2	*23*	*12.1*
National diploma	3	21.4	0	0	*35*	*18.4*
Degree / Further degree	0	0	10	45.5	*49*	*25.8*
Missing	1	7.1	0	0	*2*	*1.1*
Car ownership						
No car	0	0	2	9.1	*13*	*6.8*
One car	8	57.1	13	59.1	*111*	*58.4*
More than one car	6	42.9	7	31.8	*63*	*33.2*
Missing	0	0	0	0	*3*	*1.6*
Home ownership						
Own / buying	12	85.7	18	81.8	*136*	*71.6*
Rent	2	14.3	3	13.6	*47*	*24.7*
Other	0	0	1	4.5	*4*	*2.1*
Missing	0	0	0	0	*3*	*1.6*

Child characteristics

Table 3.5 presents child characteristics. The gender ratio of children of diary participants was evenly split into boys and girls, but 71% of interview participants had girls. Interview and diary samples contained more children in reception than nursery class, perhaps because parents of older children could spare slightly more time to participate in this more demanding research. Child height and weight was reported much more frequently in the interview/diary sample than in the main sample - 71% and 73% of cases compared to only 54% of cases in the full sample. This is likely to reflect heightened interest and awareness in the self-selected sample than the wider group. 2/14 children were overweight in the interview group and 4/22 children were overweight or obese in the diary group. Diary and interview samples each contained children representing every possible birth order.

Table 3.5: Child characteristics

	Interview participants		**Diary participants**		***Total sample***	
	n	%	n	%	*N*	*%*
Gender						
Female	10	71.4	11	50.0	*101*	*53.2*
Male	4	28.6	11	50.0	*89*	*46.8*
School class						
Nursery (3-4 yrs)	7	50.0	10	45.5	*120*	*63.2*
Reception (4-5 yrs)	7	50.0	12	54.5	*70*	*36.8*
BMI group (calculated from parent-reported height and weight)						
Underweight	1	7.1	0	0	*14*	*7.4*
Normal weight	7	50.0	12	54.5	*69*	*36.3*
Overweight	2	14.3	2	9.1	*11*	*5.8*
Obese	0	0	2	9.1	*9*	*4.7*
Missing	4	28.6	6	27.3	*87*	*45.8*
Family position						
Oldest	6	42.9	8	36.4	*45*	*23.7*
Middle	1	7.1	3	13.6	*22*	*11.6*
Youngest	3	21.4	6	27.3	*76*	*40.0*
Only child	4	28.6	5	22.7	*45*	*23.7*

3.3.3 Themes and examples

Although interview and diary methods generated different levels of data, a decision was taken to treat the information together here in order to give a good general picture of the feeding strategies described. Interview or diary quotations are denoted with the letter 'I' or 'D' following the subject's ID number. Spontaneously mentioned behaviours and the number of times they occurred in either interview transcripts or diary manuscripts are summarised in Table 3.6. Where one subject mentioned more than one example, all examples were counted. As an informal attempt to validate individual scale scores using qualitative examples, an independent rater was given five interview transcripts / diaries with very low scores on 'Pressure to eat', and five with very high scores on 'Pressure to eat', and asked to classify them as 'Low pressure' or 'High pressure' parents. A similar process was used to generate 'High restriction' and 'Low restriction' parents. However, correct categorisation for both 'Pressure to eat' and 'Restriction' was approximately at the level of chance. This confirmed that frequency of behaviours could not be taken as a reliable indication of their actual prevalence, and reflects the fact that interviews were only semi-structured and that participants completed the diaries in varying levels of detail.

Table 3.6: Examples of spontaneously reported parental feeding behaviours

Themes and sub-themes	n	Example/s
Pressuring the child to eat		
Verbal exhortations	13	Said you have to eat some more and finish your plate
Compromise	3	Just three more mouthfuls then you can stop
Spoon-feeding	6	Gets a bit bored so I feed her the last bit
Use food as means to end	2	Insist he has to finish otherwise can't watch cartoons
Verbal encouragement	2	Said I was pleased he ate it all
Reason with child	5	Said important to eat certain things for healthy bones
Mix target with liked foods	4	C. will drink milk when it's with Coco Pops
Mix target into sauce/soup	2	Add a lot of vegetables to the sauces
Enhance visual appeal	4	Made the food into pictures on her plate
Modify preparation method	2	She asked for toast but not crunchy
Repeated exposure	2	Keep serving because eventually they'll try it and eat it
Turn into game	4	J.'s mouth was a gate and had to get the yoghurt in
Offer limited choice	2	Likes to choose own cereal, happy as long as cereal
Help to prepare	2	J. chose the ingredients herself and opened the boxes
Restriction		
Limiting access	3	Put crisps in the cupboard where they can't reach
Limiting availability	6	Only buy one multi-pack of crisps a week
Time of day restrictions	9	Don't have crisps before dinner
Occasion restrictions	3	On brother's birthday allow one chocolate bar each
Suggest healthy alternatives	4	Say can have a yoghurt or apple or banana instead
Food to reward behaviour	1	Gave couple of sweets - hard to be dragged on errands
Monitoring	4	Watch the amount of sweets she has in my head
Meal-time rules		
Explicit dessert contingencies	2	D. knows will only get pudding if eats veg
Dinner-time structure	2	Don't let them wander round, have to finish dinner
Use of food to reward food		
Rewarding healthy items	6	Said could have chocolate if ate satsuma first
Rewarding meal consumption	7	Can have sweets after if they eat well at dinner
Non-contingent rewards	3	Happy with what she had so agreed could have lolly
Food to calm		
When upset	2	Fell over and got upset so gave chocolate to distract
When bored	1	Think she asked for food because bored, gave peach
When hyperactive	1	Bought crisps to calm children down

Pressuring the child to eat

The most commonly reported behaviours amongst parents centred around pressuring the child to eat. Verbal exhortations were common (*"He will often try and leave the table before he's finished, and I will have to say 'Come on, finish this!'"* ID 2020, I) and parents often settled at a compromise with their child, e.g. *"If it gets to the point where he says 'I don't want anymore', I'll say 'Just eat 6 carrots and 2 pieces of broccoli then you've finished'"* ID 2087, I). Several parents, especially those with younger children, described spoon-feeding their child to make them eat more: *"She ate all the casserole and potato, but left the beans saying she didn't like them. I fed her them and that way she ate them without a fuss"* (ID 1045, D). A few parents reported using food as a means to an end, that is, offering or withholding a treat contingent on the child's consumption of that food. For example, one mother mentioned that the prospect of opening presents after Christmas dinner formed an incentive to eat well, and another described insisting her child should finish his breakfast or he could not watch any cartoons.

More subtle attempts to encourage the child to eat were perhaps more common than the well-documented strategies above, and mothers who used one strategy were more likely to report using others as well. Several types of verbal encouragement were described, ranging from simply praising the child when he or she had eaten a target food (e.g. cabbage, ID 1004, D), to explaining to children the short- and long-term effects of eating the food. Some mothers explained the health benefits of target foods. For example, one mother described telling her children it was important to eat certain things for healthy bones (ID 2017, I). Another reported successfully persuading her child to eat using this method: *"Jamie said I don't like cheese but I told him it was good for him. So he carried on eating it"* (ID 2129). Other parents were more practical in their reasoning: one mother told her child that if he did not finish his meal 'he would be hungry later' (ID 11362, D). A mother of a child who had been underweight in earlier years as a result of sickle cell anaemia recalled telling him, *"Eat it if you want to be stronger than your brother, if you want to beat one of them up!"*

Increasing the taste appeal of target foods by combining them with liked foods was another common strategy. Many mothers found mixing milk with popular cereals to be a successful way of increasing their child's milk intake (*"I get C. to drink milk by having it with Coco Pops because he'll drink it when it's chocolatey"*, ID 2014, I). Banana was added to ice-cream in a similar strategy (ID 1033, D). Foods were also presented in the form of soup or sauces to increase children's nutrient intake: *"I know this week their eating times have been a bit irregular, so I'll probably cook a little chicken soup for them - chicken and vegetables - in order to get it down them nice and easily"* (ID 2070, I); *"I give the children a lot of pasta as it is something they both like and I am able to add a lot of vegetables to the sauces. They eat a lot of things blended into a sauce which they wouldn't eat if it was on a plate on its own"* (ID 2072, D).

Several parents recognised the influence of enhancing the visual appeal of the food. Two parents reported being careful not to confront the child with overwhelming portion sizes: *"I don't make too large a dinner because I think that puts children off, a big mass of food"* (ID 2084, I). Two other parents reported arranging their child's lunch 'to look like a face', and one found this a useful way of getting her child to *"sample one or two new things: baby spinach leaves, red pepper and a sliver of vegetable tart made with puff pastry"* (ID 1013, D). Some parents were willing to prepare target foods in a way that their child preferred, for example, peeling and cutting up fruit (ID 2100, D), or preparing *"toast but not crunchy, so warm bread"* (ID 2002). Others appreciated the value of repeatedly exposing children to foods without forcing them to eat: *"I do believe, even if they don't like something, keep serving it because eventually they'll try it and eat it. I've done that with cauliflower, brussel sprouts, and we had some swede the other day"* (ID 2087, I).

Social techniques were also used to encourage their children to eat target foods. The consumption of target foods was often turned into a game to hold children's interest: *"We played a game. Jamie's mouth was a gate and I had to get the yoghurt in before the gate shut"* (ID 2129, D); *"We try and keep up the fruit circle they have at nursery - we chop the fruit up and pass it round"* (ID 2016, I). Children were also encouraged to participate in the feeding process, by exercising a limited choice over what to eat (*"I always offer 2-3 alternatives. It gives her the opportunity to choose, so she is not* *feeling overruled or helpless"* ID 1112, I) and sometimes by helping to prepare the food (*"Rose likes making little cakes and jellies and things and she'd made some jelly frogs and we put some cubes of pineapple into that and some cake things so it wasn't just pure jelly"* ID 2070, I).

Motivations. Reasons cited as underlying pressuring behaviours were diverse, and could be broadly categorised into three sets of considerations: short-term nourishment, long-term health, and enjoyment of food. Parents who were concerned about short-term nourishment often applied pressure to make sure their child had enough energy to last until the next meal: *"Breakfast is the only thing I really make him eat in a day because I don't want him to go to school without anything"* (ID 2055, I). Two mothers expressed concern that their children should have a *"substantial"* meal (ID 2017, I; ID 2006, D), and one described giving her child Weetabix because it was *"warm and filling"* (ID 2106, I), indicating a prominent concern to make sure their child was 'full'. Perhaps related to the timing of the study in the autumn term, a concern that the child should eat warm food was also apparent in several other cases (ID 2061, I; ID 2082, I). Concern that the child should eat enough to sustain him or her was often linked to controlling the child's appetite later in the day. For example, one mother expressed concern that not eating at lunch would make her child request less healthy foods in the afternoon (ID 1013, D). Another parent *'offered [her child] more pasta as I didn't want her to say she was hungry later at bedtime'* (ID 2072, D). This concern was also expressed through other behaviours. One mother described how a group of parents had pressured their nursery to allow children to have a fruit snack, *"otherwise they get hungry before dinner"* (ID 2016, I).

Amongst long-term health considerations, one of the strongest was a concern about underweight, with some parents pressuring their children to eat anything at all, specifically to make them gain weight: *"I pressure them to eat and I don't restrict them because when my daughter was little she was very fussy, very slim, she wouldn't eat... I'm happy for them to eat to put on weight"* (IS 2059, I). However, much more common was pressuring to eat foods that were perceived as *"healthy"* or *"proper"*. For example, one mother said she wanted her child to *"eat a proper dinner; I don't like snacking"* (ID 2009, I). Others talked about *"keeping up to the veg quota"* (ID 2014, I), making sure the child had enough *"milk and fibre"* (ID 2106, I) or *"plenty* *of yoghurts"* (ID 2082, I). Some parents demonstrated a substantial degree of nutritional knowledge which led them to pressure their child to eat certain foods: *"I've said to her in the past I suppose that it's very important that she eats certain things to have healthy bones and she likes to say 'Well it's really good for you to drink milk mum'".* This type of pressuring to eat was frequently accompanied by the restriction of less healthy foods, and this profile of behaviours was invariably motivated by a concern to achieve a *"balanced diet",* i.e. a diet that conformed to participants' perceptions of a medically recommended diet (ID 1070, I). Subjects explained that they wanted to do this to ensure their child *"stayed healthy"* (ID 2087, I), or in order to give them *"a good start in life"* (ID 2082, I).

A number of parents also emphasised the importance of teaching their child *"to experiment and try lots of different foods, not be stuck in a routine - to enjoy your life and stay healthy!"* (ID 2087, I). Indeed, although not all parents verbalised it explicitly, there was a strong impression that their children's enjoyment of food was highly important to them. The desire to make mealtimes a pleasant experience for the child was implicit in parents' attempts, food look more appealing and to seek a compromise regarding the amount eaten rather than insisting on a rigid amount. Efforts to make eating pleasurable also led parents to allow their children some choice over what they ate: *"I try to give her things she likes as well as things that are good for her. If she had the same thing everyday she'd probably get bored"* (ID 2082, I). Many parents also talked about the difficulty of striking a balance between getting their child to eat healthily without causing *"tantrums"* (ID 2061, I). One mother described a friend who *"ran around after [her child]"* and how the child *"quite enjoyed it"* and this behaviour could *"just weigh up the situation"* (ID 2087, I).

<u>Food to reward food</u>

The use of a liked food to encourage the consumption of a less liked food may be thought of as representing the dual use of pressure to eat healthy foods and, by implication, the restriction of less healthy foods. This was by the far the most commonly reported feeding behaviour, reported in some form by nearly all participants. However, parents displayed slightly different variations of the strategy. Some used the liked foods explicitly as bribes which were contingent on the consumption of target foods. Target foods were sometimes specific items (*"She then asked for a chocolate from the Christmas tree. I said she could have one if she ate a satsuma first, which she did"* ID 2072) and sometimes a greater amount of a prepared meal: *"She then asked for pudding and I said she hadn't eaten enough of her main course, so she took it back and ate some more"* (ID 1004, D); *"Today she wanted a cornet and I said 'Well it's only half an hour til your dinner'. So I said 'You can have it after you've had your meal, if you eat it all up or near enough'"* (ID 2082, I). Other parents used the liked foods purely as rewards for eating to their satisfaction, without specifically alerting the child to the existence of a contingency: *"Eve asked for a chocolate biscuit and since she had eaten all her tea I gave her one as a treat"* (ID 1062, D); *"Because I was glad she'd eaten all her cottage pie and vegetables, I said 'Do you want some ice-cream?'"* (ID 2106, I).

Food to calm

The PFQ 'Food to calm' scale assesses the use of food to make the child feel better if upset, bored or agitated, or to prevent him or her having a 'temper tantrum'. Parents are asked if they use these strategies even when they know that their child is not hungry. Interview data did not reveal any examples of this type of behaviour, but diaries contained several instances. The use of food to comfort a child who had been hurt occurred twice: *"One tiny chocolate - J. was hungry and had hurt his eye. I was cooking for six and the chocolate kept him quiet"* (ID 1045, D); *"H.'s brother (who hadn't had a nap) fell over and got very upset. To distract him, I said he could open his [chocolate] advent calendar"* (ID 2072, D). One parent described offering food specifically to alleviate boredom (*"She asked for something to eat. I offered a peach - I think she asked for food because she was bored"* ID 2003, D), and another described giving her children food to occupy them and suppress their hyperactive behaviour in a social situation: *"We were meeting friends in a pub. The children were getting bored and we bought crisps to calm things down"* (ID 2072, D).

Restriction

The majority of parents reported exerting some form of restriction on their child, but individuals varied on the rigidity of this restriction and on underlying motivations.

The majority of parents described themselves as taking a moderate approach, accepting that less healthy foods could be eaten occasionally but not all the time: *"I try not to give them too much chocolate and biscuits, I would not exactly label them as healthy food, but every now and again they're not too bad"* (ID 1070, I).

Certain foods were restricted due to specific fears relating to health. For example, one interviewee said she avoided processed food such as scotch eggs because she was *"suspicious if they can sit in the shop for weeks"* (ID 2017, I). Sweets were often limited due to concerns about dental caries: *"I don't like him to have too many sweet things because of his teeth"* (ID 2020, I). A few mothers also had specific concerns about levels of salt in foods: *"I read in the paper that too much salt is not good for children. When some of them have a packet of crisps, their lips go white"*. However, most parents were primarily motivated by ensuring that their child had a reasonably balanced diet, including all the main food groups, plenty of fruit and vegetables, specific foods with perceived health benefits (e.g. milk), and not too many 'junk' foods. Parents tried to achieve balance both within meals (*"I try to get a reasonable balance so I do things like rice and stir-fry, or pie or meat with veg and potatoes"* ID 1082, I), and over a number of days. For example, one mother described presenting a healthier meal over a less healthy meal based on internal judgments about what their child had lacked over the preceding days: *"Over a couple of days, I'll think she's not had enough milk or fibre so I like her having Weetabix or brown bread. It's not a conscious thing really but over three days I'll think I don't feel she's had enough of this or that. For example one day she'll have pizza and chips, the next day she'll have vegetable soup"* (ID 2106, I).

Restriction often involved keeping certain foods inaccessible to their children (*"I put crisps in the cupboard where they can't reach!"* ID 2059, I) or teaching them that they must ask before helping themselves to food in the house (*"D. is aware what's in the house but she's not allowed to just take something"* ID 1082). They also made attempts to impose restrictions further upstream at the 'availability' stage, for example by buying 'junk foods' in small amounts or portion sizes to help to limit intake (*"I got an advent calendar with the smallest chocolates possible!"* ID 2016, I; *"I only buy one multi-pack of crisps a week, so they have them maybe one every other day"* ID 2087, I; *"I buy snack-size chocolate bars and allow them one piece a day"* ID 2017, I). One mother said she limited her own preparation of meal-time foods that were seen as less healthy: *"I don't cook bacon or sausage during the week"* ID 1082, I).

The most common restrictive behaviour was limiting the consumption of energy dense snack foods to certain times in the day (*"Any cake or crisps has to be after lunch"* ID 2059, I; *"Sweets are restricted to the afternoon, they can only have yoghurt or fruit after dinner"* ID 2017, I). Time restrictions were sometimes set for food in general rather than specific foods, and all time restrictions were primarily motivated by making sure that the child would be hungry enough to eat meals prepared by the parent (*"I restrict food before breakfast and lunch because I know what she's like, she won't eat"* ID 2106, I). Others were led by ideas about acceptable eating practices that they practised themselves or had adopted due to previous experience with their children. For example, some felt it was not good practice to eat shortly before going to sleep (ID 2055, I; ID 2061, I); others worried about their children going to bed hungry (ID 2020, I; ID 2059, I). One parent refused her child's request for cheese and ham at the start of the day because she felt it was *"a bit funny for breakfast"* (ID 2055, I).

Although instances of daily time restrictions were motivated mainly by appetite control, they were also a way for parents to decrease the overall amount of 'junk' food eaten. Also for this purpose, certain foods were reserved for *"special occasions"*: *"On my brother's birthday I allowed them one chocolate bar each"* (ID 2059, I); *"I will limit them to buying one or two things they want [from the supermarket] at Christmas"* (ID 2059, I). Explicit concerns about overweight were generally not mentioned as motivating restriction behaviours, although concerns about weight may be implicit in the concerns for long-term health that were mentioned. However, one parent said she had *"always been strict with my older daughter, because she was always bigger"* (ID 2017, I). Another indicated that she had concerns about her child becoming overweight, which she had thought about addressing by limiting fat in her child's diet and increasing her exercise: *"I mean, you know, she's not overweight, but this time of year we're probably driving too much, I'd like her to do more exercise and running around and what have you…And I'd probably cut out – she does eat a lot of cheese…"*.

As was the case with choosing meals to have, some parents felt that giving the child some degree of choice over which snack to eat was important. Rather than prescribing a specific replacement for a requested snack that was unsuitable, a range of healthy alternatives were suggested: *"She asked for something to eat. I told her that a sandwich with marmalade is not possible. I offered a banana or a sandwich with cream cheese. She wanted the banana"* (ID 1112, D). Although a few parents reported simply criticising their child for eating inappropriate amounts (*"H. put a lot on his plate at the party so I said 'You're being greedy, don't put so much on your plate'"* ID 2016, I), it was more common to offer a reason. For example, one parent described refusing her child's request for another shortbread, explaining it was *"nearly dinner-time"* (ID 2002, D). Other parents put their children's requests in the context of the rest of their consumption that day, motivated by the desire to achieve a healthy overall balance: One child requesting sweets was told *"No, as he had a sugary donut earlier"* (ID 2005, D). Another mother wrote, *"Callum asked for a biscuit but I said no - He wanted something with his milk but I said that he'd had a good dinner today plus sweets so he really didn't need anything more. He accepted that and didn't pester me"* (ID 2006, D).

As with pressuring the child to eat, parents perceived themselves as reacting against certain tendencies within their child in order to achieve a reasonably balanced diet, e.g. *"I have to limit D.'s coke or she would probably sit there and drink two litres"* (ID 1082, I); *"I restrict food before breakfast and lunch because I know what she's like, she won't eat"* (ID 2106, I). When children did not display these tendencies parents did not feel compelled to act: *"If she had more of a sweet tooth I would be more strict on it because I feel she has enough really"*, ID 2105, I).

Consistent with the low overall scores on 'Food to reward behaviour' found in Study 1~~A~~, no parents described deliberately using food to manipulate their child's behaviour. However, using small food treats to reward the child for not complaining was reported by one mother: *"I felt it was hard on S. to be dragged round on my errands, and that a couple of small sweets after a good breakfast wouldn't hurt"* (ID 1013, I). Several parents mentioned ways they had of keeping a tally of the foods their children ate, corresponding to items on the 'Monitoring' scale of the CFQ. For example one parent said she preferred her children to eat packed lunches *"because then I know* *exactly what they've eaten because the debris's there"* (ID 2082, I). Another parent said, *"I really watch the amount of sweets she has in my head"* (ID 2106, I).

Parental behaviours as responses. Apparent in the language of all parents was the conception that their behaviours were essentially responses to their child. Sometimes parents reported adapting their feeding behaviours according to perceptions of the child's weight (see earlier) or to the child's current state, e.g. illness, tiredness (e.g. *"He actually had quite a bad cold last week and really didn't have much of an appetite at all so I was generally letting him eat as and when he wanted"* ID 2020, I). Some parents made reference to dispositions or traits in their child that affected their feeding behaviour, and this was evident for both restricting and pressuring behaviours. For example, one parent implied that she was compelled to restrict her child because she was highly responsive to food: *"I keep an eye on what she actually is eating because I'm sure if I put, you know, a big tin of Quality Street out in front of her she'd quite happily demolish as many as possible"* (ID 1082, I). The same mother reported restricting her child's intake of soft drinks in response to her appetite for them: *"My son won't drink anything except water anyway. Whereas D. if you gave her the coke she would drink it... [She has coke] about once a week. That's consciously I keep it to that because she would probably sit there and drink 2 litres if let".*

Another mother described her child being more generally food responsive (*"If there's a banana or an apple she'll say can I have a banana, can I have an apple? Whatever's available, she will ask for and have just for the sake of it, even if he's just eaten. Like, you have to be eating something"*), and gave several examples of restriction in response to this: *"At the weekend, I would think, she would probably ask for a packet of crisps quite early in the day and I would say no. Actually on Sunday yes she asked for some sweets or chocolate I think ... and I said no"* (ID 2061, I). Another mother talked about her child's tendency to eat only small amounts of things and to leave the rest, which caused her to restrict his intake in order to reduce waste: *"Yesterday afternoon he asked for a tangerine which I peeled for him, he ate half of it and left it. And then he asked for a packet of crisps which I opened and gave to him. He ate a few crisps out of the packet and then didn't want to eat anymore and then I think he asked for some sweets and I said no. And I thought he's not going to just* *keep asking for food and leaving it. Well I suppose the first thing that came into my head was the waste really – I said if you're not going to eat these things you're not having them".*

Other parents described pressuring their child to eat in response to their satiety responsiveness or lack of interest in food. For example, one mother said, *"With C., it's always pushing him that much further – 'Come on you can do three more mouthfuls' and he will do it, it's just laziness, he doesn't find it interesting, he wants to be down doing something different, it's a chore to him to be eating."* Another mother had a similar account of responding to a child who does not drink: *"I feel I have to remind her to drink or she doesn't bother"* (ID 1013, D). One mother reported pressuring her child to eat specifically at breakfast, because he tended not to be hungry in the morning: *"The only thing I can do really is to say 'Come on Sirrus, try and eat up', you know, and I do tend to do that quite a lot. Because otherwise he wouldn't eat anything at that time in the morning and it does worry me if he went to school without eating anything."* In contrast, another mother described how her child's eating habits meant that there was no need to pressure to eat: *"Well friends and neighbours have real problems with their children eating ... And you know we're always saying K.'s really really good ... she'll always try something new ... and she will usually finish her dinner up. And even if there's other children playing, ~~or~~ and then running off ... she will sit and eat her dinner."* Together these accounts suggest that parents strongly perceive themselves as responding to children's eating styles and more general temperamental characteristics when feeding them.

<u>Meal-time rules</u>

In keeping with the existence of a separate scale describing rules specifically relating to meal-times, a number of parents spontaneously mentioned rules about how to eat at dinner. Insisting that the main meal was consumed before dessert was commonplace: *"D. knows he will only get pudding if he eats all his veg"* (ID 1107, D). Rules based on etiquette and manners were frequently mentioned (*"I don't let them wander round, they have to finish their dinner"* ID 2016, I), and one parent described repeatedly exercising this rule in her diary: *"J. told to sit down and finish eating before he runs about x2"* (ID 2003, D).

3.4 Discussion

The current study aimed to explore parents' feeding behaviours and their perceptions of them to provide a measure of confirmation of the parental feeding factors identified in Study 1. Interviews were only semi-structured, and participants completed diaries to varying degrees of detail. The interview format encouraged more general discussion of feeding style, whereas the diary method elicited more concise accounts of actual interactions. The resulting descriptions of feeding interactions may not therefore be thought of either as an accurate reflection of the participant's general behaviour, or of each day's events in their entirety, making comparing participants' parental feeding scores with reported feeding behaviours of limited value. However, data from both interviews and diaries yielded a wide range of examples of parental feeding behaviours, which provided ecological illustrations of each of the questionnaire factors. The data also demonstrated the diverse sets of motivations underlying each feeding behaviour (supporting the distinctiveness of separate factors), and highlighted some areas needing further characterisation.

3.4.1 Pressuring to eat

The majority of parents reported one or more attempts to make their child eat more. However, the character of these attempts and their underlying motivations were different. Some parents reported trying to get their child to eat anything they could because they were worried they did not eat enough. Parents conveyed a strong sense that they were responding to an inherent tendency in their child. This profile corresponded well to the pairing of motivation and behaviour inherent in 'Pressure to eat' items (e.g. "If I did not guide or regulate my child's eating, my child would eat much less than he/she should"). Consistent with the low scores for items expressing rules centred around meal-times (e.g. "My child should eat everything on his/her plate"), few parents reported these behaviours in such extreme terms, although many reported encouraging their children to eat as much as they could of their meal and making it clear that they must have a good try at their dinner before being granted dessert. Parents who described several rules about eating either had very rigid ideals for their child's diet, or seemed keen to teach their child to conform to social norms.

Much more common amongst parents was presenting target foods and liked foods in a reward contingency, reflecting items in the 'Food to reward food' scale (e.g. "Did you offer your child dessert after a meal to get him/her to eat foods that were good for him/her?"). These behaviours were frequently associated with a desire to increase the child's consumption of healthy, wholesome foods rather than to increase the general amount eaten or to increase the child's weight. The use of food to reward the consumption of other food was also evident in mothers who expressed low levels of desire to pressure or restrict their children, suggesting that it may sometimes be employed mindlessly, perhaps modelled on participants' own parents' use of this strategy. This evidence supports the maintenance of a distinction between 'Pressure to eat' and 'Food to reward food' scales.

Mothers also reported a wide variety of encouraging behaviours that were not ostensibly captured by any of the parental feeding scales examined thus far. These included verbally encouraging and reasoning with the child, making target foods more appealing to the child by mixing them with other liked foods, and encouraging the child to sample and enjoy new foods. These behaviours were demonstrated by parents who were keen to provide their child with a healthy diet, but also wanted to teach their child to enjoy food and eating. Furthermore, these behaviours tended to cluster together within individual parents, suggesting that a more comprehensive measure of parental feeding should incorporate this aspect of parental feeding, which may relate very differently to child eating behaviour and weight.

3.4.2 Restriction

Both interviews and diaries generated plentiful examples of restrictive behaviours, many of which corresponded to items described in the CFQ 'General restriction' and 'Monitoring' scales. Consistent with 'Food to reward behaviour' representing a feeding behaviour that is different from other restriction items, very few examples arose, suggesting that grouping 'Food to reward behaviour' items with other restriction items may be misleading. There was also some support for the clusters of behaviours described in each scale. For example, one parent (ID 2017) reported avoiding processed foods, buying only snack size chocolate bars, and restricting sweets to the afternoon. Another parent (ID 2059) reported keeping crisps out of her children's reach and only allowing one chocolate bar each on a special occasion. Again, mothers often expressed their behaviours as responses to individual child characteristics, e.g. a pronounced appetite for sugary foods and drinks.

However, there was an overwhelming impression that many mothers restricted their children first for short-term practical reasons such as appetite control (e.g. withholding snacks before dinner), sometimes for reasons of health (e.g. avoiding foods with associated health scares, avoiding foods that might cause tooth decay), but only rarely with weight control in mind. Similar results were found in a survey of mothers of 5-11 year olds, which found that the primary consideration when choosing foods for their children was nutritional value and long-term health (St John Alderson & Ogden, 1999). There was also some overlap with concerns of French mothers regarding child feeding (Fischler, 1986), i.e. to provide filling food, to allow 'not too much' sugary or artificial food, and to achieve a 'balanced diet', which essentially included dairy foods and green vegetables. This is a very different conception of restriction than in much of the literature (e.g. Birch et al, 2001), and suggests that the interaction between parental feeding behaviour and motivation may be critical. For example, restriction practised in the context of weight control may have a far stronger relationship with child eating and weight outcomes than restriction practised for another reason. It is beyond the scope of this thesis to examine parental motivations in greater detail, but the relationship between feeding behaviours and weight concerns are explored in more detail in Chapter 5, and the differential motivations seen here may explain some of the demographic associations discussed in Chapter 4.

3.4.3 Instrumental feeding

The frequency of using food to reward food has already been discussed. Two other forms of instrumental feeding assessed in Study 1 were the use of food to reward behaviour, and the use of certain foods to reward the consumption of others. Corresponding to the low scores on 'Food to calm' revealed in Study 1, interviewing parents produced no examples of the use of food to calm the child, and diaries produced only a few instances. It is plausible that this behaviour is indeed rare in the current sample. Alternatively, parents may find it hard to admit to instrumental feeding of this kind because they perceive it to be undesirable. Certainly, obese individuals have been shown to blame this kind of parental feeding for giving rise to their weight problems (Brink, Ferguson & Sharma, 1999; Rand & Stunkard, 1978), so there may be public distaste for the practice. Rephrasing questionnaire items might help to increase parents' endorsement of instrumental feeding.

3.4.4 Implications of other findings

Another purpose of the qualitative study conducted here was to inform hypotheses to be tested in future studies. The diversity of motivations for parental control has already been discussed. A second important finding was that parents had a strong impression of adapting their feeding behaviour in response to the characteristics of the child, such as child weight, eating behaviour, or general temperament. Consistent with this, they often described taking very different approaches to feeding siblings, who sometimes displayed radically different eating styles from birth. This has implications for the causal relationship between parental feeding and child outcomes, suggesting that some associations could be interpreted as reflecting the child's influence on the parent rather than vice versa. Future research should therefore consider testing this causal model as well as the traditional model where influence flows from parent to child. This idea is explored further in Studies 4 and 5.

3.4.5 Conclusions

In conclusion, this study provided informal support for the maintenance of the parental feeding factors identified in Study 1. The findings also point towards further relevant dimensions of parental feeding behaviour and highlight diversity in the motivations underlying particular behaviours. In particular, it seemed that parents used a number of 'softer' methods of pressure to eat and restriction, not all of which were captured in existing scales, and many parents were motivated by concerns about child underweight, cost considerations, health concerns and practicalities than by concern about overweight. Another important theme was that parents frequently described themselves as adjusting their feeding behaviour according to characteristics of their child rather than simply imposing an inflexible feeding policy. The results of Studies 1 and 2 will inform the development of a comprehensive parental feeding measure, and the hypotheses to be tested in Studies 3 and 4.

CHAPTER 4

Study 3: Parental feeding survey – associations between parental feeding and demographic factors

4.1 Introduction

4.1.1 Rationale

The results of Study 2 highlighted the complexity of motivations underlying parental feeding behaviour and identified a number of sections in the parental questionnaire that could benefit from amendment or expansion. Study 3 had the following aims: i) to assess the factor structure of a more extensive, modified measure of parental feeding strategies in a large, socio-economically diverse sample of parents of 3-5 year olds, and ii) to assess and explore associations between demographic factors and parental feeding strategies in the same sample. To this end, a number of community primary schools in Outer London were recruited to represent a range of socio-economic deprivation. Children were weighed and measured in school, and parents completed measures of demographics, self-reported weight and height and parental feeding behaviours. General parenting style was also assessed as a form of validation.

4.1.2 Associations between socio-economic background and parental feeding

Established evidence for a pronounced socio-economic gradient in the incidence of obesity (Flegal et al, 1998; Sundquist & Johansson, 1998), combined with emerging studies demonstrating associations between parental feeding and child weight (see Chapter 5), have raised the possibility that there might be important socio-economic differences in parental feeding style which contribute to children's obesity risk. Many studies examining parental control over feeding in relation to adiposity have focused exclusively on affluent, white samples (Spruijt-Metz et al, 2002; Lee et al, 2001; Birch & Fisher, 2000), limiting the variance available to detect socio-economic differences. However, a growing number of studies from the obesity and wider nutrition literature examine the impact of socio-economic indicators such as education and income on parental feeding in more diverse samples.

Evidence from nutrition studies. In a Dutch study comparing 849 mothers of 4-14 year olds from lower (i.e. elementary and lower vocational training for 12-16 year olds), middle (i.e. technical or general secondary education, 16-18 year olds) and higher educational classes (i.e. higher vocational training for 18 year olds and over, and university), higher class mothers prescribed (i.e. believed their child should eat) a greater number of foods (Hupkens et al, 1998). The most frequently prescribed foods were meal-time items such as cooked and raw vegetables, meat and potatoes. Higher class mothers also restricted their child's consumption of a significantly greater number of foods, and the most frequently restricted foods were sweets, soft drinks and chips. The relationship between class and restriction was only partially explained by lower class participants considering taste more and health less in relation to food choices, suggesting that other factors such as cost and time pressure may also be relevant. The only UK study to assess SES differences in feeding practices (Hart et al, 2003) used a focus group methodology and produced similar findings. Mothers of 7-12 year olds who had lower area-level deprivation scores (i.e. higher SES), were more likely to restrict fizzy drinks and crisps, and prescribe fruit and vegetables. Lower SES parents were more concerned with increasing overall consumption and maintaining a pleasant social interaction, and were more likely to give the child greater choice over what to eat at home.

In a more recent Flemish study, Vereecken et al (2004) assessed a broader range of feeding practices among parents of 2.5-7 year olds. Consistent with Hupkens et al (1998), higher educational level was associated with lower permissiveness (e.g. "My child is allowed to take sweets whenever he/she wants"). Higher education was also associated with praising the child for eating fruit and vegetables, negotiating with the child over what he or she should eat (e.g. "If my child does not like something we agree that he/she only has to eat a small amount"), and conscious avoidance of negative modelling behaviour (e.g. "If I would like to eat sweets, I would restrain myself because of the presence of my child"). There were no education differences in pressuring the child to eat, offering rewards for the consumption of food, considering the child's preferences when preparing food, discouraging intake of soft drinks, and encouraging fruit and vegetable intake using rationales.

Evidence from the obesity literature. The studies described above were specifically interested in parental feeding behaviours associated with children's diets and healthy eating habits. In an older study addressing the relationship between education and feeding behaviours in the context of obesity research, Olvera-Ezzell et al (1990) interviewed 38 obese Mexican-American mothers about their feeding practices, and found that those with more years of formal education served healthier foods and were more likely to report using reasoning strategies, limiting consumption of unhealthy food, monitoring their child's consumption outside the home, and allowing the child input in the feeding situation.

In a study designed to achieve a socio-economically diverse sample, Baughcum et al (2001) designated families as low income and high income, with low income families meeting the criteria for enrolment in WIC, a state-funded nutritional programme offered to families with an income at or below 185% of the federal poverty level ($30,433 per year for a family of four at the time of the survey). Mothers from low income families were found to score more highly on the PFQ scales 'Pushing the child to eat more' and 'Age-inappropriate feeding" (e.g. "I fed the child myself if he/she did not eat enough"), and lower on 'Structure during feeding interactions' (e.g. "My child watched TV at meals"). In an earlier study using focus group methodology, Baughcum et al additionally showed that low income mothers of 1 to 3 year olds set few limits on the type and amount of food their child ate, and frequently used food to shape their behaviour, e.g. to soothe infants, or to bribe young children to behave well (Baughcum et al, 1998).

Other studies have failed to find an influence of educational level on parental feeding. For example, Francis, Hofer and Birch (2001) found no association between education and two CFQ scales shown to be linked with adiposity – 'Restriction' and 'Pressure to eat' – in a sample of non-Hispanic white 5 year old girls and their mothers. This lack of association may be in part because of limited variance in education among the participants, over half of whom had a university degree. Household income level showed slightly more variance, and several non-significant relationships were evident when using this variable, such that there was greater restriction in higher income families and greater pressure to eat in lower income families. Participants from lower educational backgrounds were better represented in a population-based study by Faith et al (2003). This study also failed to find any education differences on scores for any of the measures of parental feeding assessed. However, the parental feeding measures used in this study were unvalidated single items measuring child eating compliance, child eating obedience, and mother-allotted child food choice, and the weakness of these measures may have produced the negative results.

Taken together, these results seem to suggest that restrictive feeding behaviours and encouraging the child to eat healthy foods by praise, negotiation and reasoning, may be more common in parents with higher socio-economic status. In contrast, pressuring the child to finish his or her food may be associated with lower income and education. Other behaviours, such as using food in a reward contingency, may be unassociated with socio-economic factors.

4.1.3 Associations between ethnicity and culture and parental feeding

Despite strong research interest in ethnic and cultural differences in parental feeding strategies, no studies in the USA, UK or Europe have yet assessed parental feeding systematically in a large population-representative sample. However, evidence from separate studies using samples from different ethnic backgrounds suggests that parental feeding may differ widely across groups. For example, using the Child Feeding Questionnaire, Birch et al have found significant use of 'Restriction', 'Monitoring' and 'Pressure to eat' in samples predominantly composed of white parents. In contrast, several studies suggest that parental control is less pronounced in Mexican-American mothers, with rural Mexican children being largely responsible for choosing when to eat, whether to eat, and which foods to eat themselves (Garcia, Kaiser & Dewey, 1990; Olvera-Ezzell et al, 1990). Other studies suggest that this trend may reverse with increasing time in the USA. For example, Cousins, Power & Olvera-Ezzell (1993) found that mothers who behaved less traditionally (i.e. showed more acculturation) displayed more use of commands to get their children to eat. Acculturation may also discourage the use of certain feeding practices. For example, Kaiser et al (2001) found that more acculturated mothers were less likely to view bribes, threats and punishments as effective child feeding strategies. However, in contrast to the results of Garcia et al, they were also more likely to offer alternative foods to their child when he or she refused to eat.

Differences in parental control are unlikely to be confined to Mexican-American groups. Faith et al (2003) found that both Hispanic and African-American mothers gave their children less food choice than the majority white population. That is, they exerted greater control over feeding, at least in some dimensions. One focus group study of low income mothers which included 13 black and 5 white participants found that mothers reported having trouble controlling their children's eating and frequently gave their children snacks in order to manipulate their behaviour (Jain et al, 2004). In contrast, Hughes et al (2005) compared feeding styles in Hispanic and African-American mothers and found that whereas Hispanics were more likely to be indulgent, African-Americans were more likely to be uninvolved.

Sociological and anthropological literature also supports the idea that parental feeding is influenced by cultural factors. Stearns (2001), for example, suggests that the less child-centred approach to parenting and parental feeding which is found in France may partially explain lower obesity rates in French children. In summary, a substantial degree of our knowledge about parental feeding is based on white, middle-class participants, but a growing body of research from various disciplines suggests that ethnic and cultural differences in feeding practices may exist. Measures of parental feeding should therefore take socio-cultural differences in feeding practices into account, and aim to represent the full range of parental behaviour displayed across cultures.

4.1.4 Associations between parent weight and parental feeding

A small number of studies have examined associations between parental weight status and parental feeding behaviour, motivated by the possibility that parents might transmit obesity risk to their currently normal weight children via their feeding strategies. Wardle et al (2002) administered the Parental Feeding Style Questionnaire to 214 families with same sex twins (mean age 4.4 years). In 100 families parents were overweight or obese (mother's BMI $\geq$ 28.5, father's BMI $\geq$ 25), and in 114 parents were normal weight status. 'Emotional feeding', 'Instrumental feeding' and 'Prompting the child to eat' were equivalent for overweight/obese and normal weight parents. However, overweight/obese parents reported significantly less control over over their child's eating (e.g. "I decide how many snacks my child should have").

Using a different methodology, Sallis et al (1995) interviewed 247 mothers of preschool children and found that heavier mothers purchased a higher percentage of food items the child requested after seeing them on television, and reported watching more television with the child. Maternal adiposity (measured by triceps and sub-scapular skinfolds) and BMI were unrelated to either parental control of eating (e.g. "When your child asks for potato chips, what do you usually do?"), or food given as a reward (e.g. "How often do you use the following [foods] to reward your child when he/she is good?"). Comparing parental feeding behaviours in obese (BMI$\geq$30) and non-obese mothers, Baughcum et al (2001) found evidence for a less structured feeding style (e.g. child watched TV at meals), and more age-inappropriate feeding (e.g. spoon-feeding) in the obese group. Only the association with lower control remained after controlling for income. In contrast, Francis, Hofer and Birch (2001) found no differences between overweight and non-overweight mothers in terms of either restriction or pressure to eat. These studies can be interpreted as suggesting that mothers who are overweight themselves have a tendency to exert less control over their child's eating, and this represents an unconscious mechanism for the inter-generational transmission of obesity.

An alternative school of thought holds that to the extent that overweight parents perceive themselves to be overweight and are concerned about it, they may actually show higher levels of control over feeding. This could either be because they recognise increased risk in the children, or because the consequences of overweight are more salient to them, and could increase the likelihood of them controlling their children's eating (Costanzo & Woody, 1985). In support of this, a number of studies have specifically examined the relationship between parental feeding behaviours, and indices of weight concern, finding that maternal restriction of their daughters' food intake is more common in mothers who exhibit greater concern about their own weight (Francis, Hofer & Birch, 2001), have a history of eating disorders (Duke et al, 2004), and are higher in dietary restraint (Tiggeman & Lowes, 2002).

4.1.5 Other predictors of parental feeding

The literature also highlights a number of other variables likely to be associated with parental feeding behaviours. Of these, child adiposity and perceived child weight are central to the thesis and will be discussed in more detail in Chapter 5. Associations between child age and parental feeding behaviour may also be important, and may explain some of the discrepancies in past results. For example, whereas the majority of cross-sectional studies looking at associations between parental control and children's eating behaviour and weight have focused on preschool children aged between 3 and 5 years (Fisher et al, 2002; Lee et al, 2001; Birch & Fisher, 2000, Fisher & Birch, 1999a; Fisher & Birch, 1999b), or between 2 and 6 years (Faith et al, 2003; Wardle et al, 2002; Baughcum et al, 2001; Sallis et al, 1995), Vereecken et al (2004) used primary school children ranging from 2.5 years to 7 years, and Robinson et al (2001) used 8-9 year olds. Spruijt-Metz et al (2002) used a broad-ranging sample of 7-14 year olds. Some studies have also included or focused exclusively on adolescents (Hupkens et al, 1998; DeBourdeauduij, 1997).

Comparison of the findings of these studies suggests that a negative association between restriction and weight is more common in the older samples, suggesting that restriction may be more protective against weight gain among older children. It is difficult to compare absolute levels of control in each age group because of the variation in measures, but it is also likely that control strategies change with age. In one of the only studies to directly address child age as a predictor of control, Olvera-Ezzell et al (1990) used a sample of obese Mexican-American mothers and their 4-8 year old children, and found that child age was negatively correlated with a range of feeding behaviours, including use of commands, reasoning, threats and bribes. Mothers of older children were more likely to use non-directive verbal control strategies, offer extra servings, and achieve child compliance. In order to limit variance in parental feeding resulting from variation in age, and to facilitate comparison with past results, the current study uses a large sample of 3-5 year olds.

Another potentially important child variable is child sex. The well-documented gender differences in societal ideals relating to eating and weight (McCabe & Ricciardelli, 2004; Garner et al, 1980) raise the possibility that parents may pressure boys to eat to increase their weight, and restrict the intake of girls to decrease their weight. Few studies have reported gender differences, and many have used exclusively female samples (Francis, Hofer & Birch, 2001; Lee et al, 2001), based on evidence for stronger relationships between parental feeding and eating and weight in females (e.g. Fisher & Birch, 1999b; Johnson & Birch, 1994). However, one of the few parental control studies to include boys and girls found higher 'Monitoring' scores for boys, suggesting that parents may feel greater need to monitor the intake of their male children (Spruijt-Metz et al, 2002), and boys have been shown to have a more pronounced behavioural response to a restriction manipulation (Fisher & Birch, 1999b). The current study samples both male and female children in order to test whether parental feeding differs with sex, and whether relationships between parental feeding and child outcomes apply equally to both boys and girls. This has important implications for the scope of the parental control hypothesis as a general theory of obesity aetiology.

There is also some evidence suggesting that male parents may be less restrictive than females (DeBourdeauduij, 1997). However, as the mother most frequently takes responsibility for feeding the child, the majority of the literature deals predominantly with maternal rather than paternal feeding behaviours. Parental age may also be important. For example, one study found that 7-8 year olds with older parents had less power in household related decisions and less access to sweet snacks (Roberts, Blinkhorn & Duxbury, 2003).

4.1.6 The current study

The current study explores the factor structure of a multi-dimensional parental feeding measure and goes on to examine associations between parental feeding scales and a range of demographic predictors including child age and sex, parental age, sex, ethnicity, education and affluence. Associations between parental weight, perceived parent weight, and parental feeding are also considered, and associations with general parenting style are assessed as a form of validation for the parental feeding measures. Associations with child weight are discussed more fully in Chapter 5.

4.2 Methods

4.2.1 School recruitment

Three Outer London boroughs were selected for proximity to UCL – Enfield (A), Waltham Forest (B) and Barnet (C). Lists of primary schools serving children between 3-5 years were generated from local authority lists and information on eligibility for Free School Meals (FSM), (a government benefit available to lower income families) for each school was obtained. Schools within each borough were then divided into quartiles according to percentage FSM eligibility. Schools within each quartile were then sent recruitment letters and follow-up telephone calls to head teachers were conducted when necessary. The first school within each quartile to express interest and availability for one of the proposed weeks of data collection was recruited into the study. Where more than one school in the same quartile of the borough expressed interest, the school with the largest class sizes was selected.

The 12 participating schools had approximately 1140 3-5 year olds according to school records. On the whole, schools with higher proportions of children eligible for FSM were more ethnically diverse, with higher proportions of families for whom English was a second language. It was not possible to translate the questionnaire into the numerous different languages spoken, but questionnaires were distributed to as many parents as possible, as we were keen to achieve a diverse sample, and school staff informed us that many parents were able to complete official documentation with help from other sources. It was anticipated that 70% of parents would be able to complete the questionnaire, and 70% of those would do so, giving an estimated sample size of 559. Power analysis (Power and Precision, Biostat Inc, 1997-2000) showed that this sample size would give 95% power to detect correlations between parental feeding and demographic variables of the order r=.15 (Francis, Hofer & Birch, 2001).

4.2.2 Participants and procedures

Prior to data collection, parents were informed about the study and given the opportunity to withdraw their child from weight and height assessment. On each day of data collection, the researcher (SC) and an assistant arrived at school before pupils arrived, and distributed questionnaires to parents as they delivered their children to school. Where recipients were not the primary guardian of the child, they were asked to pass the questionnaire on to whoever was most frequently responsible for feeding the child in the household. Parents who missed distribution were either approached when collecting their child, or received questionnaires at home via their child's class teacher. A total of 1088 questionnaires were distributed, with 52 parents unreachable due to long-term absence of their child, or because families had left the school since the most recent updating of school lists. This problem was particularly marked in one school (B4), which had a very high percentage of pupil mobility due in part to a high intake of refugees. Following recommendations in Edwards et al (2002) we chose to offer a minimal incentive which was not contingent on questionnaire completion. All parents were therefore informed that they had already been entered in a draw to win a £30 shopping voucher. Parents who had not returned the questionnaire within the stipulated period of two weeks were sent reminder questionnaires with freepost envelopes. Parents with questionnaires still outstanding two weeks after this initial reminder were sent a second questionnaire and freepost envelope.

On the day of questionnaire distribution, the researchers also weighed and measured all children present in nursery and reception classes. A very small number of children refused to take part ($n \approx 3$) but the vast majority complied. Parents in two schools (C1 and C4) were offered feedback on their children's height and weight in line with teachers' requests. Children were asked to remove their shoes and any outside clothing (e.g. coat) before participating. Heights were measured to the nearest millimetre using a stand alone Leicester height measure and weights were recorded to the nearest tenth of a kilogram using calibrated TANITA digital scales.

A decision was taken not to take more direct measures of adiposity (e.g. waist circumference, skinfolds) as the procedures were thought to be too time-consuming for the young children sampled, and including such measures in the protocol may have discouraged schools from taking part. We did not have equipment with which to conduct bioelectrical impedance analysis (BIA), a relatively quick, inexpensive and non-invasive way to assess body composition. It is recognised that there are some weaknesses in using measures of weight adjusted for height (most commonly BMI) to index fatness. Not least, they are unable to distinguish between fat mass and fat-free mass, and BMI is a relatively insensitive measure of fatness in people who are particularly short or tall. However, BMI has been shown to correlate highly with DEXA (dual-energy X-ray absorptiometry) in even young children (Pietrobelli et al, 1998; Lazarus et al, 1996) and was hence adopted as the most suitable measure for the current study.

4.2.3 Questionnaire measures

Following the questionnaire used in Study 1, the Study 3 / 4 questionnaire (see Appendix V) asked for basic demographic information for parent and child, together with details of family position and the parent's relationship to the child. Modifications to the parental feeding scales, and the addition of a general parenting measure are described below.

Parental feeding scales

Given the independence of the Child Feeding Questionnaire (CFQ, Birch et al, 2001) and Preschooler Feeding Questionnaire (PFQ, Baughcum et al, 2001) scales found in Study 1, and the existence of several sub-scales, most items composing feeding scales were included. For example, CFQ 'General restriction', 'Food to reward behaviour', 'Monitoring' and 'Pressure to eat' items were included as presented in Study 1. On the basis of the factor analysis and qualitative interview data, other items were substituted or expanded using items from the Parental Feeding Style Questionnaire (PFSQ, Wardle et al, 2002). This measure was excluded from Study 1 because it was specifically designed to capture obesogenic feeding styles in overweight mothers. As such, it was validated on a sample selected for high and low familial obesity risk, rather than a sample reflecting the full range of risk. However, face consideration of the items in the light of Study 1 suggested that they would also be appropriate for a sample with a normal weight distribution. The following changes were made:

i) PFQ 'Food to reward food' scale expanded

Given the low internal reliability of the two item 'Food to reward food' scale established from factor analysis of the PFQ, an additional item was added from the 'Instrumental feeding' sub-scale from the Parental Feeding Style Questionnaire (PFSQ, Wardle et al 2002): "Do you use puddings as a reward to get your child to eat his/her main course?" This item also seemed to typify one of the most common feeding practices reported in the qualitative interviews, e.g. "She knows she can have her sweets after if she eats well at dinner" (ID 2014).

ii) CFQ 'Food to reward behaviour' scale expanded

Similarly, three further 'Instrumental feeding' items were added to expand the 'Food to reward behaviour' scale: "Do you promise your child something to eat in order to get him/her to behave?", "Do you reward your child with something to eat when he/she is well behaved?", and "Do you withhold your child's favourite food if he/she misbehaves?". These items describe more subtle variations on the theme of using food to influence the child's behaviour, and it was hoped they might capture extra variance in feeding practices when combined with the CFQ items (e.g. "I offer sweet things to my child as a reward for good behaviour"), which some parents felt sounded too negative to endorse: "I'd think of that more as blackmail, more well if you do this you can have that...If they'd got a swimming certificate or something like that, I'd offer something more as a treat ... just a treat as in I'm proud of you, well done" (ID 2014).

iii) PFQ 'Food to calm' scale replaced by PFSQ 'Emotional feeding' scale

Despite having acceptable internal reliability (α=.73), the 'Food to calm' scale had a strong negative skew, and a recent paper by the authors of the original scale found that mothers found the questions accusatory in tone, implying that the parent used feeding as a first resort rather than as a final strategy when all avenues had been exhausted (Jain et al, 2004). To limit the possibility that social desirability was decreasing endorsement of the items, the scale was replaced by the 'Emotional feeding' scale from the PFSQ. The 'Emotional feeding' items are distinct from 'Food to calm' items in that the majority stipulate that the behaviour is practised to make the child feel better, the possibility that the child is hungry is not ruled out, and the behaviours are not described as a first resort. E.g. "Do you give your child something to eat to make him/her feel better when he/she is feeling upset?" vs. "Did you ever give your child something to eat or drink if he/she was upset even though you thought he/she was not hungry?".

iv) PFSQ 'Prompting to eat' scale added

In addition to the expansions and substitutions detailed above, a separate scale from the PFSQ was added - 'Prompting to eat'. This was because interview testimonies revealed that the majority of parents used more subtle methods of encouraging their children to eat than those described in the CFQ or PFQ. For example, many reported encouraging children to try foods they had not tasted before by repeatedly exposing them to those foods: "I would always try new foods more than once" (ID 2061); "If she just won't eat it you let it go and a couple of weeks later she probably will eat it" (ID 2070). A long-term objective to encourage the child to enjoy a wide variety of foods was also apparent: "I would like them to experiment and try lots of different foods, not to be stuck in a routine. Just to enjoy your life and stay healthy really!" (ID 2087).

Others reported making efforts to make the food appealing to the child by methods of presentation or preparation: "She likes Weetabix with hot milk, as her grand-dad ate it. It's not something we'd normally do here so it seemed like a bit of a treat to her" (ID 2061); "I normally stir in a bit of dried fruit, raisins and things into the porridge which they both absolutely love. It just encourages them to eat the porridge really"; "I don't make them too large a dinner because I think that puts children off, a mass of food" (ID 2087). The 'Prompting to eat' scale from the PFSQ includes eight items assessing behaviours like these, and was included to capture a wider range of parental feeding practices.

Slight changes to the formatting of the questionnaire were also made in order to increase the equivalence of CFQ and PFQ items. First, conceptually similar items from the PFQ and PFSQ were grouped together in the manner of the CFQ. For example, 'Prompting to eat' items and 'Emotional feeding' items formed separate sections, and PFQ 'Meal-time rules' and 'Food to reward food' items were grouped together. Second, PFQ items were translated into the present tense to conform with PFSQ and CFQ items, e.g. "Did you make your child eat all the food on his/her plate?" became "Do you make your child eat all the food on his/her plate?"

General Parenting Scale

Following Francis, Hofer & Birch (2001), Baumrind's (1971) 13-item self-report scale of authoritarian parenting was included here as an indirect form of validation for the parental feeding scales (see Table 4.1). This scale is composed of the Firm Enforcement and Authoritarianism sub-scales of the Parent Attitude Inquiry (PAI) developed by Baumrind (1967). The Firm Enforcement scale measures a positive value placed upon firmness in handling the child and obedience from the child, and the Authoritarianism scale measures non-egalitarian attitudes and respect for parental authority. Although in the original PAI each question contained two opinions on the same item and parents gave a forced-choice response, 4-point Likert scales (ranging from disagree strongly to agree strongly) were used by Francis, Hofer & Birch (2001) to increase variability. Reliability statistics were not reported.

Table 4.1: General Parental Control Scale (Baumrind, 1967)

1.	I believe that my child should be able to question the authority of her parents.
2.	Too much emphasis is placed on personal freedom nowadays for young children.
3.	A child who defies authority is not very likeable.
4.	Other parents probably see me as rather firm with my child.
5.	I believe children would be better behaved if parents listened more to what their children had to say.
6.	A child who always does as she is told is not very interesting.
7.	I care more than most parents I know about having my child obey me.
8.	It is good to see my child hold her own in an argument with an adult.
9.	I try to take my child's opinions seriously.
10.	I do not like my child to question my decisions.
11.	It is all right with me if my child argues with me about my decisions.
12.	I don't particularly like my child to argue with me.
13.	With respect to my child, I would characterise my discipline as quite firm.

Following Hughes et al (2005), it was predicted that scales made up of items from the CFQ 'Pressure to eat' and 'Restriction' scales would be associated with authoritarian parenting. It was not clear how scales measuring the use of food to reward food and the use of emotional feeding would relate to authoritarian parenting. However, Nicklas et al (2001) suggest these behaviours are authoritarian, as they represent attempts to control children's eating through coercion. 'Monitoring' was conceived as a softer form of restriction, and 'Prompting to eat' described use of more responsive techniques to encourage consumption of healthy foods, so these scales were not expected to be associated with authoritarian parenting, but rather with authoritative parenting. Unfortunately, it was not possible to find a satisfactory parent-report measure of all dimensions of parenting at the time of the study. The Parenting Styles and Dimensions Questionnaire (PSD; Robinson et al, personal communication) measured both authoritative and authoritarian parenting and was piloted in the Study 1 questionnaire (See Appendix II), but produced a large amount of missing data and was unpopular with parents.

A measure of child temperament, the Emotionality-Activity-Sociability Temperament scale (Buss & Plomin, 1984), was also included in the current questionnaire. However, statistics are not presented as it was incorporated only as a pilot for Study 6. A shortened version of the child neophobia scale (Pliner, 1994; Cooke et al, 2004) was also included as part of a separate study.

4.2.4 Data analysis

Univariate ANOVAS and independent t-tests were used to test the influence of categorical demographic predictors on continuous parental feeding scores. Bivariate and partial correlations (Pearson's r) were used to test associations between continuous predictors and parental feeding outcomes. Independent t-tests and Chi^2 analyses were used to evaluate differences between participants with missing and complete data on the variables of interest.

4.3 Results

4.3.1 Response rates

Parental questionnaire. 541 parents returned the questionnaire either immediately (n=309) or after the first (n=153) or second (n=79) reminder, giving an overall response rate of 50%, and therefore 94% power to detect correlations of r=.15.

Response rates were generally lower in schools with higher proportions of families eligible for FSM, and higher proportions of pupils with English as a second language. According to school records, 36% of total pupils had English as a second language, leaving 64% who should have been capable of completing the questionnaire, amounting to approximately 698 of the 1088 distributed. Recalculations based on this reduced hypothetical sample size gave an estimated response rate of 78% of eligible participants. This figure is likely to be an overestimate as a number of participants with English as a second language returned questionnaires with the help of husbands, family or friends, increasing the possible number of respondents. Not all schools were willing to supply individual level information on language status so it was not possible to adjust for this on an individual basis. The effective response rate therefore lies between 50% and 78%.

Children's weights and heights. Children's height and weight was assessed for 76% of the 1088 children present on the day of data collection. Children's height and weight was available for 439 (81.1%) of questionnaire respondents.

4.3.2 Sample characteristics

Parent characteristics

Tables 4.2 and 4.3 show parent and child characteristics for the complete questionnaire sample (n=541). The aim of the Study 2 sampling strategy was to increase socio-economic diversity, so the sample was compared to that of Study 1. As in Study 1, the majority of respondents (92%) were female and most were the mother of the child (93%). The Study 2 sample contained slightly younger participants than Study 1 (M=34.8, SD 5.8). Slightly fewer of the Study 2 participants were married or living as married (80% vs. 89%), perhaps reflecting the younger age of this sample, and a greater proportion described themselves as single (12% vs. 4%). Again, the majority of respondents were white (64%). However, excluding missing cases, slightly more participants put themselves in 'non-white' categories than in Study 1 (34% vs. 27%). As for the Study 1 sample, participants were more likely to be married, and more likely to be non-white than mothers of 2-15 year old children sampled in the Health Survey for England 2002 (Sproston & Primatesta, 2002).

Occupational status, education and affluence. Similar proportions of participants were employed either part-time or full-time (43% vs. 48%) or were full-time homemakers (41% vs. 42%). Proportions attaining a particular educational level are not directly comparable due to a larger proportion of missing data or 'other' classifications in the more ethnically diverse Study 2 sample (6% vs. 1%). However, Study 2 participants seemed to be less educated than Study 1 participants, with 48% (vs. 43%) educated to GCSE level/vocational equivalent or below, 21% (vs. 31%) possessing an A-level or equivalent qualification, and similar proportions having attained a degree or higher qualification (25% vs. 26%). Study 2 participants were less affluent than Study 1 participants: a greater proportion did not own a car (18% vs. 7%) and fewer described themselves as owning or buying their home (58% vs. 72%). These proportions are more comparable to national data for the same population group (Health Survey for England 2002). Income data were missing for 27.7% of the sample (there was no income question in Study 1) but was evenly distributed across categories, with 15% earning under £10,000, and 15% earning over £50,000 per household.

Parental weight. Fourteen percent of cases were missing self-report height and weight compared to only 5% in Study 1. Of those who did provide data, 39% were categorised overweight or obese, compared to 31% in the Study 1 sample; this estimate was still far below the 44% excess weight for this population group taken from the Health Survey for England 2002. Parent BMI ranged from 12 to 39 kg/m^2 (M=24.5, SD 4.3). Male parents had a higher BMI than females (M=26.9, SD 4.28 vs. M=24.4, SD 4.3; t=3.25, df 464, p=.001). Lower education was marginally associated with higher parental BMI (F=2.22, df 3, 445, p=.085) and BMI increased with parent age (r=.15, p=.001, n=463). In the sample providing data, parent BMI was not associated with employment status, home ownership, car ownership or income.

Table 4.2: Parent characteristics

	n	%
Gender		
Female	496	91.7
Male	43	7.9
Missing	2	0.4

Table 4.2: Parent characteristics (contd.)

	n	%
BMI group (self-report height & weight)		
Underweight (<18.5)	18	3.3
Normal weight (18.5-24.99)	267	49.4
Overweight (25-29.99)	135	25.0
Obese (>30)	46	8.5
Missing	75	13.9
Relationship with child		
Mother	503	93.0
Father	32	5.9
Other (Grandparent / Guardian)	4	0.7
Missing	2	0.4
Marital status		
Married	370	68.4
Living as married	60	11.1
Separated / Divorced / Widowed	39	7.2
Single	67	12.4
Ethnicity		
White British	328	60.6
White European	16	3.0
Indian / Pakistani / Bangladeshi	78	14.4
Black African / Black Caribbean	50	9.0
Chinese	7	1.3
Other (inc Mixed race)	52	9.6
Missing	11	2.0
Occupational status		
Full-time employment	86	15.9
Part-time employment	149	27.5
Full-time homemaker	219	40.5
Self-employed	9	1.7
Unemployed	47	8.7
Disabled / too ill too work	5	0.9
Retired	0	0
Student	15	2.8
Other	4	0.7
Missing	7	1.3
Education		
None	47	8.7
GCSEs / O-levels / school cert	156	28.8
NVQs / GNVQs	58	10.7
A-levels	56	10.4
National diploma (HND / ONC)	59	10.9
Degree	96	17.7
Post-graduate diploma	26	4.8
Higher degree	13	2.4
Other	15	2.8
Missing	15	2.8
Car ownership		
No car	99	18.3
One car	263	48.6
More than one car	161	29.8
Missing	18	3.3
Home ownership		
Own / buying	314	58.0
Rent	194	35.9
Other	18	3.4
Missing	15	2.8

Table 4.2: Parent characteristics (contd.)

	n	%
Income		
Less than £9,999	79	14.6
£10,000-19,999	58	10.7
£20,000-29,999	51	9.4
£30,000-39,999	65	12.0
£40,000-49,999	56	10.4
£50,000-59,999	27	5.0
£60,000-69,999	24	4.4
More than £70,000	31	5.7
Missing	150	27.7

Child characteristics

In terms of child characteristics (see Table 4.3), slightly over half the children were male, and around 60% were in nursery rather than reception classes, reflecting the typical nursery to reception class numbers in each school. Mean age was 4.3 (SD 0.6) and ranged from 3 to 6 years. The distribution of birth order in children was similar in Studies 1 and 2, with the majority of children being the youngest in the family.

Table 4.3: Child characteristics

	Study 2 sample	
	n	%
Gender		
Female	239	44.2
Male	299	55.3
Missing	3	0.6
School class		
Nursery (3-4 years)	327	60.4
Reception (4-5 years)	214	39.6
Family position		
Oldest	134	24.8
Middle	65	12.0
Youngest	241	44.5
Only child	100	18.5
Missing	1	0.2
BMI group (IOTF cut-offs)		
Normal weight	318	58.8
Overweight	83	15.3
Obese	38	7.0
Not weighed and measured	102	18.9

Child anthropometrics. BMIs were calculated from measured heights and weights. Mean BMI was 16.8 (SD 1.9), ranging from 12 to 31 kg/m^2. Higher child BMI was weakly associated with higher parent BMI (r=.17, p=.001, n=379). Child BMI was unassociated with child sex, parent education, home or car ownership, or income.

Weight status was calculated using cut-off points developed by Cole et al (2000) using data from six different reference populations for the International Obesity Task Force (IOTF). These cut-offs are based on centile curves passing through the points of 25 kg/m² and 30 kg/m² at age 18 years, and hence give age- and gender- specific points corresponding to the received cut-off points for adult overweight and obesity. In 3-5 year old children these cut-offs correspond to BMIs of around 17 kg/m² for overweight and 19 kg/m² for obesity. IOTF cut-off points were chosen over other methods of classification because they produce similar estimates of overweight to other common methods (Wang & Wang, 2002), give a relatively conservative estimate of overweight in young children (Flegal et al, 2001), and are increasingly being adopted as a way to facilitate comparison of international research.

Based on available data (n=439), 19% of children were overweight and 9% obese. Overweight and obesity rates were slightly higher than estimated by the latest British population data, which indicates 15% prevalence of overweight and 6% prevalence of obesity in a similar age group (Health Survey for England, 2002). In order to characterise each child weight group further, anthropometric characteristics are given by weight category in Table 4.4. Girls and boys did not significantly differ in terms of mean BMI or BMI centile, and overweight and obesity figures were similar for both sexes, although excess weight was slightly more common in boys. Both sexes were therefore categorised together for the purposes of describing the sample.

Table 4.4: Child anthropometric characteristics by weight group (IOTF cut-offs)

	Normal (n=318)		Overweight (n=83)		Obesity (n=38)	
	M (SD)	Range	M (SD)	Range	M (SD)	Range
Age (years)	4.4 (0.6)	3.2 - 5.8	4.3 (0.6)	3.3 - 5.4	4.4 (0.6)	3.3 - 6.0
BMI (kg/m^2)	15.9 (1.0)	13.2 - 18.1	18.1 (0.5)	17.2 - 19.2	21.0 (2.1)	19.2 - 31.3
BMI centile	55.9 (24.0)	1.6 - 95.8	94.0 (3.3)	85.4 - 99.0	99.5 (0.5)	98.2 - 100
Weight (kg)	17.7 (2.1)	13.0 - 26.2	20.9 (2.6)	15.4 - 28.7	25.4 (4.7)	16.6 - 38.8
Weight centile	57.9 (26.1)	0.8 - 99.8	90.4 (11.9)	30.0 - 100	98.4 (2.9)	83.1 - 100
Height (cm)	1.05 (0.06)	0.91 - 1.24	1.07 (0.06)	0.92 - 1.24	1.10 (0.07)	1.05 - 100
Height centile	56.3 (28.9)	1.8 - 99.9	70.4 (26.0)	1.1 - 100	74.7 (21.7)	13.2 - 100

Accuracy of child height and weight data. These figures are based on a large proportion (81.1%) of the full questionnaire sample (439/541). However, they may under-estimate actual prevalence for two reasons.

Firstly, height and weight data was only gathered for the 75.7% (824/1088) of children who were present on the day of data collection. Parental exclusion did not contribute significantly to missingness as only one parent requested that their child not be weighed and measured. However, it is possible that absence was directly or indirectly related to adiposity, because both school absence (Reid & Kendall, 1982) and obesity (Sundquist & Johansson, 1998) show a social gradient. Heights and weights may therefore have been greater for the children who were not weighed and measured.

A second source of under-estimation in the sub-sample data reported above might be parents responding to the questionnaire according to their child's weight. For example, parents with more overweight children (or more underweight children) may have been reluctant to return the questionnaire. To test this we compared child BMI for questionnaire respondents (M=16.8, SD 1.9) with available BMI for non-respondents (M=16.6, SD 2.07), and found that there was no significant difference (t=-.927, df=822, p=.354).

4.3.3 Parental feeding scales

Scale development. Before creating questionnaire scales, Principal Components Analysis with direct oblimin rotation was used to examine the factor structure of the new set of parental feeding items. An exploratory method was selected because it was not clear how the new questionnaire items would factor together. An oblique rotation was selected to allow factors measuring similar constructs to correlate. Results are presented in Table 4.5.

Emerging scales were largely as predicted. The PFSQ 'Prompting to eat' and 'Emotional feeding' scales factored exactly as outlined in the questionnaire manual (Wardle et al, personal communication). CFQ 'Monitoring' and 'Pressure to eat' contained identical factors to the Study 1 solution. Items from the PFSQ 'Instrumental feeding' scale ("Do you use puddings as a reward to get your child to eat his/her main course?"; "Do you reward your child with something to eat when he/she is well behaved?" and "Do you promise your child something to eat in order to get him/her to behave?") combined with the 'Food to reward food' and 'Food to reward behaviour' scales respectively to create larger factors. Items which comprised the six item 'General restriction' scale in Study 1 formed two separate factors here ('General Restriction' and 'Restriction 2').

Table 4.5: Factor loadings for revised parental feeding behaviour items†

Factor and items in solution	1) Food to reward healthy food	2) Prompting to eat	3) General restriction	4) Emotional feeding	5) Mealtime rules	6) Pressure to eat	7) Monitoring	8) Food to reward behaviour	9) Restriction 2
Factor 1: Food to reward food									
Offer child dessert to get to eat foods good for him/her	**.80**	-	-	-	.11	-	-	-	-
Use puddings as reward to get to eat main course	**.73**		-.11	-	-	.10	-	.14	.15
Use foods child likes to get to eat healthy foods doesn't like	**.65**	-	-	-	-	.15	-	-	-.24
Factor 2: Prompting to eat									
Encourage child to try foods hasn't tasted before	-	**.78**	-.11	-.11	-	-	-	-	.14
Encourage child to taste each of foods served at mealtimes	-	**.77**	-	-	-	-	-	-.13	.10
Encourage child to enjoy his/her food	.12	**.69**	-	.12	-	-	-	-.23	-.14
Praise child if eats new food	-	**.60**	-	-	-	-	-	.17	-.12
Encourage child to eat wide variety of food	-.14	**.59**	.11	-.16	.12	-	.11	.14	-
Praise child if eat what give him/her	-	**.58**	-	-	-	.23	-	.29	-
Encourage child to look forward to meal	.11	**.51**	.30	-	-	-	-	.16	-.30
Present food in attractive way to child	.19	**.50**	-	.12	-	-	.12	-.22	-
Factor 3: General restriction									
If did not guide or regulate, child would eat too much of favourite foods	-	-	**-.79**	-	-	-	-	-	-
If did not guide or regulate, child would eat too many junk foods	-	-	**-.75**	-	-	-	-	-	-
Intentionally keep some foods out of child's reach	-	-	**-.72**	-	-	-.11	-	-	-
Have to be sure child does not eat too much of his/her favourite foods	-	-	**-.47**	-	.11	-	-	-	-.42
Factor 4: Emotional feeding									
Give child something to eat if worried	-	-	-	**.86**	-	-	-	-	-
Give child something to eat if hurt	-	-	-	**.84**	-	-	.12	.12	.18
Give child something to eat if upset	-	-	-	**.80**	-	-	.15	.13	.13
Give child something to eat if bored	-	-	-	**.79**	.10	-	-.13	-	-
Give child something to eat if angry	-	-	-	**.73**	-	-	-.16	-	-.14

Table 4.5: Factor loadings for revised parental feeding behaviour items†

Factor and items in solution	1) Food to reward healthy food	2) Prompting to eat	3) General restriction	4) Emotional feeding	5) Mealtime rules	6) Pressure to eat	7) Monitoring	8) Food to reward behaviour	9) Restriction 2
Factor 5: Meal-time rules									
Make child eat all food on plate	-	-	-	.10	**.85**	-	-	-	-
Make child finish all dinner before can have dessert	.23	.12	-.10	-	**.75**	-	-	-	-
Child has to stay at table until has eaten certain amount	.12	-	-	-.11	**.72**	-	.13	-	.17
Child should always eat all of food on plate	-.18	-	-	-.15	**.66**	.19	-	-	-.12
Withhold child's favourite food if misbehaves	.28	-.15	-	-	**.34**	-	-	.30	-
Factor 6: Pressure to eat									
If did not guide or regulate, child would eat much less than should	-	-	-	-	-	**.86**	-	-	-
Have to be especially careful child eats enough	.20	-	-	-	-	**.77**	-	-	-.17
If child says 'I'm not hungry', try to get to eat anyway	-	-	-	-	.11	**.71**	-	-	.18
Factor 7: Monitoring									
How much keep track of sweet things child eats	-	-	-	-	-	-	**.92**	-	-
How much keep track of snack food child eats	-	-	-	-	-	-	**.91**	-	-
How much keep track of high fat foods child eats	-.12	-	-	-	-	-	**.83**	-	-.15
Factor 8: Food to reward behaviour									
Offer sweet things to child as reward for good behaviour	-	-	-.11	-	-	-	-	**.78**	-
Offer child favourite foods in exchange for good behaviour	-	-	-.11	-	-	-	-.15	**.76**	-
Reward child with something to eat when well behaved	.22	-	-	.38	-	-	-	**.49**	-
Promise child something to eat to get to behave	.26	-	-	.36	-	-	-	**.44**	-
Factor 9: Restriction 2									
Have to be sure child does not eat too many high fat foods	-	-	-.15	-	-	-	.14	-	**-.83**
Have to be sure child does not eat too many sweet things	-	-	-.26	-	-	-	.20	-	**-.68**

†Only factor loadings over .1 are included.

Cronbach's alpha scores and variance explained for each factor are presented in Table 4.6. Each scale explained between 2.5-5% of variance. Several scales were identical to those extracted in Study 1 and therefore had comparable or superior internal consistency ('Pressure to eat' α=.76 cf α=.81; 'Monitoring' α=.88 cf α=.83). Alphas for both expanded scales were higher than for the original scales ('Food to reward behaviour' α=.80 cf α=.67; 'Food to reward food' α=.77 cf α=.50). The expanded 'Meal-time rules' scale had an identical alpha to that in Study 1 (α=.77). Dropping the lowest loading item, "Do you withhold food from your child if he/she misbehaves?" slightly increased the alpha to .78, so a shortened scale omitting this item was adopted for future analyses.

The newly added 'Prompting to eat' scale had reliability of α=.81, which was higher than that for the 'Pressure to eat' (α=.76) and 'Food to reward food' scales (α=.77). Replacing the 'Food to calm' scale (α=.73) with the 'Emotional feeding' scale increased the alpha score to α=.88. The further sub-division of restriction items that occurred here made negligible difference to scale alphas; the more parsimonious 6 item factor was therefore adopted for future analyses ('Restriction 1' (4 items) α=.69, 'Restriction 2' (2 items) α=.72 cf 'General restriction' (6 items) α=.69).

Table 4.6: Cronbach's alpha and variance explained for new parental feeding factors

Factor name	Number of items	Alpha	Variance explained (%)
1) Food to reward food	3	0.77	3.46
2) Prompting to eat	8	0.81	3.75
3) Restriction 1	4	0.69	2.90
4) Emotional feeding	5	0.88	4.62
5) Meal-time rules	5	0.78	3.65
6) Pressure to eat	3	0.76	2.75
7) Monitoring	3	0.88	3.44
8) Food to reward behaviour	4	0.80	3.24
9) Restriction 2	2	0.72	2.39

Descriptive statistics for final parental feeding scales. Descriptive statistics for the final parental feeding scales are given in Table 4.7. Cronbach's alpha values were based on cases with complete data on items for that scale, and descriptives are based on all subjects for whom item means were calculated (range 0-4). There was very little missing data for the parental feeding items and item means could therefore be calculated for the vast majority of participants. The mean 'Prompting to eat' score (M=3.1) was noticeably higher than for other scales assessing pressuring the child to eat ('Food to reward food' M=1.6; 'Meal-time rules' M=1.9). Compared with results from the Study 1 sample, mean scores on the majority of feeding scales appeared slightly higher.

Scale distributions. The distributions of all scales were checked for normality using histograms and statistics for skewness and kurtosis. There was substantial negative kurtosis for 'Pressure to eat', 'Meal-time rules', and 'Food to reward behaviour', indicating frequency distributions that were too flat, with too many cases in the tails. 'Pressure to eat' in particular formed an almost flat distribution, with similar numbers of participants having scores throughout the possible range of 0-4. In contrast, 'Prompting to eat' and 'Emotional feeding' had distributions with high peaks and long thin tails, indicated by the positive kurtosis values. In terms of skewness, 'Emotional feeding' showed a pronounced positive skew and 'Prompting to eat', 'General restriction', 'Pressure to eat' and 'Monitoring' all showed negative skew, whereas 'Food to reward food', 'Meal-time rules' and 'Food to reward behaviour' were approximately normally distributed.

In Chapter 2, skewness and kurtosis values which were more than twice their standard error were considered to represent significant deviations from normality. A problem with using this criterion in the current dataset was that standard errors decrease with sample size, and variables in studies with large samples will therefore be assumed to be skewed even with only minor deviations from normality. Cut-offs of +1 for positive values and -1 for negative values were therefore adopted here, by which criteria only 'Emotional feeding' and 'Prompting to eat' showed significantly non-normal distributions.

Nevertheless, it is recognised that even a small degree of non-normality in the dependent variables may decrease the reliability of significance testing in parametric analyses. Several approaches to tackle non-normality were therefore considered. One possibility is to use non-parametric tests. These have the advantage of not assuming normality, but decrease power available to detect significant effects. Another possibility is to dichotomise dependent variables, but this approach leads to a loss of information in the data. A third option is to transform variables so that distributions are approximately normal, maintaining variance in the data and allowing parametric tests to be conducted.

One problem with transformation is that it can prevent the reader from gaining an accurate impression of the effects discussed. Furthermore, only 5 of the 8 parental feeding scales used here merited transformation, and only one scale passed the criterion for significant skewness, so using adjusted variables for these only would prevent comparison between scales. Transforming variables would also prevent comparison with other studies, which have neither described scale distributions or made adjustments to approximate normality.

Most importantly, the univariate tests used in this chapter and the multiple regression methods used in Chapter 5 are generally robust against violations of their assumptions, and the size of the sample was such that significance tests were unlikely to be radically affected by slight skewness in the dependent variable. Analyses were therefore conducted using unadjusted scales. They were also repeated using non-parametric alternatives for each test (i.e. Mann-Whitney U, Kruskal-Wallis H, Spearman's rho) but there was little change in results.

Table 4.7: Alpha scores and item means for final parental feeding questionnaire scales

Factor name	No. of items	Alpha	n	Mean (SD)	n	Skewness (SE)	Kurtosis (SE)
1) Food to reward food	3	0.77	526	1.6 (0.9)	529	-0.00 (0.1)	-0.35 (0.2)
2) Prompting to eat	8	0.81	526	3.1 (0.6)	529	-0.84 (0.1)	1.68 (0.2)
3) General restriction	6	0.69	529	2.7 (1.0)	536	-0.67 (0.1)	-0.43 (0.2)
4) Emotional feeding	5	0.88	528	0.9 (0.8)	531	1.13 (0.1)	1.59 (0.2)
5) Meal-time rules	4	0.78	522	1.9 (1.0)	529	-0.00 (0.1)	-0.72 (0.2)
6) Pressure to eat	3	0.76	529	2.3 (1.2)	533	-0.32 (0.1)	-0.95 (0.2)
7) Monitoring	3	0.88	533	3.0 (0.9)	530	-0.70 (0.1)	0.22 (0.2)
8) Food to reward behaviour	4	0.80	527	1.5 (1.0)	540	0.27 (0.1)	-0.72 (0.2)

4.3.4 Associations between demographic factors and parental feeding

A further note on data analysis. Associations between parental feeding behaviours and each demographic factor were tested using individual t-tests, univariate ANOVAs and Pearson's correlations as appropriate. Within ANOVA tables, similar letters in superscript denote where figures are significantly different according to post hoc tests (LSD). It is acknowledged that adjusting for multiple testing would have reduced significance levels in some cases. However, the following analyses were exploratory and significance levels are used only to indicate the importance of a relationship. In addition, repeating each analysis with adjustment made little difference to results, so only the unadjusted analyses are reported here. Where correlations are presented, continuous versions of variables are used, and described where necessary. Results are presented in the text except where there were several significant associations: these results are presented in tabular format. Minimum n for each column of analyses are presented at the top of each column.

Grouping of parental feeding scales. Parental feeding scales were grouped into those describing strategies which theoretically resulted in greater intake (i.e. pressuring behaviours) and those designed to restrict intake (i.e. restricting behaviours). For the purposes of this classification, 'Emotional feeding' was grouped with pressuring behaviours because, although it might not be specifically motivated by the desire to increase food intake, greater food intake was the assumed result.

'Meal-time rules' was considered to focus predominantly on restriction because a key concept was restricting consumption of dessert until the meal was finished. 'Food to reward behaviour' was classed as restrictive because Birch et al (2001) include it in the restriction scale and the use of a food as a reward implies it may normally be withheld in order for it to have the necessary reinforcing value. In the text, 'Emotional feeding' and 'Food to reward behaviour' are referred to collectively as instrumental forms of feeding, while 'Food to reward food' is considered predominantly as a form of pressure to eat.

Child sex. Parental feeding scores were generally similar for boys and girls. 'Food to reward food' was slightly higher for girls (M=1.7 SD 0.9, n=234) than boys (M=1.6 SD 0.9, n=292) but this difference did not reach significance (t=-1.80, df=524, p=.072) (see Table 4.8).

Table 4.8: Parental feeding scores by child sex

	Male n≥292	Female n≥234	Difference
Pressuring	**M (SD)**	**M (SD)**	**t (p)**
Pressure to eat	2.3 (1.3)	2.3 (1.2)	0.66 (p=.509)
Food to reward food	1.6 (0.9)	1.7 (0.9)	1.80 (p=.072)
Prompting to eat	3.1 (0.6)	3.1 (0.6)	0.54 (p=.588)
Emotional feeding	0.9 (0.8)	0.9 (0.8)	0.65 (p=.513)
Restricting			
Monitoring	3.0 (0.9)	3.0 (0.8)	1.12 (p=.265)
General restriction	2.7 (1.0)	2.7 (0.9)	0.34 (p=.737)
Meal-time rules	1.8 (1.0)	1.9 (0.9)	0.72 (p=.470)
Food to reward behaviour	1.5 (1.0)	1.5 (1.0)	0.34 (p=.735)

Child age. Table 4.9 shows associations between parental feeding scores and child age group (3y n=158; 4y n=273; 5y n=103). There was some evidence for decreased 'Emotional feeding' and 'Food to reward behaviour' for older children, and for lower use of 'Meal-time rules' in younger children. When nursery children (3-4 years, n=327) were compared with reception children (5 years, n=214), one significant difference was evident, such that there were higher scores on 'Pressure to eat' for children in nursery class (M=2.4, SD 1.2) than for those in reception (M=2.2, SD 1.3) (t=2.08, df 531, p=.038). In a correlational analysis, only 'Food to reward behaviour' showed a significant linear relationship with child age, such that use of 'Food to reward behaviour' decreased with increasing child age (r=-.12, p=.007, n=533).

Table 4.9: Parental feeding scores by child age

	3 years n≥155	4 years n≥269	5 years n≥101	Group difference	Correlation n≥526
Pressuring	**M (SD)**	**M (SD)**	**M (SD)**	**F (p)**	**r (p)**
Pressure to eat	2.3 (1.2)	2.3 (1.3)	2.1 (1.2)	1.33 (p=.265)	-.05 (p=.254)
Food to reward food	1.6 (0.9)	1.7 (0.9)	1.5 (0.9)	2.21 (p=.111)	-.02 (p=.605)
Prompting to eat	3.1 (0.6)	3.0 (0.6)	3.0 (0.7)	0.16 (p=.849)	-.02 (p=.586)
Emotional feeding	0.9 (0.7)	1.0 (0.9)[a]	0.7 (0.7)[a]	3.18 (p=.042)	-.05 (p=.219)
Restricting					
Monitoring	3.1 (0.8)	3.0 (0.9)	3.0 (0.7)	0.59 (p=.557)	-.04 (p=.343)
General restriction	2.7 (1.0)	2.7 (0.9)	2.6 (1.0)	1.10 (p=.335)	-.03 (p=.471)
Meal-time rules	1.7 (0.9)[a]	2.0 (1.0)[a]	1.8 (1.0)	3.64 (p=.027)	.04 (p=.336)
Food to reward behaviour	1.6 (1.0)[a]	1.6 (1.1)[b]	1.3 (1.0)[ab]	4.50 (p=.012)	-.12 (p=.007)

Parent sex. Parental feeding scores for male (n=43) and female (n=496) parents are compared in Table 4.10. Male parents had significantly higher scores on 'Pressure to eat' and 'Emotional Feeding'. Scores on 'Food to reward behaviour' were also higher but non-significant. In contrast, female parents had significantly higher scores on 'Prompting to eat' and 'Monitoring'. These differences should, however, be treated with caution due to the small number of men in the sample.

Table 4.10: Parental feeding scores by parent sex

	Females n≥85	Males n≥41	Difference
Pressuring	**M (SD)**	**M (SD)**	**t (p)**
Pressure to eat	2.3 (1.3)	2.7 (1.0)	2.31 (p=.021)
Food to reward food	1.6 (0.9)	1.7 (1.0)	0.53 (p=.597)
Prompting to eat	2.7 (0.9)	3.1 (0.6)	4.24 (p<.001)
Emotional feeding	0.8 (0.7)	1.3 (1.2)	3.77 (p<.001)

Table 4.10: Parental feeding scores by parent sex (contd.)

Restricting			
Monitoring	3.0 (0.8)	2.7 (1.0)	2.72 (p=.007)
General restriction	2.7 (1.0)	2.8 (0.8)	0.46 (p=.643)
Meal-time rules	1.9 (1.0)	2.1 (0.9)	1.57 (p=.117)
Food to reward behaviour	1.5 (1.0)	1.8 (1.2)	1.78 (p=.075)

Parent age. Univariate ANOVAs comparing parental feeding scores for different parental age groups revealed few significant differences. One significant relationship was apparent, such that 'Meal-time rules' scores were higher in the youngest parent age group, i.e. 20-30y (M=2.1, SD 0.9) than for the older groups (M=1.9, SD 1.0; M=1.8, SD 1.0; M=1.7, SD 0.9) (F=4.19, df 3,516, p=.006). This relationship was also significant when age was treated as a continuous variable (r=-.15, p=.001, n=518).

To test whether associations with parent age could be explained either by a) the child's age (with younger parents having younger children and therefore making greater use of meal time rules ~~food to reward behaviour~~), b) the number of children in the family (affecting the parents' degree of experience and demand on the parent's attention), c) the parent's employment status (affecting the degree to which parents are involved in feeding their child), or d) parental education (influencing choice in parental feeding style), these variables were systematically controlled for in partial correlations, with negligible impact on the relationship.

Ethnicity. Table 4.11 gives mean parental feeding scores by ethnicity. Analyses were first conducted for each ethnic group separately, but as differences were only evident for the white group, results are presented as 'white' (n=381) versus 'other' (n=151).

White parents differed from other ethnic groups on all scales with the exception of 'General restriction'. White mothers had higher scores on 'Monitoring' and 'Prompting to eat', and lower scores on 'Pressure to eat', 'Food to reward food', 'Emotional feeding', 'Meal-time rules' and 'Food to reward behaviour'. Entering possible confounders as covariates in univariate ANOVAs demonstrated that the ethnicity effects were independent of all other demographic measures.

Table 4.11: Parental feeding scores by ethnicity

	White n≥376	Other n≥144	Difference
Pressuring	M (SD)	M (SD)	t (p)
Pressure to eat	2.1 (1.4)	2.7 (1.1)	5.00 (p<.001)
Food to reward food	1.5 (0.9)	1.9 (0.9)	3.69 (p<.001)
Prompting to eat	3.1 (0.5)	2.9 (0.7)	2.50 (p=.013)
Emotional feeding	0.8 (0.7)	1.2 (0.9)	5.50 (p<.001)
Restricting			
Monitoring	3. 1 (0.8)	2.7 (0. 9)	4.53 (p<.001)
General restriction	2.7 (1.0)	2.8 (0.9)	1.11 (p=.269)
Meal-time rules	1.8 (1.0)	2.1 (0.9)	3.78 (p<.001)
Food to reward behaviour	1.4 (1.0)	1.9 (1.0)	5.02 (p<.001)

Parental education. Although measures of education and affluence are often combined to give a general index of socio-economic status, SES variables were treated separately here, in order to enhance comparability with existing studies, and because findings in Study 2 suggested that effects might be different for each variable. For example, education might be associated with increased nutrition knowledge and therefore increased restriction, whereas lower income might be associated with concern about waste and therefore increased pressure to eat. Parental feeding scores are presented by parental education group in Table 4.12.

Table 4.12: Parental feeding scores by parental education level

	None n≥46	GCSEs / equiv. n≥210	A levels / equiv. n≥110	Degree or above n≥132	Group difference	Correlation n≥500
Pressuring	M (SD)	M (SD)	M (SD)	M (SD)	F (p)	r (p)[†]
Pressure to eat	2.3 (1.3)	2.3 (1.3)	2.2 (1.7)	2.2 (1.2)	0.23 (p=.876)	-.04 (p=.344)
Food to reward food	1.6 (0.9)	1.7 (0.9)	1. 6 (0.9)	1.6 (0.9)	0.21 (p=.887)	-.02 (p=.584)
Prompting to eat	3.0 (0.6)	3.1 (0.6)	3.1 (0.6)	3.0 (0.6)	1.47 (p=.223)	-.07 (p=.121)
Emotional feeding	1.2 (0.9)[abc]	0.8 (0.7)[a]	0.9 (0.7)[b]	0.7 (0.7)[c]	4.11 (p=.007)	-.13 (p=.005)
Restricting						
Monitoring	2.8 (1.0)[ab]	3.0 (0.8)[a]	3.2 (0.8)[b]	3.0 (0.8)	2.39(p=.068)	.05 (p=.299)
General restriction	2.4 (1.0)[ab]	2.7 (1.0)	2.7 (0.92)[a]	2.8 (0.9)[b]	2.20(p=.087)	.10 (p=.020)
Meal-time rules	1.8 (1.1)	1.9 (1.0)	1.9 (0.9)	1.7 (1.0)	1.47 (p=.223)	-.08 (p=.065)
Food to reward behaviour	1.3 (1.2)	1.5 (1.0)	1.5 (1.0)	1.4 (1.0)	0.77 (p=.512)	-.02 (p=.697)

[†] *r was calculated by correlating individual parental feeding scales with education in 5 ordinal categories i.e. none/GCSE level or vocational equivalent/A level or vocational equivalent/degree/post-graduate degree*

'Emotional feeding' and 'General restriction' showed significant education gradients, such that higher 'Emotional feeding' was associated with lower educational level and higher 'General restriction' was associated with higher educational level. Lower 'Monitoring' scores were evident in the 'No education' group, but the group difference was not significant. Pearson's correlations between parental feeding scores and education treated as a continuous variable replicated these findings.

Home ownership. Parental feeding scales differed substantially with home ownership status (see Table 4.13). In order to create two groups, participants who reported living with their parents, other relations, or in church or other accommodation (n=18) were categorised with those who reported renting either privately or from a local authority (n=194) to form a 'Rent home or other' group (n=212). Those who owned or were buying their home formed the 'other' category. A series of individual t-tests demonstrated that 'Pressure to eat', 'Emotional feeding' and 'Food to reward behaviour' were lower and 'Monitoring' was significantly higher for those who owned or were buying their home. There was also evidence for lower use of 'Food to reward food' and 'Meal-time rules' with increasing affluence.

Table 4.13: Parental feeding scores by home ownership status

	Rent home / other $n \geq 204$	**Own / buying home $n \geq 310$**	**Difference**	**Correlation $n \geq 515$**
Pressuring	**M (SD)**	**M (SD)**	**t (p)**	**r (p)** [†]
Pressure to eat	2.5 (1.2)[a]	2.1 (1.3)[a]	4.19 (p<.001)	-.15 (p<.001)
Food to reward food	1.7 (0.9)	1.6 (0.9)	1.73 (p=.085)	-.08 (p=.085)
Prompting to eat	3.0 (0.7)	3.1 (0.5)	0.73 (p=.463)	.04 (p=.315)
Emotional feeding	1.0 (0.9)[a]	0.8 (0.6)[a]	2.75 (p=.006)	-.11 (p=.009)
Restricting				
Monitoring	2.8 (0.9)[a]	3.1 (0.8)[a]	3.61 (p<.001)	.14 (p=.002)
General restriction	2.7 (0.9)	2.7 (1.0)	0.77 (p=.443)	.03 (p=.444)
Meal-time rules	2.0 (1.0)	1.8 (1.0)[a]	1.93 (p=.054)	-.10 (p=.022)
Food to reward behaviour	1.7 (1.1)[a]	1.4 (1.0)[a]	2.71 (p=.007)	-.10 (p=.026)

[†] *r was calculated by correlating individual parental feeding scales with home ownership in 3 ordinal categories i.e. live with family or other arrangement / rent from local authority or private landlord / own or buying house*

Car ownership. Analyses were also conducted comparing parents who had no car (n=99), one car (n=263) and two or more cars (n=161). Car ownership is problematic as a measure of affluence in London, as many individuals who could afford a car are well-served by public transport and choose to travel by this method instead.

However, results were very similar, supporting the existence of a robust relationship with affluence.

Income. Finally, as a more direct test of affluence effects, Table 4.14 gives parental feeding scales by income group for all those providing income data (n=391, i.e. 72.3% of the questionnaire sample). 'Emotional feeding' and 'Meal-time rules' scores were lower, and 'Monitoring' was higher among parents with a higher income (Figure 4.1). There was an additional association with 'General restriction' such that those with the lowest income had lower scores, but the difference was only marginally significant. Income was unrelated to 'Food to reward behaviour' and 'Food to reward food'. Pearson's correlations produced similar results.

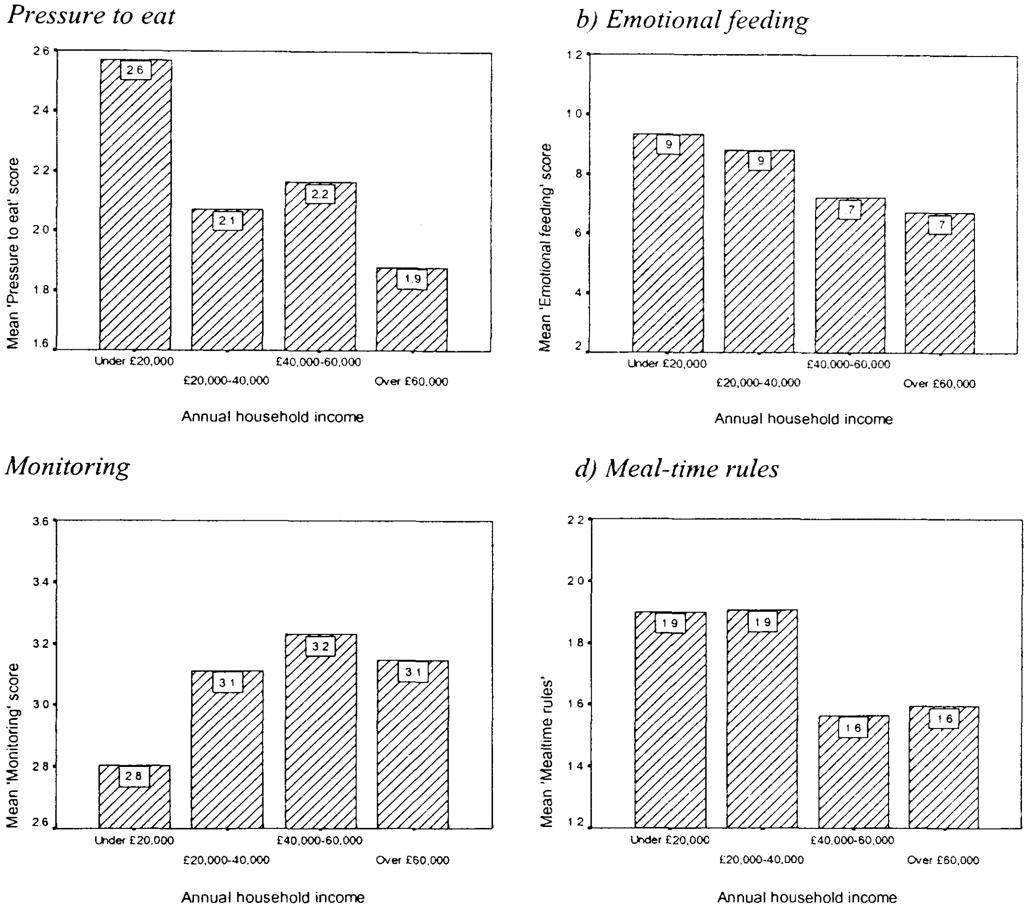
Table 4.14: Parental feeding scores by annual household income

	Up to £19,999 n≥132	**£20,000 - £39,999 n≥112**	**£40,000 - £59,999 n>=80**	**£60,000 or over n≥54**	**Group difference**	**Correlation n≥382**
Pressuring	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**F (p)**	**r (p)**
Pressure to eat	2.6 (1.2)^{abc}	2.1 (1.2)^{a}	2.2 (1.3)^{b}	1.9 (1.2)^{c}	5.55(p=.001)	-.18 (p<.001)
Food to reward food	1.6 (0.9)	1.6 (0.8)	1.6 (0.9)	1.5 (1.0)	0.36 (p=.784)	-.06 (p=.260)
Prompting to eat	3.0 (0.8)^{a}	3.1 (0.5)	3.0 (0.6)	3.2 (0.5)^{a}	1.73 (p=.160)	.07 (p=.185)
Emotional feeding	0.9 (0.9)^{ab}	0.9 (0.7)	0.7 (0.6)^{a}	0.7 (0.6)^{b}	2.58 (p=.053)	-.13 (p=.011)
Restricting						
Monitoring	2.8 (0.9)^{abc}	3.1 (0.8)^{a}	3.2 (0.7)^{b}	3.2 (0.6)^{c}	6.12 (p<.001)	.17 (p=.001)
General restriction	2.6 (0.9)^{a}	2.9 (0.9)^{a}	2.7 (1.0)	2.7 (1.0)	2.32 (p=.075)	.01 (p=.867)
Meal-time rules	1.9 (1.0)^{ac}	1.9 (0.9)^{b}	1.6 (0.9)^{ab}	1.6 (1.0)^{c}	3.52 (p=.015)	-.16 (p=.002)
Food to reward behaviour	1.6 (1.1)	1.4 (1.0)	1. 6 (1.0)	1.4 (0.9)	0.73 (p=.532)	-.07 (p=.158)

† *r was calculated by correlating individual parental feeding scales with 8 ordinal categories of annual household income ranging from £9,999 or under to £70,000 or over*

It should be noted that the income variable may not reflect the real distribution of income in the sample because evidence suggests that those on lower incomes are less likely to answer income questions. Additionally, associations between parental feeding and income may not generalise well to the whole sample. For example, those who did not report income exhibited higher 'Emotional feeding' (t=2.20, df 529, p=.029) and higher 'Meal-time rules' (t=3.47, df 527, p=.001) than those who provided data.

Figure 4.1: Parental feeding scores by income



Finally, given the association between ethnicity and parental feeding, and the known associations between ethnicity and SES, all SES analyses were repeated on the white group only. Associations with education and income were very similar. However, when including white parents only, the association between home ownership and both 'Emotional feeding' and 'Food to reward behaviour' disappeared. However, given that patterns were largely unchanged, future analyses were conducted with the whole sample to increase numbers.

4.3.5 Associations between parent adiposity and parental feeding

Parent adiposity. Although there is no evidence to suggest that a BMI<18.5 should be considered underweight in terms of associated health risks (Sarlio-Lahteenkorva et al, 2004), a 'low weight' group was included here to explore the relationship in more detail (n=18). 267 parents fell in the normal weight category, 135 in the overweight group, and 46 in the obese group. As 86% of parents (466/541) reported their own height and weight, Table 4.15 is based on a reduced sample. Height and weight data were not more likely to be missing if parents perceived themselves to be currently overweight (χ^2=1.65, df 2, p=.439). However, overweight parents may be more likely to both withhold height and weight data and under-report their perceptions of their own weight (Larson, 2000), so this does not rule out biased 'missingness'.

Those who did not supply self-reported height and weight also differed from those who provided data in a number of other ways. In terms of parental feeding, they had higher scores on 'Food to reward food' (t=3.16, df 527, p=.002), 'Emotional feeding' (t=2.41, df 529, p=.016), and 'Food to reward behaviour' (t=2.98, df 538, p=.003), and lower scores on 'Prompting to eat' (t=1.82, df 527, p=.069), and 'Monitoring' (t=2.02, df 528, p=.043) than those who provided data. They also had a significantly lower income (t=4.05, df 389, p<.001), were less likely to own their home (χ^2=29.8, df 1, p<.0001), and had a slightly lower educational level (t=1.65, df 509, p=.100).

Based on the available data, however, 'General restriction' was lowest in parents who were obese and highest in those who were overweight, with normal and low weight groups falling in between. The use of food to reward behaviour increased linearly with parent weight group, but this trend was not significant. In order to capture additional variance in parental weight, analyses were repeated correlating parental BMI with parental feeding scores. Significant negative correlations became apparent for 'Food to reward food' (r=-.09, p=.045) and 'Prompting to eat' (r=-.09, p=.044), and there was a positive correlation between parental BMI and use of food to reward behaviour (r=.11, p=.044).

Table 4.15: Parental feeding scores by parent weight status (self-reported height and weight)

	Low weight BMI <18.5 n≥18	**Normal weight** BMI <25 n≥263	**Over-weight** BMI <30 n≥132	**Obese** BMI>30 n≥44	**Group difference**	**Correlation** n≥459
Pressuring	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**F (p)**	**r (p)**
Pressure to eat	2.2 (1.5)	2.3 (1.2)	2.3 (1.3)	2.2 (1.2)	0.13 (p=.943)	.01 (p=.766)
Food to reward food	1.9 (1.0)	1.6 (0.9)	1.5 (0.9)	1.5 (0.9)	1.50 (p=.214)	-.03 (p=.045)
Prompting to eat	3.1 (0.6)	3.1 (0.5)	3.0 (0.6)	3.0 (0.7)	1.36 (p=.254)	-.09 (p=.044)
Emotional feeding	0.7 (0.7)	0.9 (0.7)	0.8 (0.8)	0.8 (0.6)	0.27 (p=.849)	.04 (p=.372)

Table 4.15: Parental feeding scores by parent weight status (contd.)

	Low weight BMI <18.5 n≥18	Normal weight BMI <25 n≥263	Over-weight BMI <30 n≥132	Obese BMI>30 n≥44	Group difference	Correlation n≥459
Restricting						
Monitoring	3.1 (0.9)	3.1 (0.8)	3.0 (0.9)	2.9 (0.8)	0.58 (p=.630)	-.06 (p=.179)
General restriction	2.6 (0.8)	2.7 (1.0)[a]	2.8 (0.9)[b]	2.3 (1.0)[ab]	2.75 (p=.042)	-.05 (p=.275)
Meal-time rules	1.9 (1.0)	1.9 (1.0)	1.8 (1.0)	1.8 (0.9)	1.12 (p=.341)	-.07 (p=.162)
Food to reward behaviour	1.4 (1.0)	1.4 (1.0)	1.5 (1.0)	1.7 (1.0)	1.50 (p=.213)	.12 (p=.009)

Perceived parent weight. In order to gain more subjects in the analysis and hence to increase power to detect significant effects, the same analyses were repeated using perceived current parent weight as a proxy for actual weight, and also to see whether the associations with parental weight could be best explained by parents being motivated by perceptions of their own current weight status. There were only 4 individuals who described themselves as 'very underweight' and 14 individuals describing themselves as 'very overweight', so this variable was collapsed into three categories- perceived underweight, perceived normal weight and perceived overweight. For the sake of comparison to data using self-report parent weight, analyses were also conducted using only those parents who supplied weight data, with very similar results. Correlations were also conducted using continuous rather than group variables and results of all analyses are given in Table 4.16.

Results for pressuring behaviours were broadly similar to those for actual parent weight. Significant negative correlations were additionally evident between perceived current weight and both 'Pressure to eat' ($r=-.09$, $n=518$, $p=.05$), and 'Meal-time rules' ($r=-.10$, $n=513$, $p=.027$). In opposition to findings for actual parent weight, 'Food to reward behaviour' was not positively associated with perceived parent weight. Associations with restrictive behaviours also revealed some differences between actual parent weight and perceived parent weight. For example, while actual parent weight showed non-significant negative correlations with 'Monitoring' and 'General restriction', there was some evidence for negative correlations between 'Monitoring' and 'General restriction' and parental perceived weight.

Table 4.16: Parental feeding scores by parental perceptions of their current weight

	Under-weight $n \geq 21$	Normal weight $n \geq 308$	Over-weight $n \geq 183$	Group difference	Correlation $n \geq 513$
Pressuring	**M (SD)**	**M (SD)**	**M (SD)**	**F (p)**	**r (p)**
Pressure to eat	2.5 (1.0)	2.3 (1.2)	2.2 (1.3)	1.90 (p=.151)	-.09 (p=.050)
Food to reward food	2.1 (0.9)^{ab}	1.6 (0.9)^{a}	1.6 (0.9)^{b}	4.10 (p=.017)	-.09 (p=.037)
Prompting to eat	3.1 (0.6)	3.1 (0.6)	3.0 (0.6)	0.77 (p=.465)	-.04 (p=.405)
Emotional feeding	1.1 (0.8)	0.9 (0.8)	0.8 (0.7)	1.05 (p=.349)	.05 (p=.307)
Restricting					
Monitoring	2.8 (0.9)	3.0 (0.8)	3.1 (0.8)	1.75 (p=.174)	.08 (p=.074)
General restriction	2.5 (1.0)	2.7 (0.9)	2.8 (0.9)	1.43 (p=.239)	.05 (p=.289)
Meal-time rules	2.1 (0.9)	1.9 (1.0)	1.7 (0.9)	2.47 (p=.086)	-.10 (p=.027)
Food to reward behaviour	1.7 (1.0)	1.4 (1.1)	1.5 (1.0)	1.32 (p=.268)	.01 (p=.812)

General parenting style. Finally, Table 4.17 shows correlations between parental feeding scores and authoritarian parenting. The authoritarian parenting scale was included not as a predictor of parental feeding *per se*, but as a form of validation for the parental feeding scales. The scale had an acceptable Cronbach's alpha score (α=.60) and a mean of 1.6 (SD 0.4). It was approximately normally distributed (skewness statistic=1.13 SE 0.1; kurtosis statistic=0.81 SE 0.2). Consistent with the findings of Hughes et al (2005), 'Pressure to eat' was associated with authoritarian parenting, suggesting that this scale represents an authoritarian style of feeding. There was also a positive association between authoritarian parenting and 'Meal-time rules' scores. 'General restriction', however, was not positively associated with authoritarian parenting. Nor were 'Monitoring' or 'Prompting to eat', suggesting that these may indeed represent more authoritative feeding styles. Consistent with the classification adopted by Nicklas et al (2001), 'Food to reward behaviour' and 'Emotional feeding' showed non-significant trends towards positive associations with authoritarian parenting.

General parenting scores could be calculated for 508/541 i.e. 94% of participants. The overall findings may, however, not generalise to the small sample not supplying data on authoritarian parenting. Those for whom authoritarian parenting scales could not be calculated had higher scores on 'Pressure to eat' (t=2.42, df 531, p=.016), ‘Emotional feeding’ (t=2.03, df 529, p=.043), and ‘Food to reward behaviour’ (t=1.85, df 538, p=.066). They also had lower income (t=3.05, df 389, p=.002) and were less likely to own their home (χ^2=8.03, df 1, p=.007), although they did not differ in terms of educational level.

Table 4.17: Correlations between parental feeding scores and authoritarian parenting

Pressuring	**r (p)**	**n**
Pressure to eat	.11 (p=.014)	503
Food to reward food	.09 (p=.046)	500
Prompting to eat	.04 (p=.422)	500
Emotional feeding	.05 (p=.247)	501
Restricting		
Monitoring	-.01 (p=.837)	500
General restriction	.02 (p=.629)	504
Meal-time rules	.24 (p<.001)	500
Food to reward behaviour	.07 (p=.111)	506

Summary of findings. Findings are summarised in Table 4.18. There was little evidence for an effect of child sex on parental feeding. However, ‘Emotional feeding’ differed with child age group, and ‘Food to reward behaviour’ was lower for older children. ‘Prompting to eat’ and ‘Emotional feeding’ were higher in male parents, whereas ‘Monitoring’ was higher in female parents. The use of meal-time rules was highest in the youngest parents. ‘Prompting to eat’ and ‘Monitoring’ were higher in white parents, while non-white parents were more likely to pressure their children to eat, use certain foods to reward the consumption of others, enforce rules around meal-times, and use food instrumentally to manipulate their child’s affect or behaviour.

In terms of SES, ‘Pressure to eat’, ‘Emotional feeding’ and ‘Meal-time rules’ were generally lower in higher SES mothers, while ‘Monitoring’ and ‘General restriction’ were higher in low SES groups. Higher parent weight was generally associated with lower levels of pressure to eat, but there was also some evidence for higher use of food to reward behaviour among heavier parents. Parents who perceived themselves ro be underweight were more likely to pressure their children to eat; parents who perceived themselves as overweight were slightly more likely to restrict their children. Authoritarian parenting was positively associated with scores on ‘Meal-time rules’, ‘Pressure to eat’ and ‘Food to reward food’.

Table 4.18: Summary of relationships between demographic factors, parental adiposity and parental feeding behaviours†

	Child sex	Child age	Parent sex	Parent age	Ethnicity	Educational level	Home ownership	Income	Parent weight	Perceived parent weight	Authoritarian parenting
Pressuring											
Pressure to eat			*		*		-	-		(-)	+
Food to reward food	(*)				*		(-)		-	(-)	+
Prompting to eat			*		*				-		
Emotional feeding			*		*	-	-	-			
Restricting											
Monitoring			*		*		+	+		(-)	
General restriction						+					
Meal-time rules				-	*	(-)	(-)	-		-	+
Food to reward behaviour		+			*		-		+		

†Asterisks denote group differences (e.g. male vs. female, white vs. non-white); plus signs denote positive associations; minus signs denote negative associations. Symbols without parentheses indicate significant effects at $p<.05$; parentheses indicate that effects were marginally significant at $p<.1$.

4.4 Discussion

The results of Study 3 confirm the existence of several distinct dimensions of parental feeding behaviour and replicate and expand past results showing demographic differences in parental control. The clearest effects were evident for socio-economic status, with parents from higher socio-economic groups displaying higher rates of restriction, and those from lower socio-economic groups showing more pressuring behaviours and more instrumental feeding. Results are discussed below in the context of previous findings.

4.4.1 Socio-economic differences in parental feeding

Restriction. A number of previous studies have shown that restriction is more common in parents with higher socio-economic status, while lower SES parents tend to be more permissive, giving children greater food choice (Vereecken et al, 2004; Hart et al, 2003; Hupkens et al, 1998). Consistent with these findings, higher 'Monitoring' and 'General restriction' scores were associated with greater education and affluence in the current sample. This may be because more educated parents have a better understanding of what constitutes a healthy diet and are therefore more concerned to restrict their child's consumption of 'unhealthy' snacks. Higher social class has also been associated with greater general concern for long-term health and a more internal locus of control in relation to health (Wardle & Steptoe, 2003): these factors may also increase restriction among high SES mothers.

Pressure to eat. The literature suggests that, while almost all mothers sometimes pressure their children to eat, there may be class differences in the character of this pressure, with educated mothers being more inclined to praise the child for eating fruit and vegetables and to negotiate that the child should eat only a small amount of the target food (Vereecken et al, 2004), and mothers from low income households showing more direct pressure on the child to finish his/her meal (Baughcum et al, 2001). Consistent with this trend, 'Prompting to eat' (a measure of child-responsive methods to encourage healthy foods) was slightly higher in more affluent mothers, while 'Pressure to eat' (a measure of direct pressure) was higher in parents with lower socio-economic status.

Given the link between SES and obesity, this may indicate that items within the 'Pressure to eat' scale describe an obesogenic type of feeding common in low SES parents, where the mother erroneously believes the child is not eating enough, and hence pressures him/her to eat more in general. This belief is consistent with findings among low SES mothers of preschoolers in the USA (Jain et al, 2001; Baughcum et al, 1998). In contrast, the 'Prompting to eat' scale was included because it describes encouragement to try different kinds of healthy foods rather than to eat more *per se.* Higher income parents may be more likely to adopt these behaviours not only because they are more informed regarding the effects of food on child health, but because they can afford the time and the cost of presenting their child with food they may not eat.

Instrumental feeding. Although studies examining the influence of SES on parental feeding have generally failed to find SES differences in the use of food to comfort, reward or manipulate the child's behaviour (Vereecken et al, 2004; Baughcum et al, 2001), specific studies of low income samples have noted high levels of instrumental feeding (e.g. Jain et al, 2004; Baughcum et al, 1998). Consistent with these findings, less affluent parents had higher 'Emotional feeding' and 'Food to reward behaviour' scores. This could be because more affluent parents have less need to manipulate their child's affect and behaviour with food because they have other rewards to offer, such as games and activities, which are often more costly and time consuming than food rewards. Higher SES parents may also be more aware of and receptive to popular psychology literature, which broadly condemns using food instrumentally both as an adult and a parent.

4.4.2 Other group differences in parental feeding

As the majority of the current sample was white and the remaining 28% were made up of diverse ethnicities, exploration of ethnic differences in feeding styles was limited. However, the higher 'Monitoring' and 'Prompting to eat' among white parents, and higher pressuring and instrumental feeding among non-white parents suggests that parental feeding might differ between ethnic groups in the UK and could potentially help to explain ethnic differences in child adiposity. Alternatively, parental feeding styles could have different profiles of associations in different ethnicities; this possibility is addressed in the following chapter.

Differences in parental feeding with child sex, child age, parent sex and parent age were minimal. However the evidence for higher scores on most feeding behaviours among girls suggests that parents may be more concerned to modify their daughters' eating. An important implication of this finding is that sex differences may not simply be explained by a stronger inclination to restrict girls so that they conform to the feminine ideal of a lean body shape. Parents were also more likely to pressure girls than boys to eat, suggesting that the sex difference is a more general one, whereby mothers are more inclined to intervene with girls' eating than with boys. These findings may be an interesting topic for future research. The decreases in scores on 'Food to reward behaviour', 'Emotional feeding' and 'Pressure to eat' with child age also have two interesting implications: i) parental feeding behaviour is not stable and should not therefore be treated as an immutable *a priori* influence on the child; ii) parents may alter their feeding style not only in response to child weight and eating style, but also in response to their development in other domains.

In general, male parents were more likely to pressure their children to eat and to use instrumental methods of feeding than were the majority female parents. They were also less likely to monitor intake. This suggests a less pronounced concern with health and weight among men, and perhaps less knowledge regarding which feeding methods are deemed acceptable in the popular literature. However, there were too few men in this sample to draw firm conclusions, and those who participated may be different from the general population. Contrary to popular conceptions of secular decreases in parental control, 'Meal-time rules' scores were actually highest in the youngest parents, and this relationship was independent of other factors which might be associated with young age such as number of children in the family. This finding may be spurious and requires replication, but it is possible that young mothers are more likely to impose rules, whereas older mothers realise these are ineffective, unhelpful or difficult to maintain.

The current results provided mixed support for Wardle et al's (2002) finding of less control over feeding in overweight/obese parents. For example, 'General restriction' was lowest among obese parents, but was actually highest in overweight parents, and lower again in underweight and normal weight parents. This suggests that some relationships with parent weight may be non-linear and may have been obscured in previous studies which have used correlational methods or inappropriate categorical weight outcomes. This non-linearity may be related to parental awareness of their weight levels. For example, although restriction was non-linearly related to parent weight, higher perceived weight was weakly associated with higher restriction. This suggests that the very heaviest parents may restrict their children less; however, if parents perceive themselves to have a weight problem they may restrict their children more. A problem with examining the relationship between parental weight and parental feeding is that weight is highly heritable, and results may therefore be confounded by child weight. Parent-child correlations in weight were low in this sample ($r=.17$, $p=.001$), but the possibility of confounding is explored further in the next chapter.

4.4.4 Implications for parental feeding scales

Study 3 provided two forms of support for the distinctiveness of the parental feeding scales that were measured. First, each scale showed a differential pattern of demographic associations. For example, whereas 'General restriction' was positively associated with SES, 'Food to reward behaviour' showed a negative association, supporting the existence of these two sub-scales within the original CFQ 'Restriction' scale. Similarly, while 'Pressure to eat' was negatively associated with SES, 'Prompting to eat' was unassociated. A more conventional form of validation was provided by examining correlations with the authoritarian parenting scale: these associations confirmed the authoritarian nature of 'Pressure to eat', 'Food to reward food' and 'Meal-time rules', and suggested that 'Monitoring', 'General restriction' and 'Prompting to eat' were likely to be more authoritative forms of feeding.

4.4.3 Limitations

A number of limitations to this study should be acknowledged. First, the overall response rate was low, decreasing the generalisability of findings. One reason for this was the large proportion of parents who did not speak English, a problem which is often encountered when sampling for varying SES in London. Financial constraints prevented us from translating the questionnaire into the numerous different languages which would be required to reach all parents. An alternative approach would be to recruit schools from high SES areas only, but we felt that the approach adopted here would at least ensure some degree of diversity. Another consequence of the approach was that the majority of respondents were white British and the non-white group was too ethnically varied to draw conclusions about ethnic differences. However, the large number of white parents in the sample supports generalisation to the white community, and SES effects were broadly similar when analyses were repeated on white parents only. The disappearance of the relationship between instrumental feeding and SES when minority groups were removed was, however, of interest and suggests that cultural differences in feeding practices may be relevant for these particular behaviours.

Another problem was the substantial degree of missing data on parental BMI, authoritarian parenting and income, and that the 'missingness' was associated with different parental feeding scores. In general, those who did not report data on all three variables had higher scores on authoritarian feeding strategies such as 'Pressure to eat', 'Emotional feeding' and 'Food to reward behaviour', and lower scores on more authoritative practices such as 'Monitoring'. This affects the generalisability of results. However, it is likely that the size of the relationships would have increased rather than decreased if the more extreme values of non-reporters had been included. An approach to tackle the missing income data and to strengthen the associations with SES may have been to combine education, income, home ownership and car ownership data to make a general index of SES. However, indices were kept separate here due to the different predicted associations with education and affluence, and to increase comparability with previous research. Future work could also consider using a more acceptable measure of general parenting, which may have increased completion rates.

Finally, we may not have used the most comprehensive measures of parental feeding available. Since this study was conducted, other measures of parental feeding have been published (e.g. Vereecken et al, 2004; Hughes et al, 2005) which encapsulate a wide range of feeding strategies. Future work may want to include factors taken from these papers. However, at the time of study design, the Child Feeding Questionnaire (Birch et al, 2001), Preschooler Feeding Questionnaire (Baughcum et al, 2001) and Parental Feeding Style Questionnaire (Wardle et al, 2002) were the most appropriate measures to use.

4.4.4 Conclusions

To our knowledge, this is the first survey on parental feeding to be conducted on a large, socio-economically varied UK sample. The multi-dimensional parental feeding measure developed for this study showed good psychometric properties, and each scale displayed differential associations with demographic, anthropometric and other sample characteristics. Notably, while restrictive feeding was more common in white parents and higher SES groups, pressure to eat and instrumental feeding were more common in non-white and lower SES groups. Chapter 5 goes on to use the same dataset to explore relationships between parental feeding and child adiposity.

CHAPTER 5

Study 4: Parental feeding survey – associations between parental feeding and child adiposity

5.1 Introduction

5.1.1 Rationale

Existing studies paint an inconclusive picture of the relationship between parental feeding behaviour and child adiposity. Experimental and observational studies of child eating behaviour suggest certain types of parental control over feeding may lead to increased weight, but most large cross-sectional studies using different measures of parental control show modest associations between higher parental control and lower child weight and relationships depend on the type of control assessed. The aim of the current study was to examine the association between child adiposity and parental control over feeding as assessed by a comprehensive, multi-dimensional measure of parental feeding and to explore two possible models explaining the emerging associations: i) mediation by parental perceptions and concerns relating to child weight; ii) confounding of the relationship by child eating behaviour.

5.1.2 History of the study of parental feeding and child adiposity

The relationship between parental feeding style and child weight has long been a topic of interest among obesity researchers. Early theories had their grounds in the testimonies of adult obese patients, who variously reported their parents using higher levels of instrumental feeding (use of food as a reward), emotional feeding (use of food to encourage positive affect), and greater pressure to eat during childhood (Rand & Stunkard, 1978; Brink, Ferguson & Sharma, 1999). Thus the idea was formed that certain parental feeding patterns might be 'obesogenic', leading to excessive eating and weight gain in their child.

The complexity of the story has increased in recent years, with an increasing number of studies taking diverse approaches to the problem, and generating conflicting findings. This chapter focuses on evidence for direct associations between parental feeding and child weight; studies examining associations with children's eating behaviour (and by implication, child weight) are addressed in Chapters 7 and 8.

5.1.3 Observational studies

Few studies have demonstrated explicit support for the early theory that pressuring the child to eat directly results in heightened intake and increased weight. The strongest evidence comes from observational studies which associate naturalistic meal-time behaviours in parents with adiposity in children. Klesges et al (1986) observed 30 preschool children and their mothers during a family dinner at home, and found that parental encouragements to eat (e.g. "Eat your steak"), food presentations (e.g. placing the food in front of the child) and food offers (e.g. "Do you want more peas?") were all positively correlated with children's weight percentiles. However, this was not replicated in a more recent laboratory study (Drucker et al, 1999), in which various forms of maternal pressure to eat were associated with faster eating and greater calories consumed, but not with adiposity.

5.1.4 Case-control studies

An alternative approach to the problem is to compare parental feeding styles in overweight and non-overweight children. Saelens, Ernst and Epstein (2000) administered an early version of the Child Feeding Questionnaire to 18 families with 7-12 year old siblings who were discordant for obesity. The advantage of a discordant siblings design is that children are broadly matched in terms of the wider family environment. However, age and sex differences between siblings may also have an important influence. Although mothers reported perceiving differences between their 'obese' (BMI percentile > 85^{th}) and non-obese children's intake regulation, intraclass correlations showed no evidence for differences between siblings in terms of maternal control over feeding.

Taking a case-control approach to analysis rather than sampling, Baughcum et al (2001) measured parental feeding within the context of a large feeding survey in a socio-economically and ethnically diverse sample of mothers of preschoolers, and found no differences in pushing the child to eat more or using food to calm the child between overweight or non-overweight children.

5.1.5 High risk studies

A small number of studies have used overweight status in parents as an indicator of heightened obesity risk in their currently normal weight children, and tested differences in parental feeding style on the assumption that the children of heavier mothers are more likely to become overweight. Taking this approach minimises the possibility that parents modify their feeding behaviour in response to pre-existing child weight problems, and means that genuine influences of parental feeding behaviours on child weight can be seen more clearly.

In one of few studies of this kind, Wardle et al (2002) administered the Parental Feeding Style Questionnaire to 214 families with same sex twins (mean age 4.43 years), in 100 of which both parents were overweight or obese (mother's BMI ≥ 28.5, father's BMI ≥ 25), and in 114 of which parents were normal weight. 'Emotional feeding', 'instrumental feeding' and 'prompting the child to eat' were equivalent for overweight/obese and normal weight parents. However, overweight/obese parents reported significantly less control over ~~over~~ their child's eating (e.g. "I decide how many snacks my child should have").

Sallis et al (1995) interviewed 247 mothers of preschool children and found that heavier mothers purchased a higher percentage of food items the child requested after seeing them on TV, and reported watching more TV with the child. Maternal adiposity and BMI were unrelated to either parental control of eating (e.g. "When your child asks for potato chips, what do you usually do?"), or food given as a reward (e.g. "How often do you use the following [foods] to reward your child when he/she is good?"). Baughcum et al (2001) found evidence for a less structured feeding style (i.e. more watching TV during meals, more *ad hoc* snacking), more age-inappropriate feeding (e.g. spoon-feeding) and lower control over feeding among overweight mothers. However, only the association with lower control remained after controlling for income.

5.1.6 Cross-sectional surveys

The most common approach to investigating the association between parental feeding and child adiposity has been the cross-sectional survey. For example, Wardle et al (2002) assessed parental control in children from a population-representative twin sample selected for low and high risk of obesity and found no associations between parental feeding and child weight. The results of Baughcum et al (2001) were discussed in more detail in section 5.1.4, and found no differences in parental feeding between obese versus non-obese children. Robinson et al (2001) administered a brief parental control index (PCI: Johnson & Birch, 1994; see Table 5.1) to mothers of 792 older children (8-9 years) recruited from 13 public elementary schools. BMI and triceps skinfolds were assessed in all children. Both indices were found to be uncorrelated with parental control in boys (BMI r=-.02; skinfolds r=.01) and negatively correlated (BMI r=-.12; skinfolds r=-.011) with parental control in girls. The strongest effect was found for Asian and white girls, while correlations for Hispanic girls were close to zero.

Table 5.1: Parental Control Index (PCI, Johnson & Birch, 1994)

1.	When my child does not finish dinner, he/she should not get dessert
2.	My child should always eat all of the food on his/her plate
3.	Generally, my child should only be permitted to eat at set mealtimes
4.	My child often has to be strongly encouraged to eat things he/she doesn't like because those foods are often good for him/her
5.	My child should be strongly reprimanded for playing or fiddling with food
6.	I have to be especially careful to make sure my child eats enough

More recently, another cross-sectional study was conducted using data from the National Longitudinal Survey of Youth (Faith et al, 2003). Measures of parental feeding were limited to three questions posed to mothers of 3-6 year old children during home or telephone interviews: 1) "How much choice is your child allowed in deciding what foods he/she eats at breakfast and lunch?" (Child food choice), 2) "When it is mealtime, how often does your child eat what you want him/her to eat?" (Child eating compliance), and 3) "When your child doesn't eat what you want him/her to eat and you tell him/her to do so, how often does he/she obey and eat?" (Child obedience during eating). Results revealed that children who were allowed no food choice had a marginally lower BMI z score than those who received a little, some, or a great deal of choice. However, the presence of food choice did not discriminate overweight from lean children. Finally, a very recent study of African-American and Hispanic families enrolled in the Head Start program (i.e. at or below the US level for poverty), reported highest BMI z scores among children whose parents had an indulgent feeding style, and lowest among those whose parents were authoritarian, with children of authoritative and uninvolved parents falling in between (Hughes et al, 200~~4~~5).

Different types of parental control. On balance, these studies all suggest that parental control is likely to be either unassociated with child weight, or associated with maintenance of a healthy weight. However, a set of studies by Birch and colleagues suggests that this interpretation may be too simplistic. Cross-sectional surveys using scales from the Child Feeding Questionnaire (CFQ, Birch et al, 2001) typically find differential associations with weight depending on the dimension of control in question. For example, Birch and Fisher (2000) used cross-sectional data to test a structural equation model in which mothers' 'Restriction' and 'Monitoring' of their 5 year old daughters' eating predicted poorer intake regulation and greater daily intake, which in turn predicted greater BMI z scores. Lee et al (2001) produced similar results, finding that 5 year old girls' BMI was negatively associated with maternal pressure to eat ($r=-.20$, $p<.005$) and positively associated with maternal restriction ($r=.20$, $p<.005$). Spruijt-Metz et al (2002) surveyed a small community sample of 7-14 year old children ($n=74$) and found that higher restriction was associated with higher fat mass (assessed by dual-energy X-ray absorptiometry, DEXA), while higher pressure to eat was associated with lower fat mass. However the relationship with restriction disappeared when concern about overweight was controlled.

Interpretation of results. The negative association between pressure to eat and child weight may be interpreted as reflecting parents' responding to thinner children by pressuring them to eat. However it is equally plausible that pressure could lead to lower child weight, either by causing a contrary, under-eating response in the child, or by encouraging intake at meal-times and thereby decreasing intake of energy-dense snack foods. The zero order relationship between high restriction and high weight could plausibly result from parents applying more restriction in heavier children. but the disappearance of the association when controlling for concern about overweight suggests either that restrictive practices and concern for the child's weight explain a similar part of the variance in fat mass, or that increased fat mass causes concern for the child's weight which leads to parental restriction. The cross-sectional nature of the data makes it impossible to draw causal inferences. Furthermore, the diversity in measures of control used in each of the studies discussed makes it difficult to determine whether discrepancies in results represent genuine differences in findings, or sample or method differences. Some studies by Birch's group have also been criticised for predominantly testing white, two-parent families, many of whom are participating in a long-term cohort study and may not therefore be representative of the rest of the population (e.g. Lee et al, 2001).

5.1.7 Explaining associations between parental feeding and child weight

Cause-effect relationships. A key issue in the study of parental control and child adiposity, then, is the problem of causality: it remains uncertain whether the nominated parent feeding behaviours impact on child weight, whether they are merely responses to child weight which is determined by a different set of influences, or whether both parental feeding and child weight are influenced by a third variable. In reality, the influence between parent and child is almost certainly bidirectional. In support of this, the qualitative data in Study 2 revealed that parents have a strong sense of responding to the characteristics of their child rather than imposing policies upon them.

However, the literature generally shows a bias towards examining parental feeding as the independent variable and child eating behaviour and weight as the outcomes. For example, Birch & Fisher (2000) treat monitoring and restriction as causal factors in a model predicting children's eating behaviour and weight, and a host of other studies testing cross-sectional associations between parental control and child variables either interpret associations as suggesting control influences the child (Fisher & Birch, 1999b), or address control as a cause in the analyses used (Birch, Fisher & Davison, 2003; Fisher & Birch, 2002). Despite raising alternative interpretations of the results, and failing to find associations between parental feeding and children's energy intake, Spruijt-Metz et al (2002) also conclude that their results 'support earlier work showing that highly controlling feeding strategies may be related to problems of energy balance by interfering with children's ability to self-regulate their energy intake'. It is therefore essential to establish whether or not associations between parental feeding and weight can be equally as well explained by parents responding to the child's weight (or associated child factors) as by parents impacting on child weight. If they can, then we may need to re-interpret existing research findings.

Exploring causal hypotheses. Several methods may help to illuminate the causal pathways described. The most conclusive method is by experiment or intervention. However, experimenter-led, laboratory-based experiments lack generalisability, and the evidence base is currently too poor to initiate an ethically sound parental control intervention. Prospective, longitudinal studies may also be of value; if parental control is a stable trait and early parental control predicts child weight later in life, this supports a causal influence from parental behaviour to child weight (see Chapter 6). Genetically-sensitive designs could also help, for example by enabling tests of the possibility that parental feeding behaviour interacts with the child's genotype to influence children's eating habits and weight (for further discussion of this idea, see Chapter 9).

An alternative way to shed light on causal pathways is to test for mediation or confounding in cross-sectional data (Baron & Kenny, 1986). Despite the ubiquity of this method in psychosocial research, it should be noted that it is almost impossible to demonstrate causal mediation in cross-sectional data; for this, well designed longitudinal studies are needed (Cole & Maxwell, 2003). However, if two variables (e.g. parental feeding and child weight) can be shown to be associated even after controlling for alternative possible causal influences, this demonstrates that the designated independent variable and the proposed mediator explain different portions of the variance in the dependent variable, and provides at least some support for the more limited proposition that there is an independent association between those two variables. We recently applied a similar model to explore the negative association between pressure to eat and fruit and vegetable intake, and found that the relationship disappeared when child food neophobia was controlled for (Wardle, Carnell & Cooke, 2005). One interpretation of this result is that neophobia may influence both parental feeding and children's fruit and vegetable intake, leading to an indirect correlation between pressure to eat and fruit and vegetable intake. However, it is of course equally possible that neophobia and parental control simply explained the same portion of variance in children's fruit and vegetable intake, or even that parental control simultaneously influences neophobia and intake, although neophobia is theoretically considered to be a trait variable. Two other possible causal pathways for exploration are described in detail below.

<u>Perceptions and concerns about child weight as mediators of the association between parental feeding and child weight</u>

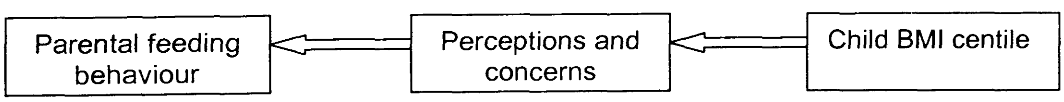
Restriction. Parental restriction has generally been construed as an influence on child weight, rather than vice versa. Based on experimental evidence for an association between greater restriction and enhanced intake and preferences for energy dense foods (Fisher & Birch, 1999a), restriction is proposed to increase weight by leading children to over-eat restricted foods. The precise mechanism of such a phenomenon is not clear, but Birch, Fisher & Davison (2003) suggest that children are simultaneously influenced by internal satiety signals (at the level of ingestion, digestion, absorption and metabolism), and by environmental cues such as portion size (e.g. Rolls, Engell & Birch, 2000) and the presence of palatable foods. Restrictive feeding practices are proposed to teach them to ignore internal signals when placed in environments where palatable, previously restricted foods are readily available. Consistent with this theory, the majority of studies explicitly measuring restriction find a positive association with weight. However, this relationship can also be explained by an alternative hypothesis: parents observe higher weight in their child, and respond by exerting restriction (see Figure 5.1).

The parental response theory may be explored by controlling for perceived child weight and concern about overweight. If the relationship between restriction and weight disappears, it is plausible that concern partly explains the relationship between restriction and overweight, although it is also possible that restriction and concern merely explain the same portion of variance in weight (Spruijt-Metz et al, 2002).

Pressure to eat. A similar approach may also be applied to the association between pressure to eat and child weight. Encouraging children to eat an amount of food determined by the parent, regardless of their satiety levels, has been proposed to limit children's opportunities to learn to control their own food intake, compromising innate appetite control systems in the long term, and leading to overeating and weight gain (Johnson & Birch, 1994). In opposition to this view, the majority of studies find a negative association between pressure to eat and weight. This may occur because parental observation of the child's fatness or leanness leads to altered perceived child weight and heightened concern about overweight or underweight, and thus to modification of feeding strategies (see Figure 5.1). The direction of this association suggests that pressure must be unsuccessful, or we would expect either a positive association between pressure and weight or a lack of association as parents achieve child weight gain and cease their pressuring behaviours. Alternatively, it is possible that pressuring causes low weight in the child, as discussed above.

The association between pressure to eat and child adiposity may be explored further by controlling for perceived child weight and concern about underweight. If the relationship disappears then perceptions and concerns about child weight may account for the association. Perceived child weight has been associated with higher pressure to eat in several studies (Birch et al, 2001; Francis, Hofer & Birch, 2001), and concern about overweight has been positively associated with child adiposity (Spruijt-Metz et al, 2001). However, concern about underweight has not been explicitly assessed in any published study on parental feeding, despite other evidence that it may be a potent motivator of feeding style, especially in very young children (Baughcum et al, 1998).

Figure 5.1: Illustration of hypothesised mediation path



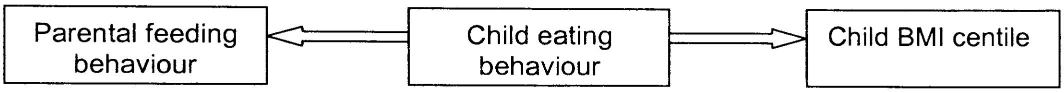
Children's eating behaviours as confounders of the association between parental feeding and child weight

Another potential explanation of associations between parental feeding and child weight might be that both are influenced by a third variable – child eating behaviour. It seems unlikely that concerns about child weight are the sole predictors, as we and others have demonstrated very low rates of recognition of overweight among parents of preschool children (Carnell et al, 2005; Maynard et al, 2003, Baughcum et al, 2000), and the qualitative data described in Chapter 3 revealed that parents see themselves as responding to children's characteristic eating styles as well as their weight status. We therefore propose that eating styles at this age represent an obesogenic phenotype that are associated with weight, and parents may adapt their feeding behaviour according to child eating behaviour rather than weight *per se*.

In the current study, Wardle et al's (2001) Child Eating Behaviour Questionnaire (CEBQ) is used to assess three eating styles which are theoretically associated with obesity – food responsiveness (e.g. "If given the chance, my child would always have food in his/her mouth"), satiety responsiveness (e.g. "My child gets full up easily"), and enjoyment of food (e.g. "My child loves food"). These scales were based on a limited body of studies on obesogenic eating behaviours. For example, evidence for higher levels of external eating in obese patients (Schacter, 1968), and that obese individuals respond to food as if it had heightened reinforcing value (Saelens & Epstein, 1996) led to the development of the food responsiveness and enjoyment of food scales. The food responsiveness scale was specifically designed to assess how much children respond to external cues such as the presence of palatable food when deciding how much to eat, and enjoyment of food was designed to assess children's enjoyment of and interest in eating. In contrast, the satiety responsiveness scale was designed to capture sensitivity to internal satiety sensations in meal initiation and cessation, which has been proposed to be lacking among the overweight (Schacter, 1968). Items constituting each scale are given in full in Table 5.2.

Eating behaviours may be treated as possible confounders of relationships between parental feeding and weight. That is, we propose that genetically or otherwise determined child eating behaviours independently influence both child weight and parental feeding behaviour, leading to an indirect correlation between parental feeding and weight (see Figure 5.2). A parent may apply more pressure on their child to eat if they are more satiety responsive, less food responsive, and show less enjoyment of food. Conversely they may restrict children who are more food responsive and show more enjoyment of food. If associations between parental feeding and child weight remain after accounting for both child eating behaviour and parents' weight perceptions of the child's weight, it is more plausible that parental feeding has an independent influence on child weight. A potential problem with this model is that children's eating behaviours may be on the pathway to adiposity. An independent association between parental feeding behaviour and adiposity may therefore be impossible because parental influence necessarily occurs via child eating behaviour. This is discussed further in section 5.4.5.

Figure 5.2: Illustration of hypothesised confounding relationship



5.1.8 The current study

The current study will add to existing findings in four ways:

1) The use of a comprehensive, multi-dimensional measure of parental control will allow me to explore the possibility that different aspects of control have differential associations with weight. Previous studies have suggested that certain types of control may have unique associations with child weight, but these have not yet been assessed in the same sample, making it unclear whether discrepancies in findings are the result of sample differences or genuinely differential associations.

2) The use of a socio-economically diverse UK sample will allow conclusions to be extrapolated beyond the white, affluent US populations used in many previous studies

3) The inclusion of boys and girls will allow sex differences in associations to be explored. The majority of studies have either found results to hold for girls only (Robinson et al, 2001), or have exclusively sampled girls (Birch & Fisher, 2000). Others do not present results by child sex (Wardle et al, 2002). Given that child obesity rates are increasing at similar rates for boys and girls (Lobstein, James & Cole, 2003), it is essential to include boys when studying the possible impact of parental control. Furthermore, given the wider range of feeding behaviours included in the current questionnaire, it is important to re-examine whether boys' weight status might be associated with different feeding behaviours than those implicated for girls.

4) The inclusion of measures of perceived child weight and concerns about weight will allow preliminary tests of whether these factors could explain existing relationships between parental feeding and child adiposity. The inclusion of

measures of child eating behaviour will allow tests of whether parents' responses to child eating behaviour might explain the same associations.

Based on previous research, we had the following main hypotheses:

1) Pressuring to eat will show a strong negative association with child adiposity.

2) Restrictive feeding behaviours will be positively associated with child adiposity.

3) Parents' perceptions and concerns relating to child weight, together with their responses to children's characteristic eating behaviours, will explain the associations between parental feeding and child adiposity.

5.2 Methods

5.2.1 Participants and procedures

Participants were the school sample described in the previous chapter.

5.2.2 Questionnaire measures

In addition to the demographic questions and parental feeding scales described in Chapter 4, measures of perceived child weight, concern about over- and under-weight, and measures of children's eating behaviour were included as follows:

<u>Perceived child weight and concerns about child weight</u>

Perceived child weight. This was assessed with the three part question: "How would you describe your child's weight at each of these time periods? <your child during his/her first year of life> <your child as a toddler> <your child at the moment>". This measure was a shortened version of the 'Perceived child weight' scale in the Child Feeding Questionnaire (CFQ; Birch et al, 2001), which contained 6 items in total, allowing comprehensive assessment of perceived weight for older children.

Concerns about child weight. In order to improve upon the characterisation of 'Concern about overweight' and 'Concern about underweight' in Study 1, five-item scales were developed to represent a broader range of dimensions of each construct. For example, the CFQ 'Concern about weight' scale ("How concerned are you about your child <eating too much when you are not around> <having to diet to maintain a desirable weight> <becoming overweight>?") was supplemented by adding "How concerned are you about your child <eating too much in general> <being overweight at the moment>?". Similarly, the PFQ 'Concern about underweight' scale ("How concerned are you about your child <becoming overweight> <being underweight at the moment>?") was supplemented by adding the items, "How concerned are you about your child <not eating enough when you are not around> <having to eat high energy foods to maintain a desirable weight> <not eating enough in general>?".

Child Eating Behaviour Questionnaire

The Child Eating Behaviour Questionnaire (CEBQ, Wardle et al, 2001, Table 5.2) is a validated parent-rated instrument assessing seven dimensions of eating style in children that have been implicated in the development of weight problems: satiety responsiveness (including slowness in eating), food responsiveness, enjoyment of food, fussiness, emotional overeating, emotional undereating and desire for drinks.

Table 5.2: CEBQ scale items (Wardle et al, 2001)

Satiety responsiveness / Slowness in eating
My child gets full up easily
My child has a big appetite *(reverse-scored)*
My child leaves food on his/her plate at the end of a meal
My child gets full before his/her meal is finished
My child cannot eat a meal if s/he has had a snack just before
My child eats slowly
My child takes more than 30 minutes to finish a meal
My child finishes his/her meal very quickly *(reverse-scored)*
My child eats more and more slowly during the course of a meal
Food responsiveness
My child's always asking for food
If given the chance, my child would always have food in his/her mouth
Given the choice, my child would eat most of the time
If allowed to, my child would eat too much
Even if my child is full up, s/he finds room to eat his/her favourite food
Enjoyment of food
My child enjoys eating
My child loves food
My child is interested in food
My child looks forward to mealtimes

The first three scales were selected for inclusion in the current questionnaire; the remaining four were omitted due to unsubstantiated links with child weight ('Fussiness', 'Desire to drink', 'Emotional undereating', 'Emotional overeating'). In two separate samples of parents of 3-9 year olds (n=320, n=308), the selected scales achieved the following Cronbach's alpha scores: 'Food responsiveness' (.80 and .82); 'Enjoyment of food' (.91 and .91); 'Satiety responsiveness' (.74 and .83); 'Slowness in eating' (.74 and .80; Wardle et al, 2001).

5.2.3 Data analysis

Bivariate correlations were used to investigate simple associations between child adiposity and parental feeding behaviour. T-tests, univariate ANOVAs and correlations were used to assess relationships between potential mediators and parental feeding scores. Partial correlations were used to examine the possibility of mediation by perceptions and concerns, and confounding by child eating behaviour. Finally, multiple regression is used to test models for the prediction of individual parental feeding behaviours.

5.3 Results

5.3.1 Scale descriptives

Descriptive statistics for the parental feeding scales are given in Chapter 4.

<u>Perceived child weight and concerns about child weight</u>

Table 5.3 gives descriptive statistics for the perceived child weight (n=529), concern about overweight (n=529) and concern about underweight (n=525) scales. The majority of cases met the chosen criterion (see section 2.3.3) of having 80% or more items complete on the scale and item means could therefore be calculated for the vast majority of the questionnaire respondents (98%, 98% and 97% respectively).

Perceived child weight. Cronbach's alpha for perceived child weight was .60 in this sample compared to .73 in the Study 1 sample. Analysis of items indicated that omitting the item, "How would you describe your child's weight *during his/her first year of life*?" increased the alpha to .67. However, the full scale was used in order to better represent the parents' general perception of child weight, and for the sake of comparability with other studies using this index. As indicated in the small standard deviation score and high positive kurtosis value, there was very little variance in perceived child weight, with the vast majority of parents describing their child as normal weight. The negative skewness statistic reflects the long left hand tail of the distribution arising from the large number of parents reporting very low levels of weight among their children. Perceived weight was significantly higher for boys (M=1.98, SD=.26) than girls (M=1.91, SD=.32) (t=2.92, df 524, p=.004).

Concern about overweight and underweight. Reliability analysis of the expanded concern scales revealed that internal consistency was improved by expanding the items included. The original CFQ 'Concern about overweight' scale had an alpha of .82 in this sample, and increased to .88 with the additional items. Similarly, the PFQ concern about underweight scale produced an alpha of .88 which increased to .93 with additional items. The two expanded 5-item scales were therefore adopted for subsequent analyses. The concern variables were both positively skewed, reflecting the low levels of concern about weight among parents. Concern about overweight showed the most skewed distribution, reflecting a pronounced lack of concern about overweight among most parents. Following the criterion adopted in Chapter 4, only concern about overweight was considered to be significantly skewed as the skewness statistic exceeded 1. Similarly, only perceived child weight was considered to show significant kurtosis. There were no sex differences on either scale.

Table 5.3 Alpha scores and item means for perception and concern scales

Factor name	No. of items	Alpha	Item mean (SD)	Range	n	Skewness (SE)	Kurtosis (SE)
Perceived child weight	3	0.60	1.95 (0.29)	0-4	529	-0.85 (.11)	6.08 (.21)
Concern re overweight	5	0.88	1.07 (1.28)	0-4	529	1.28 (.11)	0.60 (.21)
Concern re underweight	5	0.93	1.24 (0.86)	0-4	525	0.86 (.11)	-0.56 (.21)

Given the dual loading of the concern about overweight and concern about underweight scales in Study 1, Principal Components Analysis was conducted on all concern about weight items to test the independence of the scales. A clear division between concern about overweight and concern about underweight items was apparent, suggesting that each scale tapped into different constructs. However the scales were highly inter-correlated (r=.62, p<.001, n=523).

Child eating behaviour

Cronbach's alphas and descriptive statistics for child eating behaviour scales are presented in Table 5.4. Most cases met the criterion of 80% complete items for each scale, and item means were therefore calculated for the majority of participants. satiety responsiveness and enjoyment of food were normally distributed, and food responsiveness showed some positive skew. None of the variables displayed evidence of kurtosis, with the exception of food responsiveness, which showed moderate positive kurtosis. Mean scores on all CEBQ scales were very comparable to norms given for 2-7 year olds in Wardle et al (2001).

Table 5.4: Alpha scores and item means for remaining questionnaire scales

Factor name	No. of items	Alpha	Item mean (SD)	Range	n	Skewness (SE)	Kurtosis (SE)
Satiety responsiveness	9	.81	2.13 (0.63)	0-4	533	0.05 (.11)	-0.04 (.21)
Food responsiveness	5	.71	1.31 (0.63)	0-4	530	0.77 (.11)	0.65 (.21)
Enjoyment of food	4	.86	2.45 (0.79)	0-4	532	-0.06 (.11)	-0.18 (.21)

Child adiposity

Descriptive statistics relating to child anthropometrics have already been presented in Chapter 4. For the current analyses, IOTF cut-off points were adopted for group analyses in order to facilitate comparison with international research, and because they give a larger overweight group and hence more power to detect group effects. BMI centiles based on 1990 UK reference curves (Cole et al, 199~~0~~5) were chosen as a continuous index of adiposity because they have been shown to correlate well with child adiposity as measured by DEXA (Mei et al, 2002), and give easily interpretable figures which facilitate comparison with other studies.

It is noted that BMI and BMI z scores have been reported to give a more finely graded representation of the top end of the weight distribution than does BMI centile (i.e. distinguish better between a BMI of 30 and a BMI of 45), and have therefore been proposed to be a better choice for measuring adiposity changes in individuals over time (Cole et al, 2005). However, we were exclusively interested in cross-sectional relationships, for which BMI centile is a suitable index, allowing comparison with population data. Also, the children in the current sample were only 3-5 years old, so very few were extremely obese. Finally, we were interested in parental attitudes and parental feeding as possible responses to observed fatness or thinness in the child. As parents are likely to form judgements on the child's adiposity through comparison to other children of the same age and sex, position on the BMI centile curve was selected as the index most closely corresponding to observable adiposity in children.

As discussed further in Chapter 4, height and weight were only available for 439 of the 541 participants for whom questionnaire data was available. If parental questionnaire completion and absence from school on the day of weighing were related to child weight, this may have compromised the representativeness of the analysis sub-sample. However, there was no evidence that children whose parents did not return the questionnaire were different in weight from those parents who did ($t=-0.93$, df 822, $p=.354$) and given the sizeable sub-groups involved, this is not likely to increase the ability to detect effects. Even if data broadly underestimate population weight, positions within the weight distribution will be approximately correct.

5.3.2 Associations between parental feeding and child adiposity

Parental feeding by IOTF categories. In order to explore associations between parental feeding behaviours and child adiposity, parental feeding scales are presented by child weight group based on IOTF cut-off points (Cole et al, 2000) in Table 5.5. There was evidence of some linear patterns. For example, 'Pressure to eat' was highest in the normal weight children, while 'General restriction' and 'Food to reward behaviour' were progressively higher in the overweight and obese groups. Other relationships did not appear to be linear. For example, 'Prompting to eat' was highest in the normal weight and obese, 'Food to reward food' highest in the normal weight group, and 'Meal-time rules' and 'Monitoring' were highest in the normal weight and obese groups. However, none of the groups had significantly different scores.

Table 5.5: Parental feeding scores by child weight status (IOTF cut-offs) (N=439)

	Normal weight n≥311	Over-weight n≥81	Obese n≥36	Group difference
Pressuring	**M (SD)**	**M (SD)**	**M (SD)**	**F (p)**
Pressure to eat	2.3 (1.2)	2.1 (1.2)	2.0 (1.2)	1.41 (p=.245)
Food to reward food	1.7 (0.9)	1.5 (0.9)	1.5 (0.9)	0.902 (p=.407)
Prompting to eat	3.1 (0.6)	2.9 (0.6)	3.1 (0.6)	2.14 (p=.119)
Emotional feeding	0.9 (0.8)	0. 9 (0.7)	0.8 (0.8)	0.181 (p=.835)
Restricting				
Monitoring	3.0 (0.8)	2.9 (0.8)	3.1 (0.9)	0.738 (p=.484)
General restriction	2.6 (1.0)	2.8 (1.0)	2.9 (0.9)	1.15 (p=.318)
Meal-time rules	1.9 (1.0)	1.7 (1.0)	1.9 (1.1)	0.844 (p=.431)
Food to reward behaviour	1.5 (1.0)	1.6 (1.0)	1.7 (1.2)	1.2 (p=.303)

Associations between parental feeding and quintiles of adiposity. The absence of any adiposity differences with weight status suggested that significant differences in parental feeding may be confined to the thinner children. To explore this, parental feeding scores were calculated by quintiles of BMI centile scores (see Table 5.6).

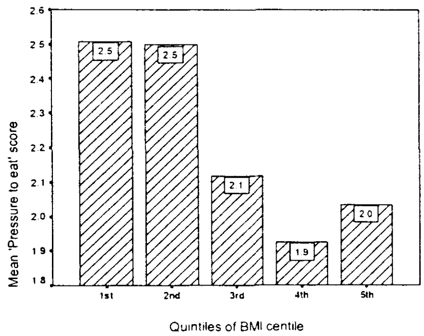
Table 5.6: Parental feeding scores by quintiles of child BMI centile (N=439)

	1st n≥86	2nd n≥86	3rd n≥86	4th n≥86	5th n≥86	Group difference
Pressuring	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**M (SD)**	**F (p)**
Pressure to eat	2.5 (1.2)	2.5 (1.1)	2.1 (1.2)	1.9 (1.3)	2.0 (1.2)	4.30 (.002)
Food to reward food	1.8 (0.9)	1.7 (1.0)	1.6 (0.8)	1.3 (0.8)	1.5 (0.9)	3.92 (.004)
Prompting to eat	3.1 (0.5)	3.1 (0.5)	3.1 (0.6)	2.9 (0.7)	3.1 (0.6)	2.33 (.056)
Emotional feeding	0.9 (0.8)	0.8 (0.8)	0.9 (0.8)	0.8 (0.7)	0.8 (0.8)	0.44 (.778)
Restricting						
Monitoring	2.9 (0.9)	3.1 (0.8)	3.1 (0.9)	2.9 (0.8)	3.1 (0.8)	1.20 (.309)
General restriction	2.5 (0.9)	2.9 (0.8)	2.5 (1.1)	2.0 (0.9)	2.9 (0.9)	3.98 (.004)
Meal-time rules	2.0 (1.0)	2.0 (1.1)	2.0 (1.1)	1.7 (0.9)	1.8 (1.0)	2.54 (.040)
Food to reward behaviour	1.5 (1.1)	1.6 (1.0)	1.6 (1.0)	1.4 (0.9)	1.6 (1.1)	0.67 (.611)

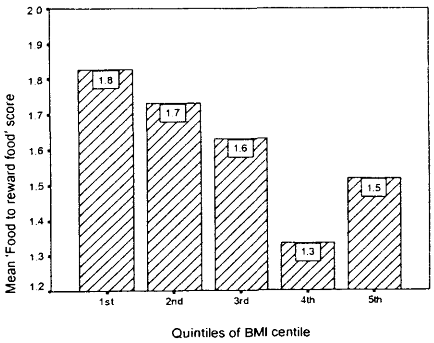
This revealed that 'Pressure to eat', 'Food to reward food' and 'Meal-time rules' scores were significantly higher among parents whose children were in the lowest quintiles for adiposity. In the cases of 'Pressure to eat' and 'Meal-time rules' this pattern was almost stepwise, with the lowest two quintiles having markedly higher scores than the remaining three categories (see Figure 5.3). There was an additional non-linear pattern within the top three quintiles of adiposity, caused by parental feeding scores in the heaviest group being higher than those in the second heaviest group. 'General restriction' and 'Prompting to eat' also displayed non-linear relationships with adiposity, such that 'General restriction' was highest in the 2nd and 5th quintiles, and 'Prompting to eat' was lower in the 4th quintile (M=2.89), than in the 1st (M=3.07), 2nd (M=3.14), 3rd (M=3.10) or 5th (M=3.07) quintiles.

Figure 5.3: Parental feeding scores by quintiles of child BMI centile

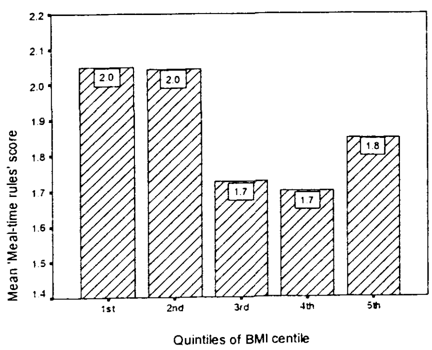
a) Pressure to eat



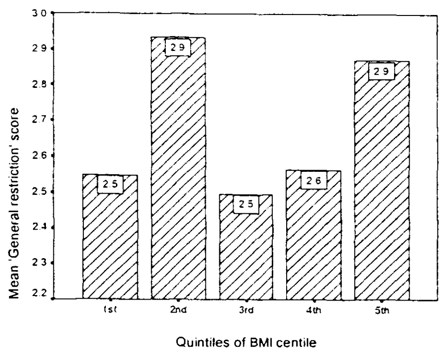
b) Food to reward food



c) Meal-time rules



d) General restriction



Associations between parental feeding and BMI centile. Finally to gain extra power, and to form the basis of the proposed mediation analyses, linear associations between parental feeding and child weight, zero order Pearson's r correlations were calculated between scores on each parental feeding dimension and child BMI centile, where this was available (n=439), and are presented in Table 5.7, first for the whole sample, and then by child sex.

Table 5.7: Correlations between parental feeding scales and child BMI centile (N=439)

	Whole sample n≥432	Boys n≥239	Girls n≥191
Pressuring	**r (p)**	**r (p)**	**r (p)**
Pressure to eat	-.18 (p<.001)	-.20 (p=.002)	-.13 (p=.062)
Food to reward food	-.16 (p=.001)	-.20 (p=.002)	-.09 (p=.226)
Prompting to eat	-.08 (p=.095)	-.13 (p=.039)	.01 (p=.941)
Emotional feeding	-.04 (p=.374)	-.03 (p=.612)	-.05 (p=.520)
Restricting	**r (p)**	**r (p)**	**r (p)**
Monitoring	.01 (p=.842)	.02 (p=.745)	-.07 (p=.352)
General restriction	.02 (p=.675)	.04 (p=.537)	.11 (p=.115)
Meal-time rules	-.10 (p=.030)	-.10 (p=.109)	-.11 (p=.133)
Food to reward behaviour	-.01 (p=.889)	-.07 (p=.317)	.08 (p=.267)

Considering the sample as a whole, significant negative correlations were evident between BMI centile and both of 'Pressure to eat' and 'Food to reward food'. Each of these correlations was markedly stronger in boys than girls. There was a pronounced difference between sexes in terms of the negative correlation between BMI centile and the 'Prompting to eat' scale, which was significant at p<.05 for boys but showed no relationship in girls.

There was little evidence for any significant associations between adiposity and restrictive feeding behaviours, although there was some suggestion of a positive association with 'General restriction' within girls (r=-.11, p=.12). BMI centile showed modest negative associations with 'Meal-time rules' for both boys and girls, producing a significant ($p<.05$) correlation in the sample as a whole. Examination of confidence intervals suggested the sex differences were not significant, so confidence intervals are not presented here; subsequent analyses are calculated for the whole sample.

5.3.3 Associations between parental feeding and potential explanatory variables

Although significant associations with child adiposity were only present for three feeding scales ('Pressure to eat', 'Food to reward food', 'Meal-time rules'; see Table 5.6), a decision was taken to present associations between parental feeding and potentially explanatory variables for all feeding behaviours. This was in order to explore whether parental feeding behaviours could be responses to attitudes towards children's weight and eating, even in the absence of an association with actual weight. Alternatively, the presence of such associations might indicate that parental feeding impacts on eating style, if not adiposity.

Perceived child weight. In order to account for the non-normality of the 'Perceived child weight' variable, parents were divided into those who perceived their child to be underweight at least one age (n=85), normal weight at all ages (n=399), or overweight at least one age (n=45). Analyses were also repeated dividing parents into groups according to current perceived child weight status (currently underweight n=41, currently normal weight n=476, currently overweight n=12), and produced similar results. To address the non-normality of the parental feeding scales, analyses were also conducted using transformed parental feeding scores, but produced similar results and are also omitted here. Significant group differences were evident for a number of parental feeding scales. For example, 'Pressure to eat' and 'Food to reward food' showed clear negative associations with weight status, while 'Meal-time rules' was significantly higher and 'Monitoring' was significantly lower in children who were perceived as underweight.

In order to capture greater variance in the data, and to form the basis of the proposed mediation analyses, relationships were also calculated between each feeding behaviour and the continuous perceived child weight variable based on average perceived weight over all ages. Non-parametric (Spearman's rho) correlations were conducted to account for non-normality in the independent and some of the dependent variables, and showed very similar results to parametric (Pearson's r) correlations; Pearson's r values are therefore reported in Table 5.8. Correlational results largely reflected the results of the analyses of variance, with the exception that the negative association between child weight and 'Emotional feeding' became significant, and the negative association with 'Food to reward behaviour' became marginally significant.

Table 5.8: Parental feeding scores by perceived child weight (N=541)†

	Under-weight $n \geq 82$	**Normal weight $n \geq 395$**	**Over-weight $n \geq 44$**	**Group difference**	**Correlation $n \geq 521$**
Pressuring	**M (SD)**	**M (SD)**	**M (SD)**	**F (p)**	**r (p)**
Pressure to eat	2.8 (1.1)^{ab}	2.2 (1.2)^{a}	2.0 (1.3)^{b}	10.3 (p<.001)	-.16 (p<.001)
Food to reward food	1.9 (1.0)^{a}	1.6 (0.9)^{a}	1.5 (0.9)	3.18 (p=.042)	-.09 (p=.036)
Prompting to eat	3.0 (0.6)	3.1 (0.6)	3.0 (0.7)	0.57 (p=.567)	-.03 (p=.491)
Emotional feeding	1.0 (0.9)	0.9 (0.7)	0.8 (0.7)	1.85 (p=.158)	-.10 (p=.017)
Restricting					
Monitoring	2.8 (1.0)^{a}	3.1 (0.8)^{a}	2.9 (0.8)	3.13 (p=.045)	.09 (p=.033)
General restriction	2.7 (1.0)	2.7 (0.9)	2.7 (1.1)	0.03 (p=.968)	.03 (p=.440)
Meal-time rules	2.2 (1.0)^{a}	1.8 (0.9)^{a}	1.9 (1.2)	4.29 (p=.014)	-.10 (p=.031)
Food to reward behaviour	1.7 (1.2)	1.5 (1.0)	1.5 (1.0)	2.06 (p=.129)	-.08 (p=.083)

†Similar letters in post-script indicate significant differences between groups (LSD)

Concern about overweight. To account for the skewness of weight concern variables, analyses were conducted by comparing parental feeding means for those with any concern with those with no concern (Table 5.9). Again, non-parametric and parametric correlational analyses were also conducted to maximise variance, and showed similar results, so parametric results are presented here.

Table 5.9: Parental feeding scores by concern about overweight (N=541)

	No concern $n \geq 211$	**Some concern $n \geq 310$**	**Difference**	**Correlation $n \geq 522$**
Pressuring	**M (SD)**	**M (SD)**	**t (p)**	**r (p)**
Pressure to eat	2.3 (1.2)	2.2 (1.3)	0.88 (p=.377)	.05 (p=.277)
Food to reward food	1.7 (1.0)	1.6 (0.9)	0.54 (p=.589)	.05 (p=.218)
Prompting to eat	3.1 (0.6)	3.0 (0.6)	0.58 (p=.564)	.06 (p=.187)
Emotional feeding	0.8 (0.7)	1.0 (0.9)	2.39 (p=.017)	.12 (p=.008)
Restricting				
Monitoring	3.0 (0.8)	3.0 (0.9)	0.79 (p=.429)	.08 (p=.076)
General restriction	2.5 (1.0)	2.9 (0.9)	4.66 (p<.001)	.22 (p<.001)
Meal-time rules	1.8 (1.0)	2.0 (1.0)	2.36 (p=.019)	.15 (p=.001)
Food to reward behaviour	1.3 (1.0)	1.6 (1.1)	3.26 (p=.001)	.14 (p=.001)

All methods demonstrated that parents who were concerned about overweight had higher scores on all of 'Emotional feeding', 'Monitoring', 'General restriction', 'Meal-time rules' and 'Food to reward behaviour'. There was also some evidence for a positive association with 'Monitoring' when the continuous analysis was conducted.

Concern about underweight. A very similar pattern of associations emerged for parents who were concerned about child underweight. However, these parents additionally showed higher scores on 'Pressure to eat', 'Food to reward food' and 'Prompting to eat' in the continuous analysis only. They also showed lower rather than higher 'Monitoring' scores but in the dichotomous analysis only, suggesting that the relationship may be non-linear.

Table 5.10: Parental feeding scores by concern about underweight (N=541)

	No concern n≥129	Some concern n≥389	Difference	Correlation n≥519
Pressuring	**M (SD)**	**M (SD)**	**t (p)**	**r (p)**
Pressure to eat	1.3 (1.19)	2.6 (1.06)	12.1 (p<.001)	.38 (p<.001)
Food to reward food	1.2 (0.85)	1.8 (0.90)	5.86 (p<.001)	.20 (p<.001)
Prompting to eat	3.0 (0.59)	3.1 (0.60)	0.18 (p=.857)	.10 (p=.031)
Emotional feeding	0.7 (0.65)	0.9 (0.80)	2.90 (p=.004)	.16 (p<.001)
Restricting				
Monitoring	3.2 (0.78)	3.0 (0.86)	2.59 (p=.010)	.01 (p=.870)
General restriction	2.6 (1.08)	2.7 (0.90)	1.97 (p=.049)	.07 (p=.099)
Meal-time rules	1.7 (1.03)	1.9 (0.96)	2.38 (p=.006)	.23 (p<.001)
Food to reward behaviour	1.2 (1.00)	1.6 (1.01)	3.68 (p<.001)	.15 (p<.001)

Child eating behaviour. As child eating behaviour scales were normally distributed, Table 5.11 presents Pearson's r correlations between parental feeding behaviours and child eating behaviour in order to capture maximum variance. Satiety responsiveness was positively associated with 'Pressure to eat', 'Food to reward food' and 'Prompting to eat', and showed a trend towards ~~the~~ association with 'Food to reward behaviour'. Food responsiveness and enjoyment of food both showed a negative association with 'Pressure to eat', and positive associations with 'Prompting to eat' and 'General restriction'. However, only enjoyment of food showed a positive association with 'Food to reward food', and only food responsiveness showed positive associations with 'Meal-time rules' and 'Food to reward behaviour'. Because categorical analyses produced similar results to correlations for the perception/concern variables, and because the CEBQ variables were normally distributed, parametric tests of difference and association are used from hereon.

Table 5.11: Correlations between parental feeding scales and child eating behaviour (N=541)

	Satiety responsiveness n≥527	Food responsiveness n≥524	Enjoyment of food n≥524
Pressuring	**r (p)**	**r (p)**	**r (p)**
Pressure to eat	.41 (p<.001)	-.15 (p=.001)	-.39 (p<.001)
Food to reward food	.24 (p<.001)	.03 (p=.485)	-.20 (p<.001)
Prompting to eat	.08 (p=.057)	.09 (p=.050)	.11 (p=.012)
Emotional feeding	.01 (p=.752)	.22 (p<.001)	-.02 (p=.712)
Restricting			
Monitoring	-.02 (p=.735)	.03 (p=.507)	.20 (p<.001)
General restriction	.00 (p=.934)	.23 (p<.001)	.08 (p=.055)
Meal-time rules	.04 (p=.321)	.13 (p=.003)	-.01 (p=.892)
Food to reward behaviour	.07 (p=.119)	.20 (p<.001)	.00 (p=.945)

5.3.4 Associations between explanatory variables and child weight

In order to check that the proposed mediators were indeed related to child adiposity, Table 5.12 gives perceived child weight, concern about weight and child eating behaviour scores by child weight category. Perceived child weight was systematically higher for overweight and obese children, and concern about overweight was greater for overweight and obese children than for those who were normal weight. Concern about underweight was slightly higher for normal weight than overweight or obese children. This group trend did not reach significance but there was a significant negative correlation between concern about underweight and BMI centile, confirming the existence of a linear relationship.

Table 5.12: Mediator variables by child weight status (IOTF cut-offs) (N=439) †

	Normal weight n≥309	Over-weight n≥82	Obese n≥37	Group difference	Correlation n≥429)
Perception/concerns	**M (SD)**	**M (SD)**	**M (SD)**	**F (p)**	**r (p)**
Perceived child weight	1.9 (0.3)[ab]	2.0 (0.2)[a]	2.1 (0.4)[b]	8.47 (p<.001)	.30 (p<.001)
Concern re overweight	0.7 (1.0)[ab]	1.1 (1.1)[a]	1.3 (1.1)[b]	9.41 (p<.001)	.13 (p=.007)
Concern re underweight	1.2 (1.2)	1.0 (1.3)	1.2 (1.4)	0.49 (p=.615)	-.10 (p=.039)
Child eating behaviour					
Satiety responsiveness	2.2 (0.6)[a]	2.0 (0.6)[a]	2.0 (0.6)	3.88 (p=.021)	-.24 (p<.001)
Food responsiveness	1.3 (0.7)[a]	1.5 (0.8)[a]	1.5 (0.8)	3.66 (p=.026)	.10 (p=.035)
Enjoyment of food	2.4 (0.8)	2.5 (0.8)	2.7 (0.8)	2.44 (p=.089)	.14 (p=.003)

†Similar letters in post-script indicate significant differences between groups (LSD)

Differences in child eating behaviour according to child weight were also evident. For example, satiety responsiveness was lower and food responsiveness was higher for overweight than normal weight children. There was also a trend towards higher enjoyment of food in heavier children but ~~this~~ was ~~not~~ significant only using linear analysis. Given the evidence for linear relationships demonstrated here, Pearson's correlations with child BMI centile are given in the final column and used in future analyses.

5.3.5 Demographic associations

Finally, in order to check for important confounding influences on the variables proposed to be mediators and confounders, basic demographic analyses were conducted. These were conducted using all available data (i.e. not just cases for whom BMI was available), in order to give the best representation of relationships in the sample as a whole. Perceived child weight was unrelated to child age, or to parent sex, age, ethnicity, education, affluence or employment status. However, boys were generally perceived to be heavier (M 2.0, SD 0.26) than girls (M 1.9, SD 0.32) (t=2.92, df 524, p=.004). In contrast, several demographic differences were apparent for weight concern. For example, white parents, full-time home-makers, and less educated and less affluent parents were more likely to express concern about both underweight and overweight. Male parents were specifically more likely than female parents to express concern about underweight (M=1.6 SD=1.12 vs. M=1.2 SD=1.24; t=2.57, n=521, p=.010). There were no differences in CEBQ scores according to parent and child background. Given the evidence for these associations and for direct associations between SES and parental feeding (see Chapter 4), a number of these demographic variables were later controlled in multiple regression analyses predicting parental feeding behaviours.

5.3.6 Testing mediation model: Perceived child weight and concerns about weight as mediators of control–weight associations

To explore whether these associations between parental feeding and child weight could be explained by parents employing certain feeding behaviours in response to their attitudes towards child weight, a table was constructed showing correlations between the three parental feeding strategies which showed significant associations with child weight ('Pressure to eat', 'Food to reward food', 'Meal-time rules'), perceptions and concerns about child weight, and child BMI centile (Table 5.13). All correlations were calculated only for those subjects who had complete BMI centile data (i.e. listwise deletion). Appendix VII contains a fuller correlation matrix presenting every combination of correlations between parental feeding, BMI, perceptions/ concerns and CEBQ scales using all available data for each pair of correlations (i.e. pairwise deletion).

Perceived child weight was negatively associated with 'Pressure to eat' (r=-.14, p=.003), and had a marginal association with 'Meal-time rules' (r=-.09, p=.068). Concern about overweight was positively associated with 'Meal-time rules' only (r=.15, p=.002). Concern about underweight showed significant positive correlations with each of the relevant feeding strategies (PTE .38, p<.001; FRF .20, p<.001; MTR .23, p<.001).

An additional requirement of the model proposed is that the hypothesised mediators should be associated with child adiposity, as well as with parental feeding. Consistent with this requirement, perceived child weight and concern about overweight were positively associated with BMI centile (PCW .30, p<.001; COW .13, p=.007), and concern about underweight was negatively associated (r=-.10, p=.039).

Table 5.13: Correlations between parental feeding scales, perceived child weight / concern about, and child BMI centile (N=439)

	BMI centile	Perceived child weight	Concern about overweight	Concern about underweight
Pressure to eat	-.18 (p<.001) n=436	-.14 (p=.003) n=431	.06 (p=.182) n=430	.38 (p<.001) n=428
Food to reward food	-.16 (p=.001) n=433	-.06 (p=.221) n=427	.06 (p=.220) n=426	.20 (p<.001) n=425
Meal-time rules	-.10 (p=.030) n=433	-.09 (p=.068) n=427	.15 (p=.002) n=426	.23 (p<.001) n=425

Partial correlations. In order to test possible mediation of feeding-weight relationships, partial correlations were then conducted, adjusting for perceived child weight, concern about overweight and concern about underweight in turn (Table 5.14). Each analysis was conducted with pairwise deletion to conserve the maximum number of cases.

Correlations were not vastly changed with adjustment with any of the individual variables and became slightly stronger when controlling for concern about overweight

Table 5.14: Correlations between parental feeding scales and child BMI centile adjusted for perceived child weight / concern about weight (N=439)

	Unadjusted correlation n≥432	Adjusted for perceived child weight n≥429	Adjusted for concern re overweight n≥428	Adjusted for concern re underweight n≥426
	r (p)	r (p)	r (p)	r (p)
Pressure to eat	-.18 (p<.001)	-.14 (p=.004)	-.19 (p<.001)	-.15 (p=.001)
Food to reward food	-.16 (p=.001)	-.14 (p=.004)	-.17 (p<.001)	-.14 (p=.003)
Meal-time rules	-.10 (p=.030)	-.08 (p=.096)	-.13 (p=.009)	-.09 (p=.081)

5.3.7 Testing confounding model: Child eating behaviour as confounding influence on feeding–weight associations

Bivariate associations. In order to explore whether these associations could be better explained by parents employing certain feeding behaviours in response to their child's eating behaviour, which independently impacted on child weight, zero order correlations were generated between parental feeding strategies, child eating behaviour and child BMI centile. Specific associations with 'Pressure to eat', 'Food to reward food' and 'Meal-time rules' are presented in Table 5.15 and a full correlation matrix using all available data can be found in Appendix VII.

Table 5.15: Correlations between parental feeding scales, CEBQ scales, and child BMI centile (N=439)

	BMI centile	Satiety responsiveness	Food responsiveness	Enjoyment of food
Pressure to eat	-.18 (p<.001) n=436	.42 (p<.001) n=433	-.15 (p=.002) n=432	-.41 (p<.001) n=433
Food to reward food	-.16 (p=.001) n=433	.27 (p<.001) n=431	.03 (p=.558) n=429	-.22 (p<.001) n=430
Meal-time rules	-.10 (p=.030) n=433	-.06 (p=.199) n=431	.12 (p=.011) n=429	-.05 (p=.269) n=430

Satiety responsiveness showed positive correlations with both of 'Pressure to eat' (r=.42, p<.001) and 'Food to reward food' (r=.27, p<.001). Food responsiveness was negatively correlated with 'Pressure to eat' (r=-.15, p=.002). Enjoyment of food was negatively correlated with both 'Pressure to eat' (r=-.41, p<.001) and 'Food to reward food' (r=-.22, p<.001). Child eating behaviour was also significantly associated with child BMI centile, such that food responsiveness and enjoyment of food were greater in heavier children (FR .10, p=.035, E .14, p=.003), and satiety responsiveness was lower (r=-.24, p<.001).

Partial correlations. Partial correlations controlling for CEBQ scores are presented in Table 5.16. The most pronounced reductions of effects were seen when controlling for satiety responsiveness, after which the negative association between BMI centile and 'Pressure to eat' became non-significant and the association with 'Food to reward food' reduced from being significant at p<.01 to p<.05. However, adjusting for each factor individually had a generally minimal impact on relationships.

Table 5.16: Correlations between parental feeding scales and child BMI centile adjusted for CEBQ scales (N=439)

	Unadjusted correlation n≥432	Adjusted for satiety responsiveness n≥429	Adjusted for food responsiveness n≥429	Adjusted for enjoyment of food n≥429
	r (p)	r (p)	r (p)	r (p)
Pressure to eat	-.18 (p<.001)	-.09 (p=.061)	-.17 (p<.001)	-.14 (p=.005)
Food to reward food	-.16 (p=.001)	-.10 (p=.023)	-.16 (p=.001)	-.14 (p=.005)
Meal-time rules	-.10 (p=.030)	-.10 (p=.044)	-.12 (p=.013)	-.11(p=.030)

5.3.8 Multiple regressions predicting parental feeding behaviours

The partial correlation analyses above suggested that perceived child weight, concern about weight and parental reports of child eating behaviour were only capable of explaining small portions of the observed associations between child adiposity and parental feeding behaviour. In order to assess whether they could explain a larger part of the associations when combined, and to see whether other demographic factors might account for any remaining relationship, a multiple regression model was created for the prediction of each feeding behaviour.

It should be noted that treating parental feeding behaviours as the dependent variables and child eating behaviour and weight as the independent variables in the following analyses is not intended to suggest that there is a causal pathway running from child to parent. However, the results are presented in this way in order to provide a counterpoint to data interpretation biases in the literature suggesting that there is a causal pathway running from parent to child.

Regression model

Home ownership was entered in the first step to represent parental SES. Although the income and education variables had more variance, home ownership data were available for more cases than income, and showed stronger associations with parental feeding than education. Home ownership was also highly associated with income ($r=.62$, $n=389$, $p=.009$) and moderately with education ($r=.23$, $n=502$, $p<.001$). The binary version of the variable was used (i.e. own/buying home vs. rent or other) in order to address the categorical nature of the home ownership variable within a multiple regression, which assumes that all variables are interval level data, and show a normal distribution.

Parents' perceived current weight (5 categories) was also entered in the first step as another known predictor of the parental feeding behaviours in question, and to explore whether the relationship between this variable and parental feeding behaviour was explained by child adiposity. Although this variable was ordinal rather than interval level data, it was felt necessary to include the full variable rather than a dichotomous variable because it was not clear whether effects were between parents who perceived themselves as normal or overweight versus parents who saw themselves as underweight, or between parents who saw themselves as normal or underweight versus parents who saw themselves as overweight. Although the analyses in Chapter 4 demonstrated that ethnicity also predicted parental feeding, it was not included in the main model because the non-white category was too diverse to draw meaningful inferences from the results.

Child BMI centile was entered in the next step in order to establish its contribution to explaining parental feeding after controlling for SES and perceived parent weight. Next, concerns relating to child weight were entered, and finally food responsiveness and satiety responsiveness were included. Perceived child weight was omitted as the measure had limited variance and the concern variables showed stronger associations with parental feeding; repeating analyses including perceived child weight made little difference to results. Enjoyment of food was omitted because the construct overlapped substantially with food responsiveness.

A potential problem of including correlated scales as joint predictors in multiple regression is that they may explain very similar portions of the variance in the dependent variable, leading to an absence of predictive value for one in the presence of the other. However, the correlation between food responsiveness and satiety responsiveness was relatively small ($r=-.30$, $n=433$ $p<.001$), and examination of the items suggested that the combination of these scales was necessary to capture fully child eating styles with the potential to influence weight. Concern about overweight and underweight were more highly correlated ($r=.63$, $n=427$, $p<.001$), but we were specifically interested in how much concern specific to the type of weight perception (as opposed to generalised concern) predicted parental feeding strategies. Multiple regression was therefore considered a suitable way to pit each concern variable against the other.

In order to maximise cases for analysis, regressions were conducted using pairwise deletion. In this method, cases with complete data for the pair of variables being correlated are used to compute the correlation coefficient on which the regression analysis is based. In order to evaluate the fit of each regression model, residuals were analysed to check for normality and constancy of model fit.

Regression results

Pressure to eat. Entering SES and perceived parent weight explained only 4% of the variance in 'Pressure to eat', with only SES functioning as a significant predictor ($t=-3.66$, df 421, $p<.001$). Adding child BMI centile explained a further 3% of variance ($t=-3.76$, df 420, $p<.001$). Entering the concern variables increased the variance explained to 23%; both concern about overweight ($t=-4.92$, df 418, $p<.001$) and concern about underweight ($t=9.22$, df 418, $p<.001$) were significant predictors of 'Pressure to eat' scores. Adding the CEBQ measures revealed that satiety responsiveness was a significant independent predictor of 'Pressure to eat' ($t=6.44$, df 416, $p<.001$), and reduced child BMI centile to non-significance. SES remained a significant predictor in each model. The full regression model accounted for 30% of variance in 'Pressure to eat' scores (see Table 5.17).

Table 5.17: Results for predictors of 'Pressure to eat' in multiple regression model (n=423)

	B	SE (B)	Beta	t	Sig	R^2	Adj r^2
Model 1							
SES	-.442	.121	-.176	-3.66	<.001		
Perceived parent weight	-.161	.108	-.072	-149	.136	.038	.033
Model 2							
SES	-.452	.119	-.180	-3.80	<.001		
Perceived parent weight	-.130	.106	-.058	-1.23	.220		
Child BMI centile	-.008	.002	-.178	-3.76	.000	.069	.063
Model 3							
SES	-.267	.111	-.106	-2.40	.017		
Perceived parent weight	-.120	.097	-.054	-1.23	.218		
Child BMI centile	-.004	.002	-.088	-1.98	.049		
Concern about overweight	-.324	.066	-.279	-4.92	.000		
Concern about underweight	.524	.057	.526	9.22	.000	.229	.219
Model 4							
SES	-.273	.106	-.109	-2.57	.010		
Perceived parent weight	-.180	.093	-.080	-1.93	.054		
Child BMI centile	-.002	.002	-.041	-0.94	.347		
Concern about overweight	-.196	.066	-.169	-2.98	.003		
Concern about underweight	.398	.058	.400	6.92	.000		
Food responsiveness	<.001	.076	.000	.003	.998		
Satiety responsiveness	.588	.091	.300	6.44	.000	.303	.291

Residuals were approximately normally distributed with only 2 outliers beyond three standard deviations from the regression line. Removing these outliers improved the fit of the model and increased the significance levels of coefficients. However, it was considered a more accurate portrayal of the data to leave genuine outlying cases in the analysis. Plotting predicted values against residuals revealed some variation in model fit, with lower predicted values being associated with positive residual values and higher predicted values being associated with negative residuals.

Food to reward food. Neither SES nor perceived parent weight were significant predictors of 'Food to reward food' in the first step, explaining only 1% of variance in scores. Adding child BMI centile to the model increased the variance explained to 3% (t=-3.25, df 420, p=.001). Adding the concern variables to the model showed that concern about underweight was a significant independent predictor of 'Food to reward food' (t=3.41, df 418, p=.001), and only marginally reduced the predictive power of child BMI centile(t=-2.57, df 418, p=.011). Adding CEBQ variables demonstrated that both food responsiveness (t=2.57, df 416, p=.010) and satiety responsiveness (t=4.24, df 416, p<.001) were significant independent predictors, increasing the variance explained by the model to 11% (see Table 5.18).

Table 5.18: Results for predictors of 'Food to reward food' in multiple regression model (n=423)

	B	SE (B)	Beta	t	Sig	R^2	Adj r^2
Model 1							
SES	-.130	.091	-.070	-1.44	.152		
Perceived parent weight	-.133	.081	-.080	-1.65	.100	.012	.007
Model 2							
SES	-.137	.090	-.073	-1.53	.128		
Perceived parent weight	-.114	.080	-.068	-1.42	.158		
Child BMI centile	-.005	.002	-.156	-3.25	.001	.036	.030
Model 3							
SES	-.066	.091	-.036	-.731	.465		
Perceived parent weight	-.118	.079	-.071	-1.48	.139		
Child BMI centile	-.004	.002	-.126	-2.57	.011		
Concern about overweight	-.053	.054	-.062	-0.99	.321		
Concern about underweight	.158	.046	.214	3.41	.001	.067	.056
Model 4							
SES	-.054	.089	-.029	-.604	.546		
Perceived parent weight	-.158	.078	-.095	-2.02	.044		
Child BMI centile	-.003	.002	-.096	-1.97	.049		
Concern about overweight	-.008	.055	-.009	-.148	.883		
Concern about underweight	.111	.048	.151	2.31	.022		
Food responsiveness	.164	.064	.126	2.57	.010		
Satiety responsiveness	.324	.077	.223	4.24	.000	.111	.096

A histogram of the residuals showed a fairly normal distribution, with one outlier at 3.04 standard deviations from the mean. The model was run for a second time after removing this case, but there was little change in results. Plotting residuals against predicted values demonstrated good constancy of model fit.

Meal-time rules. Table 5.19 gives regression results for the 'Meal-time rules' scale. Perceived parent weight showed only marginal prediction of 'Meal-time rules' in the first step, which explained 2% of the variance in scores (t=-2.00, df 421, p=.059). Child BMI centile was a significant independent predictor, explaining a further 0.7% of variance (t=-2.01, df 420, p=.040). Adding the concern variables demonstrated that concern about underweight was a significant positive predictor of 'Meal-time rules' (t=0.89, df 418, p=.006) and reduced the prediction of BMI centile to marginal significance levels (t=3.40, df 416, p=.001). Adding food responsiveness and satiety responsiveness increased the variance explained by the model to 10%, largely through the significant effect of food responsiveness (t=3.40, df 416, p=.001). Residuals were normally distributed with no outliers, and the model demonstrated good constancy of fit.

Table 5.19: Results for predictors of 'Meal-time rules' in multiple regression model (n=423)

	B	SE (B)	Beta	t	Sig	R^2	Adj r^2
Model 1							
SES	-.156	.097	.078	-2.00	.110		
Perceived parent weight	-.164	.087	-.092	-1.93	.059	.016	.011
Model 2							
SES	-.160	.097	-.080	-2.03	.099		
Perceived parent weight	-.150	.087	-.084	-1.78	.083		
Child BMI centile	-.004	.002	-.100	-2.05	.040	.025	.018
Model 3							
SES	-.065	.097	-.032	-1.06	.504		
Perceived parent weight	-.171	.085	-.096	-2.01	.045		
Child BMI centile	-.003	.002	-.088	-1.79	.074		
Concern about overweight	.053	.057	.057	0.89	.359		
Concern about underweight	.139	.050	.175	2.76	.006	.069	.058
Model 4							
SES	-.043	.096	-.021	-0.92	.659		
Perceived parent weight	-.188	.085	-.105	-2.21	.027		
Child BMI centile	-.003	.002	-.088	-1.81	.073		
Concern about overweight	.031	.060	.033	0.49	.606		
Concern about underweight	.157	.052	.198	2.96	.003		
Food responsiveness	.235	.069	.169	3.40	.001		
Satiety responsiveness	.066	.083	.042	0.80	.425	.095	.079

Other feeding behaviours. Although the primary purpose of the regression analyses was to explore associations between parental feeding and child adiposity, we were also interested to examine the predictors of other parental feeding behaviours which did not demonstrate associations with child adiposity. Based on the results of Study 2, Study 3 and those in the current chapter it was predicted that the model would be least successful at predicting 'Prompting to eat' and 'Monitoring', which were more motivated by health considerations than by children's weight or eating behaviour. Results are presented in Appendix VIII.

The model showed very poor prediction of 'Prompting to eat'. Only food responsiveness was a significant positive predictor (t=2.60, df 416, p=.010) and the full model explained only 2% of the variance in scores. Examination of the model predicting 'Monitoring' showed that SES was a significant independent predictor even when controlling for all other variables (t=0.20, df 416, p=.001). Of the other independent variables, only concern about overweight showed some marginal prediction of scores (t=1.75, df 416, p=.080). Food responsiveness was the strongest predictor of 'Emotional feeding' (t=5.16, df 416, p<.001), with some additional prediction from 'Concern about underweight' (t=2.42, df 416, p=.016). In contrast, 'General restriction' was independently positively predicted by concern about overweight (t=4.48, df 416, $p<.001$), food responsiveness (t=4.67, df 416, $p<.001$) and satiety responsiveness (t=2.39, df 416, p=.017). 'Food to reward behaviour' showed an initial association with SES, but this was reduced when concern and child eating behaviour variables were entered. The only significant predictors in the final model were food responsiveness and satiety responsiveness, both of which had positive relationships with 'Food to reward behaviour.

5.4 Discussion

The primary aim of Study 4 was to examine the association between parental control and child adiposity in a socio-economically diverse UK sample of parents of 3-5 year olds. The main finding was that lower child adiposity was associated with higher scores on the three scales assessing parental pressure to eat, but adiposity was not related to any other forms of parental control, i.e. restriction, emotional feeding, use of food to reward behaviour. A second aim was to explore possible explanations of the association between adiposity and pressure to eat. A combination of concerns about weight and parental perceptions of children's eating behaviour reduced the association with the 'Pressure to eat' scale to non-significance, but associations with the 'Food to reward food' and 'Meal-time rules' scales were unaffected. Results are discussed further below.

5.4.1 Pressuring to eat and adiposity

The negative association between the 'Pressure to eat' scale and child BMI centile (r=-.18, $p<.001$) replicated the findings of several other studies of parental feeding. The current results also extend these results, finding additional negative associations between BMI centile and both use of food to reward the consumption of other healthy foods (r=-.16, p=.001), and the application of meal-time rules (r=-.10, p=.030), such as insisting the child eat everything on his/her plate. This is important because whereas the 'Pressure to eat' scale indicates only a general tendency to encourage eating, the other scales outline the specific behaviours involved. The analysis of the relationships by quintiles of adiposity additionally confirmed that the majority of the effect results from parents applying more pressure in thinner children. This may explain the failure to find an association between pressure and adiposity in studies which have simply compared parental control in normal weight and overweight children (e.g. Baughcum et al, 2001).

The sex differences in association strength were also of interest. In contrast to previous research, which has focussed mainly on girls to demonstrate associations between parental feeding and child weight, the association with 'Food to reward food' in particular was stronger in boys than girls, suggesting that parents are more likely to adjust this dimension of feeding style according to boys' than girls' weight. This might be because low weight is seen as less desirable in boys. However, this was not evident from 'Concern about underweight' scores, which were the same for both sexes.

5.4.2 Restriction and child adiposity

Contrary to other findings, a positive association between CFQ restriction scales and child weight did not emerge in this sample (Spruijt-Metz et al, 2002). Nor was there a negative association between control and weight, as studies using less well defined measures of restriction have found (Faith et al, 2003; Wardle et al, 2002; Robinson et al, 2001). This may be because extreme overweight was rare in this population, and because parental concern about overweight was relatively low. The latter result may reflect a difference between US and UK mothers in terms of weight concern. Alternatively, the socio-economically diverse community sample achieved in this study may give a more accurate reflection of population concerns about and responses to child weight than the American studies. It was interesting that concern about overweight was associated with 'General restriction', even though actual child weight was not. This provides some support for the hypothesis that restriction is a response to parents' ideas about their child's weight rather than a determinant of child weight, at least when it is assessed for children this young.

Interestingly, there was some evidence for a weak positive association between 'General restriction' and adiposity when girls were considered separately. This association may reflect mothers' attempts to help their daughters achieve the societal ideal of a thin female figure, and is likely to grow in strength with increasing child age.

5.4.3 Explaining the association between pressure to eat and child adiposity

It was hypothesised that perceptions and concerns relating to child weight and parent reports of child eating behaviour would explain the association between low child weight and parental pressure. However, controlling for each potential explanatory variable in turn did not explain the relationship. This may have been partly because of limited variance and lack of normality in the mediator measures used: Cole and Maxwell (2003) point out that poor measurement of the mediator variable in combination with good measurement of 'x' and 'y' can lead to an overestimation of the direct effect. However, although the measure of perceived child weight could potentially be improved by providing more detailed response categories, it is difficult to see how the concern scales could be improved or expanded to increase variance. It is likely that the slight non-normality of the variables represented a genuine lack of variance in the construct in the sample, and the results are therefore of interest.

Although controlling for each variable separately did not account for the observed associations, controlling for variables simultaneously in a multiple regression analysis rendered the association between BMI centile and 'Pressure to eat' non-significant. This finding is consistent with the idea that parents pressure their children to eat in response to concern about low weight and satiety responsiveness, and that these variables are themselves associated with lower child weight. However it is equally possible that parental pressure causes satiety responsiveness in children, which causes their weight to be low, with effects on parental concern. It should be noted that regression models are only capable of estimating shared variance, and the designation of child factors as independent variables and parental factors as dependent variables merely redresses a trend in the literature to insert variables in the opposite pattern.

The combined model could not, however, entirely explain the associations between adiposity and either 'Food to reward food' or 'Meal-time rules'. This may be because while the 'Pressure to eat' scale includes items which specifically capture parents' responding to children, e.g. "If I did not guide or regulate my child, s/he would eat much less than s/he should", the 'Food to reward food' and 'Meal-time rules' scales talk about specific types of pressuring behaviour without making assumptions about the child. Finding independent associations between BMI centile and each of these scales may therefore be interpreted in a number of ways. At face value, it could indicate that the parental feeding behaviours assessed by these scales have a direct effect on child adiposity, leading children to eat less and thus have a lower BMI centile. Conversely, children's weight could somehow directly influence feeding strategies, although it is difficult to see how this could occur without some parental concern about weight. More plausibly, the relationships might be better explained by other variables, not measured here. For example, mothers' attitudes towards healthy eating would have predicted both direct efforts to increase their child's intake of healthy foods, and their provision of foods in the house and therefore children's overall adiposity levels. It is also possible that children's general characteristics (e.g. activity levels) may be associated with BMI centile, and may simultaneously encourage use of food to reward food and exertion of meal-time rules in parents. Including maternal attitudes to healthy eating and child temperament may therefore have partially explained the residual associations between parental feeding and child adiposity.

5.4.4 Predictors of other feeding behaviours

Although the regression model was designed predominantly to explore the relationship between parental feeding and child adiposity, we were also interested in how well it could predict other feeding behaviours which did not show weight associations. The very poor prediction of 'Prompting to eat' suggested that other factors such as parents' concerns that the child should eat healthily and learn to enjoy healthy foods, may be more important determinants of the behaviours described in the 'Prompting to eat' scale, which includes items such as "Do you praise your child is he/she eats a new food?" and "Do you encourage your child to eat a wide variety of food?". The model was worst at predicting 'Monitoring' scores, although it was interesting that this was one of the only parental feeding behaviours that showed an independent association with SES – this may because SES functioned as a proxy for nutritional knowledge and health concern. 'Monitoring', like 'Prompting to eat', may be more determined by concerns for health than concerns about weight and appetite. In contrast, 'General restriction' was predicted by all of concern about overweight, food responsiveness and satiety responsiveness suggesting that 'General restriction' is far more determined by overweight than is the 'Monitoring' scale. This is consistent with analysis of the items, e.g. "If I did not regulate my child, he/she would eat too many junk foods' (General restriction) vs. "How much do you keep track of the snack foods your child eats?" (Monitoring). Given that 'Food to reward behaviour' was another sub-scale of the original CFQ 'Restriction' scale, it was also interesting that it was unrelated to concern about overweight. 'Food to reward behaviour' was, however, predicted by both food responsiveness and satiety responsiveness, although the total model explained only 6.8% of the variance, suggesting that temperamental factors such as the child's distractability or tendency to misbehave may be stronger predictors of using food to manipulate behaviour.

Finally, the inclusion of parental perceived weight in the first step of each model allowed exploration of whether associations with parental feeding were mediated by child adiposity. Notably, parental perceived weight did not significantly predict any of the feeding strategies when controlling for SES, suggesting that confounding between lower SES and lower perceived weight may be partly responsible for the negative correlation between perceived parent weight and pressure to eat.

5.4.5 Limitations

A number of methodological issues arise from the analyses within this chapter. First, the perceived weight and concern about weight variables and some of the parental feeding variables showed some departures from normality, which may have decreased the reliability of significance levels in the parametric tests used. However, non-parametric tests and transformed scores were used in alternative tests and gave very similar results, and parametric tests such as multiple regression are generally robust against violations of their assumptions given large sample sizes. Second, it is possible that the use of BMI centile as an index of adiposity may have been partially responsible for the results. As explained earlier, BMI centile was chosen because of its high correlation with BMI and body fatness and because it may correspond with parents' perceptions of their child's weight. However, it was notable that correlations with parental feeding behaviour were weaker with BMI than with BMI centile. If we wanted to address the impact of parental feeding behaviour on child weight (rather than vice versa), BMI may therefore have been a more impartial index to use.

Several issues relate to the multiple regression analyses used. Firstly, as the regression analyses were designed predominantly to explore the relationship between parental feeding and child adiposity, efforts were not made to include every factor that might influence parental feeding. For example, 'authoritarian parenting' was omitted despite being associated with a number of parental feeding strategies in Chapter 4, and there was no attempt to include more explicit measures of the motivations that emerged in Chapter 3 (e.g. cost, practicalities, concerns for long- and short-term health and wellbeing). This may explain the small proportion of variance that was explained for each parental feeding behaviour, which ranged from only 2% in the case of 'Prompting to eat' to ~~29~~ 30% of variance in 'Pressure to eat'.

A second issue is that although the results have been interpreted as indicating the relative predictive power of each independent variable, differences in the error associated with each measure may have led some to appear more predictive than others. Furthermore, although predictor variables were selected to tap different constructs, measures might be expected to overlap considerably. This increases the likelihood that two measures might simply explain a similar part of the variance in the dependent variable. One measure may therefore appear to lack predictive power, while actually being nearly as good as a predictor as its similar counterpart. For example, the concern about underweight and satiety responsiveness scales both contained items that described the child's reluctance to eat, and might therefore have explained a similar portion of variance in parental feeding. The regression results should therefore be considered as indications of the relative importance of each predictor rather than as giving realistic estimates of the contribution of each predictor to explaining variance in parental feeding.

Most importantly, although parental feeding styles are treated as outcome variables in the multiple regressions, they could equally be used as independent variables predicting child BMI centile, with similar results. Similarly, although child eating behaviours were treated as predictors here, they could also be seen as consequences of parental feeding practices. Indeed, a plausible pathway to explain the associations seen here might be that the influence of parental feeding behaviour on children's weight is mediated by the effects of control on children's eating behaviour. The latter approach would be more consistent with that taken in other studies (Birch, Fisher & Davison, 2003; Fisher & Birch, 2003). However, correlations between eating behaviour scales and child adiposity were low (satiety responsiveness r=-.24, food responsiveness r=.10, enjoyment of food r=.14). Furthermore, increasing evidence suggests that eating behaviour may be genetically determined (Tholin et al, 2005; Bouchard et al, 2004) and it is therefore important to consider interpretations which see parental feeding behaviour as influenced by child factors. As discussed in the introduction, longitudinal and genetic designs will be required to draw firmer conclusions about causal pathways. Some studies have also attempted to represent the bi-directional influence between parent and child by incorporating feedback paths into structural equation models (Birch & Fisher, 2000).

A final limitation relates to the generalisability of the results. In order to deal with the problem of missing data for the income and parental weight variables, home ownership and perceived parent weight were used instead. Given that there was more variance in the income variable, the model may therefore underestimate the effect of SES. Under-representation of lower SES groups in the sample as a whole may add to this problem. The use of perceived parent weight is likely to give different results to actual parent weight, but we were more interested in the psychological consequences here, which were best assessed with a measure of perceived weight.

Possible age effects. A final point should be made about the age of the children in the current sample. Although this study and the majority of others have used preschool or early school-age children (Wardle et al, 2002; Baughcum et al, 2001; Birch & Fisher, 2000; Sallis et al, 1995), a number have also used older children, ranging from 7 to 14 years of age (Spruijt-Metz et al, 2002; Robinson et al, 2001). Parental feeding behaviours and their influence may differ with child age. For example, parental restriction may not be required in relation to weight until the child begins to have greater access to energy-dense snack foods at school and when eating with friends. Alternatively, the short-term effectiveness of parental attempts to control weight may be high when children are young (leading to an absence of correlation between restriction and weight), but may reduce as children become older and experience more eating occasions outside the home. Eating outside the home may also allow any long-term negative impacts of restriction, such as heightened preferences and intake of previously forbidden energy-dense snack foods, to exhibit themselves, producing a positive longitudinal relationship between restriction and weight. Similarly, while pressure to eat is associated with lower weight in early life, it is possible that a sub-group of children who experienced pressure to eat may go on to overeat due to impaired intake regulation, leading to overweight.

Children's age may also affect the degree to which parents are concerned about aspects of weight and eating and hence which feeding strategies they use. For example, concern about overweight may increase as children get older, because the contrast between them and their peers is more apparent and because overweight becomes more problematic in terms of exercise behaviours, teasing and self-esteem. This increase in concern may lead to changes in certain feeding behaviours.

5.4.6 Conclusions

Study 4 replicated the negative association between child BMI centile and 'Pressure to eat' and showed that it could plausibly be accounted for by parents responding to perceptions and concerns relating to weight, and evaluations of children's eating behaviour. The residual associations between BMI centile and both 'Food to reward food' and 'Meal-time rules' could not be explained in this way, suggesting that other determinants may be more important. Although these cross-sectional analyses do not allow us to infer causation, they suggest that: i) certain pressuring to eat behaviours could be parental responses to children's eating behaviour and adiposity, ii) other pressuring to eat behaviours may be motivated by other factors, also associated with child adiposity, iii) parents' attitudes towards their child's weight and eating behaviour contribute to the prediction of other feeding behaviours which do not show associations with adiposity, but a large amount of the variance in feeding behaviour remains unexplained. Study 5 uses a longitudinal survey of parental control and weight in a large twin sample to explore further the causal relationship between parental feeding and child adiposity.

CHAPTER 6

Study 5: Investigating associations between parental control and child weight in a prospective twin study

6.1 Introduction

6.1.1 Rationale

Study 4 replicated the robust negative association between parental pressure to eat and lower child weight that has been demonstrated in previous studies. The possible causal relationship between these variables was explored, but conclusions were limited due to the cross-sectional nature of the data. Parental control over feeding and child weight gain have yet to be investigated prospectively in population samples. In the current study, Birch's parental control index (PCI) was completed by mothers of 3,175 pairs of 4 year old twins, and twins' heights and weights were recorded at 4 years and 7 years of age. Parental control is examined as a prospective predictor of child weight change.

6.1.2 A longitudinal approach to parental control and child adiposity

Study 4 showed that perceptions and concerns about weight and parents' reports of their children's eating behaviours may be able to explain partially the negative cross-sectional association between pressure to eat and adiposity that has been shown in other studies. However, the cross-sectional nature of the data used here and in many other studies of parental feeding makes it unclear whether parental feeding behaviour influenced eating behaviour, or vice versa. Longitudinal studies may help to illuminate cause and effect relationships by allowing us to test one of the necessary conditions of a causal relationship, i.e. that the hypothesised causal factor precedes the hypothesised outcome.

Few studies of parental control have taken a longitudinal approach. Birch, Fisher & Davison (2003) used data collected when children were 5 years, 7 years and 9 years, and found that parental restriction at 5 years predicted 'eating in the absence of hunger' (EAH) at 7 years and 9 years. There was also some evidence of an interaction with obesity risk, such that girls who were already overweight at 5 years and received higher levels of restriction had the highest EAH scores at 9 years and the greatest increase in EAH from 5 to 9 years. Data on the stability of restriction were not reported, leaving open the possibility that parental restriction was merely a contemporaneous response to children's EAH and therefore increased in parallel.

To our knowledge, only one study has reported longitudinal evidence for a relationship between a validated measure of parental control and child weight (Faith et al, 2004). This study related parental feeding styles at 5 years to child weight gain from 5-7 years, and found that parental 'restriction' predicted higher BMI z scores, and 'pressure to eat' predicted reduced BMI z scores but only among children with overweight parents (i.e. high obesity risk). Among children with lean parents (i.e. low obesity risk), the only significant parental feeding strategy was 'monitoring', which predicted reduced child BMI z scores at 7 years. Parental restriction and 'pressure to eat' showed some evidence for stability between 5 and 7 years (Restriction r=0.52 low risk children, r=0.46 high risk children; Pressure r=0.83 low risk children, r=0.64 high risk children, but monitoring decreased with child age (r=0.23 low risk children, r=0.30 high risk children). Associations with BMI were attenuated but remained significant even after controlling for child weight status at 3 years in order to account for the influence of pre-existing weight problems on parents' feeding behaviours.

The authors interpret these results as evidence for the existence of a gene-environment interaction, such that monitoring is protective for low risk children, whereas restriction increases obesity risk among high risk children. However, the small number of subjects in the study (n=57), suggests that these results could be due to chance. Additionally, the negative relationship between 'pressure to eat' and weight gain is harder to explain. Either pressuring the child to eat acts to limit weight gain, or a third factor, such as genetically-determined child eating behaviour might influence both 'pressure to eat' at Time 1 and weight gain between Times 1 and 2.

6.1.5 The current study

The current study uses longitudinal data from a nationally representative cohort of twins to address the following main research questions: 1) Does parental control at 4y predict child weight gain between 4y and 7y~~; and 2) Can differences in parental control at 4y explain discordance for obesity within twin pairs at 7y?~~'. We were also interested in which types of parental control showed the strongest associations with the specified variables.

Based on previous results, we hypothesised that the association between control and weight would be modest, and would predominantly reflect parents' responses to differences in eating style and weight in their children, rather than parents' influence on child weight through the exertion of parental control. We therefore expected a small but significant positive relationship between parental control and weight gain. Extrapolating from cross-sectional findings, we hypothesised that any associations between our brief measure of parental control and child weight would be largely attributable to the presence of heightened pressure to eat for lower weight children.

6.2 Methods

6.2.1 Participants and procedures

Participants were drawn from the Twins Early Development Study (TEDS), a cohort study of twin pairs born in England in 1994, 1995 and 1996, representing more than a half of twins born in those years. The TEDS sample is broadly representative of UK families with young children with respect to parental educational achievement and occupational status. Further details of the sampling strategy are reported in Trouton, Spinath & Plomin (2002). 16,810 families were recruited into the study and demographic information was obtained when twins were 18 months old. 10,437 families completed questionnaires at one or more of the relevant time points, i.e. when the twins were 3 years, 4 years and 7 years of age.

After excluding all cases which were missing data at either 4 years or 7 years and all those with serious medical conditions, there were 5962 families, i.e. 11,924 cases, for analysis. Parental reports of child height and weight were assessed at 4 years and 7 years, and parental control was assessed at 4 years and 3 years. 11,635/11,924

(97.6%) cases had complete PCI data at 4 years; parental control at 3 years was available only for families who were recruited in 1994 and 1995, giving a smaller sub-sample (n=7452, 62.5%) on which to test the stability of parental control. 8582 (72.0%) cases had child height and weight data available at 4 years; of these, 8067 (94.0%) also had child age, allowing BMI centile scores to be calculated), and 8638 (72.4%) had child height and weight at 7 years (n=8621, 99.8% of these also had child age). 63~~42~~57 cases contained minimum data for the main longitudinal analysis (i.e. all 6 parental control items 4 years, BMI centile 4 years and 7 years), representing ~~64.2~~66.8% of the original ~~4 years and 7 years sample~~ 10,437. Comparison between complete cases and those with missing data revealed no significant demographic differences; results are therefore presented for this reduced sample.

6.2.2 Measures

Demographic and anthropometric characteristics

Initial baseline questionnaires to parents asked for the child's sex, date of birth, ethnicity, language spoken at home, and mother and father's highest educational qualification, occupational status, relationship to the child, marital status, and height and weight to calculate BMI and weight status. Parents were also asked to give children's heights and weights as part of another questionnaire issued when children were 4 years old, and again when they were 7 years old.

Parent control

The parent questionnaire included a 6 item Parental Control Index (PCI) drawn from Birch's parental feeding questionnaire. These items were selected for good prediction of caloric compensation performance in children (Johnson & Birch, 1994), and have been used in one other large cross-sectional survey (Robinson et al, 2001). A seventh item, "It's OK for my child to snack" was also included on the recommendation of Birch and colleagues and has been incorporated into the scale by other authors (Duke et al, 2004), but is not included in these analyses because it made negligible difference to alpha scores, and used a different polarity to the other items in the scale. Items in the 6 item scale represent a range of control behaviours, including pressure to eat ('My child should always eat all of the food on his/her plate', 'My child often has to be strongly encouraged to eat things that are good for him/her', 'I have to be especially careful to make sure my child eats enough', 'When my child does not finish dinner, s/he should not get dessert'), restriction or the absence thereof ('Generally, my child should only be allowed to eat at set meal times') and general control of the meal occasion ('My child should be told off for playing or fiddling with food'). Possible responses ranged from 1 = disagree to 5 = agree.

6.2.3 Data analysis

Twin data cannot be considered independent, because correlations between any scores among twins, who share both genes and environment, are likely to be higher than among randomly selected individuals. Data for all twins could not therefore be combined for the purposes of analysis. Each analysis was therefore conducted primarily for the first-born twin, using second-born twins as a replication group. Pearson correlations were used to assess bivariate associations between parental control at 4 years and child adiposity at both 4 years and 7 years of age. Paired samples t-tests were used to assess anthropometric changes over time. Multiple regression was used to assess the association between parental control at 4 years and child weight gain from 4-7 years. To explore the possibility that parental pressure to eat accounted for any associations between parental control and adiposity, each analysis was also conducted using 'General control' and 'Pressure to eat' sub-scales in place of the Parental Control Index.

6.3 Results

6.3.1 Sample characteristics

Parent characteristics

Mean age of the mothers at the birth of the eldest twin was 29.7 years (SD 4.9). Mothers were therefore an average of 33.7 years of age (SD 4.9) when their twins were 4 years old. The vast majority of mothers were white and had English as their first language. Four percent of mothers had no educational qualifications and 30%

had some form of higher education. 46% of mothers were employed full- or part-time, while 44% were staying at home to care for their child. 98% of mothers were the biological mother of the child and 93% were married to the father of the child. Average maternal BMI was 24.2 (SD 4.4); 20% were overweight and 10% were obese. Sample characteristics were very similar to population data given in the Health Survey for England (2002). Full details are given in Table 6.1.

Table 6.1: Parent characteristics (N=3175)

	n	%
Ethnicity		
White	3034	95.4
Other	134	4.4
Missing	7	0.2
Language at home		
English	3108	97.5
English plus additional language	25	0.9
Other	29	1.0
Missing	13	0.6
Mother's highest qualification		
No qualifications	110	3.5
CSE (Gr 2,3,4,5) or GCSE (Gr D,E,F,G)	351	11.1
CSE (Gr1) or O level (A,B,C) or GCSE (Gr A,B,C)	1180	37.2
A level, S level	500	15.7
Higher than A level	962	30.3
Missing	72	2.3
Mother's occupational status		
Works full- or part-time	1440	45.4
Does not work	288	9.1
Staying at home to care for child	1393	43.9
Missing	66	1.7
Mother's maternal status		
Natural mother	3117	98.2
Other	1	0.0
Missing	57	1.8
Mother's marital status		
Married to father of child	2961	93.3
Married to other	19	0.6
Divorced	36	1.1
Separated	32	1.0
Unmarried	27	0.9
Missing	100	3.1
Mother's BMI group		
Low weight (Under 18.5)	67	2.1
Normal weight (18.5 – 24.99)	2020	63.6
Overweight (25 – 29.99)	654	20.6
Obese (30 or over)	321	10.1
Missing	113	3.6

Child characteristics

Average age of each child at 4 year follow-up was 4.0 (SD 0.1); average age of each child at 7 year follow-up was 7.0 (SD 0.2). Slightly more children were female than male. Approximately 12% of 1^{st} born twins and 10% of 2^{nd} born twins were overweight at 4 years of age; 5% of 1^{st} borns and 5% of 2^{nd} borns were obese at the same age. Overweight slightly decreased and obesity increased at 7 years, with 9% 1^{st} borns and 9% 2^{nd} borns overweight, and 6% of 1^{st} borns and 5% 2^{nd} borns obese. Details are given in Table 6.2.

Table 6.2: Child characteristics (N=3175 pairs)

	First borns n (%)	Second borns n (%)
Sex		
Male	1486 (46.8)	1480 (46.7)
Female	1689 (53.2)	1687 (53.3)
Overweight status at 4y (IOTF cut-offs)		
Normal weight	2632 (82.9)	2682 (84.7)
Overweight	382 (12.0)	327 (10.3)
Obese	161 (5.1)	158 (5.0)
Overweight status at 7y (IOTF cut-offs)		
Normal weight	2809 (85.3)	2746 (86.7)
Overweight	285 (9.0)	270 (8.5)
Obese	181 (5.7)	151 (4.8)

6.3.2 Parental control

In order to test the stability of control, 6-item Parental Control Index (PCI) scores (∝=.61) were correlated when measured at 3 years and 4 years in a sub-sample of parents, and were found to be highly correlated (First borns, r=.66, p<.001, n=2060; Second borns, r=.65, p<.001, n=2045). For the purposes of this chapter, parental control was therefore assumed to be a stable trait. Principal Components Analysis of the Parental Control Index at 4 years revealed two sub-factors: 'Pressure to eat' (PTE, items 4, 6; α=.54, n=3164), and 'General control' (GC, items 1, 2, 3, 5; α=.63, n=3155). For first born twins, mean PCI scores were 2.91 (SD 0.79); mean score for 'General control' was 3.06 (SD 0.91) and for 'Pressure to eat' was 2.61 (SD 1.16). Results were very similar for second born twins (PCI 2.92 (SD 0.78); GC 3.07 (SD 0.90); PTE 2.63 (SD 1.17)).

6.3.3 Bivariate associations between parental control and adiposity

Table 6.3 gives Pearson's correlations between parental control scores (measured at 4 years) and anthropometric indices (measured at 4 years and 7 years). Analyses conducted separately for 1st born and 2nd born twins produced very similar results, so only those for first born twins are presented here.

The cross-sectional correlations between PCI score and both BMI centile and BMI w~~as~~ere not significant at 4 years (r=-.03, p=.124) but became significant at 7 years (r=-.06, p=.001). Splitting the PCI into two sub-scales revealed that the 'Pressure to eat' sub-scale showed significant negative associations with weight at both ages, but there was no evidence for a relationship between anthropometric indices and 'General control' at either age.

Table 6.3: Correlations between parental control (4 years) and anthropometric characteristics (4 years, 7 years)

4 years	**n**	**BMI centile**	**BMI**
Parental Control Index	3175	-.03 (p=.124)	-.02 (p=.363)
General Control	3175	.02 (p=.192)	.02 (p=.263)
Pressure to eat	3172	-.09 (p=.000)	-.06 (p=.000)
7 years		**BMI centile**	**BMI**
Parental Control Index	3175	-.06 (p=.001)	-.05 (p=.009)
General Control	3175	-.02 (p=.254)	-.03 (p=.140)
Pressure to eat	3172	-.09 (p=.000)	-.05 (p=.002)

Parental control by weight status. In order to examine further the nature of the relationship between parental control and child adiposity, parental control scores are also presented by weight status group as defined by IOTF cut-offs (Cole et al, 2000; Table 6.4). As results were similar for first born and second born twins, results are presented for first born twins only. Both PCI and 'Pressure to eat' scores were lower for the overweight children than for the normal weight group. However, 'Pressure to eat' scores were higher for the obese group than for the overweight group and were more comparable to those in the normal weight group. There was some evidence for heightened 'General control' among the obese group and for lower 'General control' among the overweight group, but the difference was not significant. A similar pattern of results emerged when using IOTF weight groups based on data at 7 years of age.

Despite this suggestion of non-linearity in the cross-sectional associations, a decision was taken to use multiple regression to address the possibility of a linear longitudinal relationship between control and child weight. It is acknowledged that fitting a straight regression line to a curvilinear function may compromise model fit. However, this approach was taken in the interests of replicating published analyses, and possible non-linear relationships will be explored further in future work.

Table 6.4: Parental control scores (4 years) by child IOTF weight status (4 years, 7 years)

IOTF 4 years	**Normal weight (n=2632)**	**Overweight (n=382)**	**Obese (n=161)**	**F**	**p**
Parental Control Index	2.93 (0.78)	2.78 (0.81)	2.98 (0.83)	6.56	.001
General Control	3.07 (0.90)	2.98 (0.96)	3.18 (0.98)	2.89	.056
Pressure to eat	2.65 (1.17)	2.36 (1.09)	2.57 (1.17)	9.92	<.001
IOTF 7 years	**Normal weight (n=2709)**	**Overweight (n=285)**	**Obese (n=181)**	**F**	**p**
Parental Control Index	2.92 (0.78)	2.82 (0.80)	2.88 (0.83)	2.32	.099
General Control	3.07 (0.91)	3.02 (0.92)	3.00 (0.98)	0.83	.435
Pressure to eat	2.63 (1.16)	2.41 (1.14)	2.64 (1.22)	4.64	.010

6.3.4 Anthropometric changes over time

Table 6.5 shows anthropometric changes in first born twins between 4 and 7 years. Raw weight and height scores (not reported) both increased significantly, but on average, BMI was unchanged and individuals' BMI percentiles decreased slightly, and were lower than national averages based on reference data obtained in 1990 (Cole et al, 1995) at both time points. As the current sample was approximately population-representative, these group results were not surprising. However, the sizeable variation in the degree of change in BMI centile and BMI suggested that there were substantial individual differences in weight change which merited exploration.

Table 6.5: Anthropometric change between 4 years and 7 years

First borns	4 years M (SD)	7 years M (SD)	t	p	Difference M (SD)
BMI centile	49.47 (32.75)	48.24 (31.71)	1.98	.048	-1.23 (35.13)
BMI	15.91 (2.31)	15.96 (2.63)	-0.90	.369	0.05 (3.03)

Given the possibility that parental control was a response to, rather than a cause of, child adiposity, we used BMI centile change as an outcome measure because changes in adiposity might be noted by parents on the basis of comparison with other children of the same age and sex, and consequently have an impact on parental feeding. Raw

BMI was also analysed because it is recommended by Cole et al (2005) as the most sensitive and specific index of change in adiposity over time.

6.3.5 Parental control as a predictor of anthropometric change

Given the evidence for negative correlations between 'Pressure to eat' and child adiposity, it was hypothesised that parental control might function as a linear predictor of weight change between 4 years and 7 years.

A multiple regression analysis was therefore conducted (Table 6.6), regressing child BMI centile at 7 years on child BMI centile at 4 years (Step 1) and parental control sub-scales (Step 2). BMI centile at 4 years explained 16.5% of the variance in BMI centile at 7 years. 'Pressure to eat' at 4 years was a highly significant negative predictor of BMI centile at 7 years, independent of BMI centile at 4 years (t=-3.18, df 3168, p=.001). Entering 'General control' and 'Pressure to eat' together explained a further 0.4% of variance.

Table 6.6: Results for multiple regression predicting child BMI centile at 7 years (n=3172)

	B	SE (B)	Beta	t	p	r^2	Adjusted r^2
Model 1							
BMI centile 4 years	.394	.016	.407	25.07	<.001	.165	.165
Model 2							
BMI centile 4 years	.390	.016	.402	24.71	<.001		
General control	-.660	.578	-.019	-1.14	.254		
Pressure to eat	-1.45	.456	-.053	-3.18	.001	.169	.168

Repeating the regression model using BMI as the outcome variable (Table 6.7) produced similar results with the exception that the final regression model for BMI explained only 6.6% of the variance in BMI at 7 years, and 'Pressure to eat' was only a marginally significant negative predictor of BMI at 7 years (t=-1.87, df 3168, p=.062). Results of both analyses are shown for the first born twins, the BMI centile analysis replicated well in the second born group but BMI at 4 years predicted BMI at 7 years in the first borns only.

Table 6.7: Results for multiple regression predicting child BMI at 7 years (n=3172)

	B	SE (B)	Beta	t	P	r^2	Adjusted r^2
Model 1							
BMI 4 years	.289	.020	.254	14.77	<.001	.064	.064
Model 2							
BMI 4 years	.287	.020	.252	14.65	<.001		
General control	-.072	.051	-.025	-1.41	.158		
Pressure to eat	-.075	.040	-.033	-1.87	.062	.066	.066

6.4 Discussion

Much of the existing research on parental control over feeding and adiposity is limited either by small, unrepresentative samples (Spruijt-Metz et al, 2002; Lee et al, 2001; Birch & Fisher, 2000; Faith et al, 2004), or by cross-sectional designs which reveal nothing about causal processes (Faith et al, 2003; Robinson et al, 2001). This study is the first to investigate prospective associations between control and child weight in a large, population-representative sample.

6.4.1 Interpretation of findings

Our main finding was a prospective association between higher PCI scores and lower weight gain between the ages of 4 and 7 years. At face value, this finding could be interpreted as evidence for a protective effect of early parental control against excessive weight gain. However, it is not clear what degree of weight gain would be considered excessive within this time period, when children's growth is highly variable. One way to tackle this might be to assess predictors of children's crossing weight status categories (i.e. moving from normal to overweight, or overweight to obese). However, as exact cut-off points are essentially arbitrary, and we were interested in relationships across the BMI distribution, this approach was not taken here.

Consistent with other cross-sectional and longitudinal findings (Spruijt-Metz et al, 2002; Faith et al, 2004), the association was attributable to increased scores on 'pressure to eat' items for lighter children, rather than to differences in scores for the other parental control items which encompassed parental restriction and general meal-time control. This was true for both between-family and within-family analyses.

This could mean that heightened pressure to eat somehow reduces children's weight gain. Although this may seem paradoxical, the focus of pressure to eat on healthier, meal-time foods provides a possible mechanism: pressure at mealtimes may enhance the child's intake of and preferences for lower energy density foods and hence decrease the consumption of higher energy, fat-promoting snack foods.

An alternative interpretation is that children who gain little weight between 4 and 7 years may display a characteristic eating style which is evident as early as 4 years old, and leads the parent to pressure him or her to eat to a similar degree at both time-points. This theory is consistent with a behavioural genetic perspective, which holds that genetic effects may be expressed through behaviour and impact on the environment, leading to a gene-environment correlation (Plomin, Asbury & Dunn, 2001). A child with an inherited disposition to 'thinness' (Bulik & Allison, 2001) may therefore display certain eating behaviours from an early age; these in turn lead the parent to adopt certain feeding behaviours. If the parent is responding to characteristic child eating behaviours rather than child weight, there is no reason to suppose parental control would increase in a dose-response fashion with either child age or child weight, so child weight gain could be associated with a stable measure of parental control.

Unlike Faith et al (2004), we found no evidence for differential associations between parental control and child weight, depending on maternal weight status, which Faith et al use to operationalise levels of obesity risk in children. The relationship between pressure to eat and child weight was slightly stronger in normal weight mothers than in obese mothers, but the direction of the relationship was the same for each group. The relationship between 'General control' and child weight was non-significant at all levels of maternal weight status. As a more specific attempt to replicate Faith et al's finding that higher 'Monitoring' was related to lesser weight gain in normal weight mothers, analyses were conducted using the seventh parental control item, "It's OK for my child to snack", as the sole parental feeding predictor. This item may be thought of as expressing the reverse attitude to monitoring the child's intake. However, item responses did not predict weight change in any of the maternal weight groups. Our failure to replicate Faith et al's results in this large sample suggests that their findings may have been spurious. The study used only 57 families, leaving very small numbers and limited power for sub-group analyses. Furthermore, the hypothesis tested has little grounds in terms of published findings and is therefore likely to have been generated post-hoc.

6.4.2 Limitations

Some features of the study design limit the conclusions that may be drawn. A minimal cross-lagged panel design requires that measures of the independent and dependent variables are taken at the same two time-points. If parental control is a causal precursor of weight at 7 years, we would expect the association between these two variables to be stronger than either cross-sectional correlation at 4 years or 7 years, and stronger than the association between weight at 4 years and parental control at 7 years. We were not able to test all of these associations in the current analysis but a follow-up when children are 9-11 years is underway, and will allow cross-lagged correlations to be fully tested regarding weight gain from 7 years to 9-11 years. If parental control is revealed to vary with child weight (i.e. does not exhibit stability; Cole & Maxwell, 2003), then it would be erroneous to view it as a precursor of weight gain. In the present study, based on correlations between control at 3 years and 4 years, we assumed that parental control was a stable trait.

Another limitation is the possibility that weight gain is predicted not by parental control but by a third, confounding variable (e.g. child eating style), and has already been discussed in Chapter 5. Unfortunately child eating behaviour variables were not present in the dataset used here, so it was not possible to account for these in the current analysis. A further limitation common to much longitudinal research is the possibility that measurements of predictor variables may not have been obtained at the appropriate times to detect effects on the outcome of interest. For example, it might be the case that parental control at 4 years does not predict weight at 7 years. Instead, it could be that control has more of an impact when children are younger, e.g. parental control at 2 years (not measured here) might have a stronger effect on 7 year weight status. Alternatively, it could be that control at 4 years does not show an impact on child weight by 7 years, when children's diets remain largely under the control of their parents and other adults, but may affect how children eat when they have greater personal control over their eating, and may therefore predict weight at an older age.

No existing cohort studies have set out to address this question directly. However, analyses of data from a study in Copenhagen schools demonstrated that the likelihood of overweight at 20-21 years was increased by teacher-rated parental neglect (Lissau & Sorensen, 1994) and by the mother's lack of knowledge about her offspring's sweet eating habits, increased acceptance of sweet eating, and provision of money for sweets when participants were 9-10 years old. These results suggest that early restriction may protect against obesity in early adulthood, but also that methods such as monitoring intake and limiting the availability of less healthy foods may be more successful than imposing explicit rules about consumption frequency. Certainly, it is unlikely that the relationship between control and eating is stationary, i.e. that control impacts on eating in exactly the same way at all time points. As with many complex relationships, it is likely that influence between variables is bidirectional and occurs frequently over time. Measurements taken at discrete times will therefore only represent an approximation of the influence exerted by one variable at a particular time.

We are also limited by the brief measure of parental control employed by ourselves and others (Robinson et al, 2001; Johnson & Birch, 1994). This instrument contains key 'pressure to eat' items used in studies which attempt to measure different dimensions of control (Spruijt-Metz et al, 2002), but provides a less thorough characterisation of other important constructs, such as 'restriction'. While the Child Feeding Questionnaire (CFQ, Birch et al, 2001) measures restriction with items such as "I have to be sure that my child does not eat too many sweet things" and "I intentionally keep some foods out of my child's reach", the PCI contains only 'Generally, my child should only be allowed to eat at set meal times'. The remaining PCI items may be motivated more by parents' preferences for making rules than by concern about intake and weight, and may represent a qualitatively different type of restriction. It is therefore unsurprising that we failed to find support for previous positive associations between restriction and weight or obesogenic eating behaviours (Spruijt-Metz et al, 2002; Birch, Fisher & Davison, 2000; Faith et al, 2004), or for negative associations with scales assessing other kinds of restriction (Wardle et al, 2002).

A final limitation which could apply to all studies relying on parent reports of their own behaviour in relation to two children within the same family, and especially twins, is a possible tendency to aim for consistency from child to child, which may have limited power to detect weight-associated differences between children in the sample as a whole, and increased the chance of a Type II error. However, this problem was addressed by conducting analyses for first born and second born twins separately, so weight-associated differences between families should still have been apparent.

6.4.3 Conclusions

Our results show that higher parental pressure to eat at 4 years is associated with lower weight gain in children between 4 and 7 years. It is still unclear whether these associations result from parents' influence on children or vice versa. However, it seems less likely that increased pressure to eat is protective against obesity, and more likely that higher pressure to eat is associated with a modest weight trajectory that may accompany slower, reluctant eating behaviour and reflect a 'thin' phenotype. Further, we found no evidence that other types of control were associated with weight gain, although we were limited by our brief measure of parental control. Future research should use prospective and genetic designs to assess the relationship between a wide range of parental feeding practices and child weight trajectories. Interventional studies could then be used to draw firmer conclusions about causal relationships.

CHAPTER 7

Study 6: Associations between parental feeding style and children's intake regulation

7.1 Introduction

7.1.1 Rationale

The results of Study 4 and Study 5 revealed few associations between parental feeding behaviours and child weight. This may be related to the age of the children in this sample. For very young children, parental control may show more associations with eating behaviour than with adiposity, either because parental control has impacted on eating behaviour but not weight at this stage, or because parents are responding to differences in eating behaviour rather than differences in weight. Excessive parental control has been proposed to predispose children to weight gain by disrupting one aspect of child eating behaviour in particular: the ability to regulate energy intake. This ability has been assessed using the 'caloric compensation' paradigm, which tests individuals' adjustment of energy intake on the basis of intake in a previous meal. However, only a small number of studies have found evidence for an association between parental control and compensation ability. These studies used only one type of compensation task and assessed only a limited range of parental control behaviours. In order to replicate and build upon this work, Study 6 assessed children's caloric compensation ability using two methods, and associations with a wide range of parental feeding behaviours were tested.

7.1.2 Caloric compensation as a measure of intake regulation

Evidence suggests that infants and very young children are able to regulate their food intake and achieve adequate nutrient intake when offered a nutritionally balanced set of foods so as to consume an appropriate amount of energy to ensure energy balance (Fomon, 1993; Davis 1928, 1939). Building on this research, Birch & Deysher (1986) conducted the first study to use a behavioural measure of intake regulation in young children. The 'caloric compensation' test is designed to assess whether individuals will compensate in one meal for calories consumed in a recent meal or snack. If the first meal is higher in calories, the appropriate compensatory response is to down-regulate their consumption in the second meal to achieve a constant energy intake. Conversely, if the first meal is lower in calories, compensation entails up-regulating consumption in the second meal to account for the calorie deficit. The compensation for energy displayed in this paradigm is thought to reflect a behaviour which is essential for ongoing regulation of intake. In their study, Birch & Deysher (1986) compared performance in a caloric compensation paradigm between 21 preschoolers and 26 adults. Subjects participated in a two-part meal, consisting of a high or low calorie version of a chocolate pudding preload, followed approximately half an hour later by a standard lunch of sandwiches, carrots, oranges and grapes. One week later the two-part meal was repeated, with order of presentation of the high and low calorie preloads counterbalanced across subjects. Results showed that whereas total consumption over the two-part meal (i.e. preload and meal combined) was nearly identical for children, adults ate on average 100 kcal more in the high calorie condition, indicating superior compensation in children.

Other studies have measured children's intake outside the laboratory in order to check for evidence of regulation over a longer period. Birch et al (1991) provided parents with set menus of food for their children to be offered on six days in total, and weighed intake was recorded. While energy intake at a given meal-time was highly variable, the variability of total daily energy intake was very low. Similar results were also found in a study measuring free-living intake as assessed by seven 24 hour dietary recalls (Shea et al, 1992), indicating that meal-to-meal compensation for energy is common in young children.

7.1.3 Associations between parental feeding and compensation

Although the results described above demonstrate children's ability to regulate their intake on average, they also indicate considerable individual differences in regulatory ability, which could contribute towards a state of energy imbalance in an individual, and ultimately lead to overweight. Parental feeding behaviours are one possible environmental influence on these individual differences, and Birch and colleagues (e.g. Birch & Davison, 2001) have specifically suggested that excessive levels of parental control over feeding might impair children's intake regulation by focusing them on external cues to satiety (e.g. the amount of food left on the plate, the amount of food that is permitted), instead of internal, physiological cues such as gastric distension and other post-ingestive satiety signals generated in the stomach, upper gut and liver. Thus far, studies from only one research group have provided strong evidence for a link between parental feeding and caloric compensation, and between caloric compensation and child weight.

In the first of these studies, Johnson & Birch (1994) conducted a caloric compensation experiment in 77 children recruited from a university preschool (3-5 years of age). Preloads were fruit drinks, with additional calories for the high energy version provided by maltodextrin (a soluble glucose polymer) to make minimal differences to taste. Lunches consisted of hotdogs, cheese slices, applesauce, carrot sticks, fig rolls and milk. Boys showed better regulation than girls, compensating for an average of 55% of preload calories compared to 35% in girls. Items from a pool of Child Feeding Questionnaire items were made into a diverse, six-item Parental Control Index (PCI; see Chapter 6, Section 6.2.2) incorporating items describing pressuring the child to eat, restricting certain foods, and general control over the mealtime situation. The PCI was negatively correlated with compensation in both boys and girls ($r=-.65$, $p<.001$), such that poorer compensation was found in children whose parents reported greater control over feeding. However, the items within the PCI scale were selected specifically for their high correlations with compensation, making it difficult to draw theoretical conclusions from the study.

Subsequent studies from the same group have used the same paradigm in combination with a more differentiated measure of parental feeding in a longitudinal sample of 197 girls followed from the age of 3 to 7 years. One of these studies reported a negative association between a parental report measure of parental restriction and caloric compensation, which in turn predicted daily energy intake and weight (Birch & Fisher, 2000). Although reduced capability to regulate intake was originally hypothesised to be particularly affected by parents encouraging their children to eat beyond satiety, no associations with other types of parental feeding (e.g. 'Pressure to eat', 'Monitoring') were apparent. It is therefore important to try and replicate these associations using a validated, multi-dimensional measure of parental control in order to establish exactly which feeding styles might impact on children's intake regulation.

7.1.4 Associations between compensation and adiposity

The assumption behind the study of caloric compensation is that is reflects a general eating style with ultimate effects on adiposity. The relationship between compensation and child weight is therefore of interest. Johnson & Birch (1994) found a significant negative association between compensation and adiposity in girls only, such that poorer compensation was associated with greater sub-scapular skinfolds and BMI scores ($r=-.37$, $p<.03$). Birch & Fisher (2000) also report that compensation ability predicted girls' 24 hour energy intake, which in turn predicted relative weight.

In contrast, other studies have failed to find any associations with child adiposity. Faith et al (2004) tested caloric compensation in 32 sibling pairs aged between 3 and 7 years. Families were recruited via newspaper advertisements and fliers. The majority of mothers had at least a college education and the sample contained large proportions of African American and Hispanic participants. High and low calorie preloads were similar to those used in Johnson & Birch (1994) and lunches consisted of macaroni and cheese, string cheese, carrots, grapes, green beans, crackers and whole milk. Mean compensation was 103.6% (SD 106.5), suggesting that average compensation was highly accurate, although there was wide individual variation. However, compensation ability was not significantly related to children's BMI or BMI z score. Compensation ability also showed no association between siblings, although total energy and macronutrient intake were more similar within siblings than within the rest of the sample.

These results suggest firstly that compensation ability may have been underestimated in past studies. A second implication is that compensation may not be an important influence on adiposity. However, the study had only approximately 41% power to detect what might be small associations ($r \approx 20$) between compensation and weight in the sample as whole. The authors suggest that the lack of familiality could mean that compensation might be influenced not by genetics or by shared environment, but instead by non-shared environmental influences. Such influences may indeed have been particularly pronounced for this sample, which contained siblings differing in age by up to 3 years. However, the results should be regarded with caution as Faith et al also failed to find the established association between maternal and child BMI, indicating a significant lack of power to detect familial similarity in traits.

7.1.5 Type of preload

The caloric compensation studies described above are designed to test children's compensation ability under precisely controlled conditions. Most importantly, external cues to the energy content of the preloads are eliminated. That is, energy content is typically increased in one preload condition by adding an undetectable form of carbohydrate. As a consequence, all the initial sensory cues to energy content that the child has learnt to associate with their post-ingestive consequences for satiety (e.g. sweetness, thickness, mouth-feel of fat), together with any higher level awareness of how much a known food will fill them up, are removed. Instead the child must rely on internal satiety sensations alone, which will consist mainly of orosensory signals and gastric distension within half an hour of ingestion, followed by a cascade of other sensations as energy absorption begins (Blundell & Stubbs, 1997). Compensation under these conditions may not, therefore, reflect how children regulate their intake in the 'real world', in which they are likely to experience both external and internal cues to energy content, and to act according to learnt associations between each of these variables.

This problem can be overcome to some extent by examining compensation in response to intake of commonly consumed, 'real life' foods or drinks, which contain all of the external cues a child might use to regulate intake. We might expect compensation to improve when all these cues are available; alternatively, if children's eating is driven more by volume, habit or palatability than by cues to calorie content, then we might predict that compensation would be worse given a well-known high calorie stimulus. For example, Wilson (1991) found that preschool children consumed a mean of 25% more energy when served chocolate milk with their meals than when offered plain milk. As the drink and meal were consumed contiguously, this was not a true preloading experiment. It is therefore unclear whether the children were able to detect satiety cues associated with drink consumption. However, the results are consistent with the idea that children may fail to compensate for calories consumed as part of a common energy-dense soft drink.

Results may be different when food preloads are used rather than drinks, as solids have been shown in some studies to have a greater effect on satiety, but current evidence is inconclusive (Almiron-Roig, Chen & Drewnowski, 2003; DiMeglio & Mattes, 2000). In a recent, more ecological study of overweight and lean adolescents, free-living energy intake was assessed for two days when fast food was consumed and two days when it was not (Ebbeling et al, 2004). Results showed that overweight participants consumed significantly more total energy on fast-food days, but lean participants consumed a similar amount, consistent with an increased ability to compensate for the energy in the fast food by adjusting intake throughout the day. This suggests that compensation may also occur when 'real life' rather than 'disguised' foods are used, and may be more apparent for participants who are not overweight.

7.1.6 The current study

In the current study, caloric compensation is measured in a sample of 4-5 year olds using two methodologies. In one test, high and low calorie preloads are organoleptically undistinguishable; in the second test preloads are familiar high and low calorie drinks with associated detectable sensory properties. Associations between caloric compensation and parental feeding behaviours are examined. Based on previous literature it was hypothesised that better compensation would be associated with lower parental restriction. We were also interested in the associations between caloric compensation and child adiposity, in associations between compensation and CEBQ scales as a test of measurement validity, and in the difference in compensation ability when using undisguised versus disguised preloads.

7.2 Method

7.2.1 Overview

Children participated in two pairs of caloric compensation trials spanning a total of four weeks. On each trial day they were presented with a drink preload followed by a standard lunch 30 minutes later. A 30 minute interval was chosen in order to replicate past research (Johnson & Birch, 1994; Faith et al, 2004). On one of these days the drink had a high energy content; on the other day the drink had a low energy content. In the first pair of trials (Part 1), the high and low energy drinks differed only in carbohydrate content (disguised cue condition). In the second pair of trials (Part 2), the drinks differed completely in terms of taste, appearance and macronutrient composition (undisguised cue condition). In each part, children were taken to show caloric compensation if they ate comparatively less lunch after the high calorie preload than after the low calorie preload. Children's sensitivity to the calorie content of drinks was estimated by measuring hunger levels after consumption of each preload. The compensation shown in both Part 1 and Part 2 was examined in relation to parental feeding behaviour. Other measures of children's eating behaviour ('eating without hunger', eating rate, average lunch intake and intake of individual foods) were also examined as further behavioural measures of children's eating, and are discussed in Chapter 8.

7.2.2 Participants

Five primary school reception classes taking children between 4 and 5 years of age were recruited into the study. One school contributing two reception classes (School A) had participated in Study 2 and expressed interest in participating in further research. Another school (School D) had participated in Study 1 and was also keen to take part. To recruit the remaining two classes, letters outlining the protocol were sent to head teachers who had expressed interest in Study 2, but were not selected to take part due to the small numbers in their nursery classes. Two of these expressed interest and were recruited into the study. All schools were located in the lowest quartile of deprivation for their borough, as indexed by free school meal eligibility. Together, the five reception classes contained 149 children. Participation was expected to be high (80%) due to the school setting and provision of free lunches. A loss of 20% of cases was expected for some analyses due to child absence for or failure to complete one or more conditions. It was therefore calculated that there would be around 89 complete cases for analysis. This number would give 100% power to detect the medium sized effects (i.e. r=.5, Cohen, 1992) between compensation and parental feeding that we would predict from the results of Johnson & Birch (1994). However, we were also interested in smaller effects (e.g. r=.25). 89 cases would give 67% power to detect effects of this order. Although we were also interested in smaller effects from a theoretical perspective, it was not possible to increase the sample size due to practical constraints. It was hoped that measurement accuracy (and hence power) would be enhanced to some degree by assessing compensation by two different methods on two separate occasions.

7.2.3 Materials and methods

Part 1 preloads (disguised cues)

Low calorie preload. This consisted of 200 ml of diluted Sainsbury's Orange and Mango Squash (J Sainsbury plc) made to the manufacturer's instructions of 1 part squash to 4 parts water, equating to 40 ml squash and 160 ml water for every 200 ml serving of squash. Based on manufacturers' information, a 200 ml serving contained 0.4 g carbohydrate, of which 0.4 g were sugars, under 0.2 g protein, and under 0.2 g fat, of which 0.2 g was saturated, amounting to 5.0 kcal / 21.0 kJ (0.03 kcal/ml).

High calorie preload. This consisted of 200ml of the same diluted squash with added maltodextrin, a soluble glucose polymer commonly used in nutrition research to increase calorie content without affecting taste (Polycose powder, Abbott Labs). In order to allow for an increase in volume with the addition of the powder, 22.5 g of Polycose was added for every 200 ml of squash, creating a 20% solution. A 200 ml measure of the resulting drink therefore contained 174.2 kcal / 728.9 kJ (0.871kcal/ml), and had a similar macronutrient composition as the low calorie squash, with the exception that the carbohydrate content was increased to 22.9 g.

Piloting these drinks on a sample of five 3-5 year olds suggested that although one child was aware of a difference between the two preloads, they could not describe why they seemed different (e.g. one was more sweet, more thick), and liking was consistently high for both versions.

<u>Part 2 preloads (undisguised cues)</u>

Low calorie preload. Sainsbury's Caledonian Spring water (J Sainsbury plc) was selected as a low calorie drink offering children maximal primary and learnt cues to caloric content. A 200 ml measure contained 0 kcal / 0 kJ (0kcal/ml).

High calorie preload. Marks & Spencer's Strawberry Milk (St Michael Foods plc) was selected as a palatable example of a common high calorie drink offering children extensive external cues (e.g. taste, texture, appearance) to caloric content. Based on manufacturers' information, a 200 ml measure contained 22.0 g carbohydrate, of which 21.8 g were sugars, 8.4 g protein, and 7.0 g fat, of which 4.4 g was saturated, amounting to 188.00 kcal / 786.59 kJ (0.94 kcal/ml).

One child was allergic to strawberries and two children disliked the strawberry flavour. These children were offered 200ml of Marks & Spencer's Chocolate Milk (St Michael Foods plc), containing 198 kcal / 828 kJ (0.99 kcal/ml). Two other children were allergic to cow's milk so milkshake mix was mixed with soya milk to create a non-dairy strawberry milkshake (30ml Strawberry Crusha Milkshake Mix, British Sugar plc + 200ml Tesco Value Soya Milk, Tesco Foods plc). A 200 ml measure contained approximately 60 kcal / 251.04 kJ (0.30 kcal/ml).

Piloting these drinks and discussions with the children suggested that the strawberry milk was well-liked by most children, but some did not like any milk- or yoghurt-based drinks. An alternative drink offering some primary and learnt cues to energy density might have been lemonade, cola, or another form of carbonated soft drink. However, all of these drinks provided far fewer calories than the strawberry milk and contain large amounts of high-fructose corn syrup, which may have unique effects on blood glucose and ~~therefore~~ hence sensations (Schulze et al, 2004). Additionally, the fizziness would have impaired the accuracy of volume calculations and affected children's ability to drink the preload within the required interval. Only strawberry milk, chocolate milk and strawberry flavoured soy milk were therefore included as options for this preload.

Lunch

On every trial day and on one 'familiarisation' (control) day preceding the four trials, children were each presented with the following foods: 5 chicken slices (Sainsbury's Chicken Slices, J Sainsbury plc, 4.10 kcal/g), 4 cheese slices (Sainsbury's Medium Cheddar Slices, J Sainsbury plc, 1.17 kcal/g), 3 halves of white bread roll (Tesco's Bridge Rolls, Tesco plc / Sainsbury's Hot Dog Rolls, J Sainsbury plc, 2.68 kcal/g), mini cheese crackers (McVities Mini Cheddars, 5.29 kcal/g), mini chocolate biscuits (McVities Mini Chocolate Digestives, 5.16 kcal/g), and white grapes (0.18 kcal/g). A portion of vegetables was also provided. For School A this consisted of 8 cherry tomatoes (0.18 kcal/g, School A); for School B-D we used carrot sticks (0.35 kcal/g). The change from tomatoes to carrot sticks was instigated because many children at School A reported disliking the tomatoes. To maintain consistency, School A children were given tomatoes throughout the trials, and Schools B-D were presented with carrots. If a child finished the bread rolls, additional halves were offered and the weights recorded. Additional servings were not offered for any of the other foods. Children were given a plastic cup of water to drink with their meal, which was refilled on their request.

Table 7.1 gives average weights and energy contents for each individual food served on the 'control' and Part 1 preload days (Days 2-3). Servings were very similar on Days 4-5, but are omitted from the calculations in the table in order to give a better picture of foods presented to children participating in Part 1, the main focus of the chapter. Only data for children who completed both preload conditions in Part 1 (n=95) were considered, as this sub-sample is used from hereon, and data from four vegetarians was excluded from the table, leaving 91 cases.

Table 7.1: Average weight and energy content of individual foods over control and Part 1 preload days (n=91)

	Serving weight (g)		Serving energy (kcal)	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**
Tomatoes (n=11)	100.8 (6.6)	87.1 – 115.0	18.2 (1.2)	15.7 – 20.7
Carrots (n=80)	54.2 (0.9)	52.0 – 56.6	19.0 (0.3)	18.2 – 19.8
Grapes (n=91)	98.3 (2.8)	94.4 – 110.1	63.7 (2.0)	60.9 – 80.0
Bread rolls (n=91)	53.5 (5.2)	44.1 – 73.5	143.4 (14.0)	118.1 – 197.0
Chicken (n=91)	63.2 (3.2)	42.0 – 71.3	74.0 (3.8)	49.1 – 83.4
Cheese (n=91)	48.3 (2.6)	43.3 – 64.1	198.1 (10.6)	177.4 – 262.9
Crackers (n=91)	36.1 (2.5)	33.9 – 43.8	190.9 (13.1)	179.3 – 231.6
Biscuits (n=91)	50.5 (2.2)	35.6 – 53.1	260.5 (11.2)	183.5 – 274.0

The average total weight of food presented was approximately 403.9 g and the average total energy content was approximately 956.7 kcal. Vegetarians were not given chicken, but were given an extra portion of cheese instead. Mean cheese serving for these four children was 86.9 g (SD=10.6, range 80.9–102.7), amounting to 356.2 kcal (SD=43.2, range 331.8–420.9). Servings of other foods were very similar to the rest of the sample.

<u>Parent questionnaires</u>

The questionnaire used in Study 3 and 4 (Appendix VI) was distributed to all participating parents. This included basic demographic information, and questions on parental feeding, child eating behaviour and parenting style. Some additional questions on child temperament factors that might be associated with eating behaviour were also included. These were taken from the Emotionality-Activity-Sociability Temperament Survey for Children (EAS; Buss & Plomin, 1984; see Table 7.2), which assesses temperamental dimensions which were selected on the basis of early appearance and high heritability, and were designed to reflect characteristic styles of behavioural response.

Table 7.2: Emotionality-Activity-Sociability Temperament Survey for Children (EAS, Buss & Plomin, 1984)

Emotionality
My child cries easily.
My child tends to be somewhat emotional.
My child often fusses and cries.
My child gets upset easily.
My child reacts intensely when upset.
Activity
My child is always on the go.
When my child moves about, he/she usually moves slowly.
My child is off and running as soon as he/she wakes up in the morning.
My child is very energetic.
My child prefers quiet, inactive games to more active ones *(reverse-scored)*.
Sociability
My child tends to be shy *(reverse-scored)*.
My child likes to be with people.
My child prefers playing with others rather than alone.
My child makes friends easily.
My child finds people more stimulating than anything else.
My child is very sociable.
My child takes a long time to warm up to strangers.
My child is something of a loner *(reverse-scored)*.
My child doesn't like to be alone.
My child is very friendly with strangers.

On each day of the study, parents were also given an additional form asking for details about the contents of their child's breakfast and what they ate and drank when they returned from school. A single item asked 'Compared to a usual day, how much did your child eat this evening?' Possible responses ranged from 'much less than usual', through 'about the same', to 'much more than usual'.

Assessment of child hunger levels

Although other studies have used a measure of fullness, where each child indicates the extent of their hunger by pointing at one of three cartoon figures depicting an empty stomach, a half empty stomach and a full stomach (e.g. Birch & Fisher, 2000; Fisher & Birch, 1999), this study utilised a basic prospective consumption measure to assess hunger. This was to avoid artificially focusing children's attention on internal satiety cues beyond habitual levels, because we were interested in capturing their natural responses to the preload. Prospective consumption measures do not correspond entirely with actual future intake (Drapeau et al, 2005), but may give a reflection of current appetitive state. Several studies also suggest that hunger measures may be a more accurate predictor of individuals' subsequent intake than measures of satiety or fullness (Merrill et al, 2002).

Hunger levels were assessed before lunch on the control day, and between the consumption of the preload and lunch on trial days. There was an additional hunger assessment before the 'eating without hunger' test on the final day (see Chapter 8). All children were familiarised with the hunger measure during the control week. In individual sessions with a researcher, they were each shown three photographs depicting small, medium, and large sized plates of spaghetti bolognese and told a story describing a child who had not had time to eat breakfast before school. After the story children were asked which portion they thought the child would choose at lunchtime. A good understanding of the measure was inferred if they pointed to the large portion and explained their choice with a phrase such as 'because it's bigger', or 'because he was hungry'. Children who pointed to the small measure or gave reasons such as 'because he liked it' were assumed not to understand.

To assess children's own current hunger level, the researcher asked, "Now I want you to think about how hungry you are, right now. If the dinner lady came up to you right now, and said do you want this portion, this portion or this portion, what would you say?" Photographs were presented in varying orders for each child and children's selections were noted. Piloting suggested that the language used and situations described in this method were familiar to children, and that responses accurately reflected their subjective level of hunger. Appendix VIIII contains the photos used to assess hunger.

Child weight and height

Children's heights and weights were measured by researchers on the familiarisation day in each school. Children were brought to the researchers in small groups and given help to remove their shoes and any outside clothing (e.g. overcoats). They were asked to stand upright on a Leicester height measure, placing their feet perpendicular to the height support and facing straight ahead, while the researcher noted their height to the nearest millimetre. They were then asked to step on to a TANITA digital weighing scale, and weight in kilogrammes was recorded to one decimal place. Where children were absent, measurements were taken on the following visit. Parents were given the option to exclude their children from weighing and measuring prior to the beginning of the study but none did so.

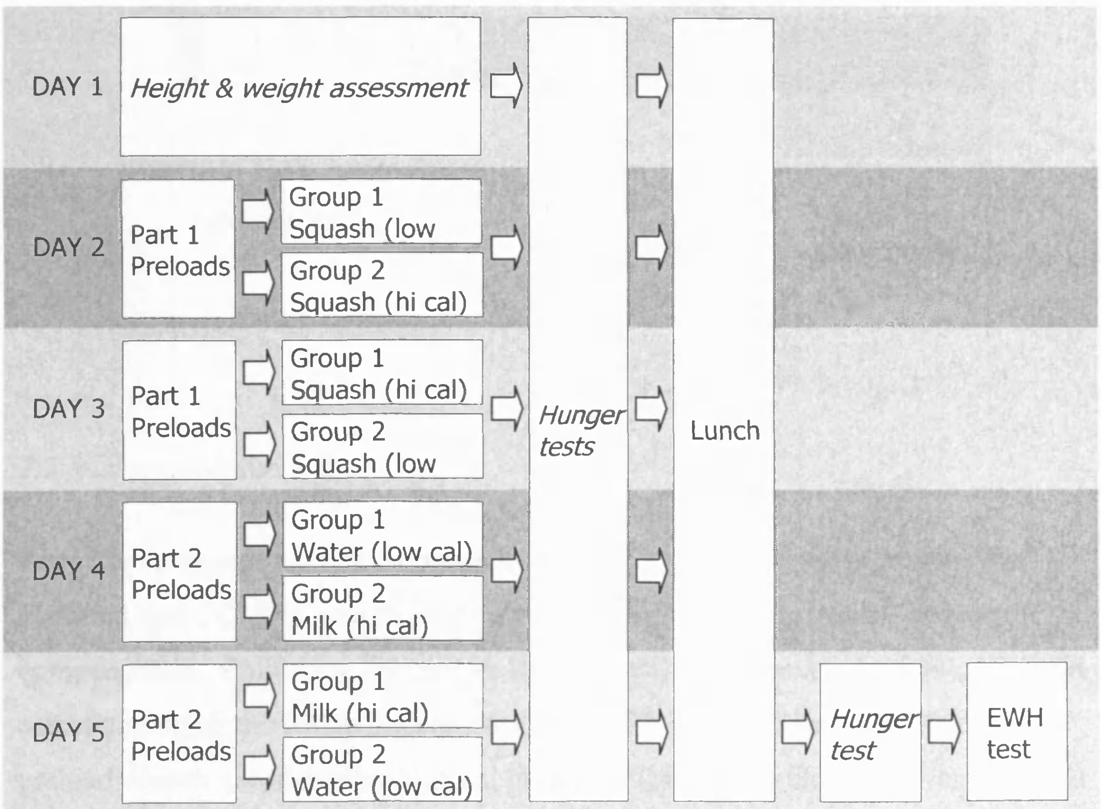
7.2.4 Protocol

The study design is illustrated in Figure 7.1 and a timeline is given in Figure 7.2.

Control day. During the first day of the five day experimental schedule, children participated in a control trial. Each class was visited on a separate day (e.g. School A on Monday, School B on Tuesday), and subsequent visits were on the same day of the week for the duration of the project. On the control day, parental consent forms were obtained for all children who were allowed to participate and parental feedback forms and questionnaires were given to teachers to distribute to participating parents. Next, all participating children were weighed and measured. The timing of preloads and meals was negotiated with teachers to fit into existing time-tables, and therefore varied slightly between schools. Half an hour before lunch-time (11.30/12.00), the

main researcher and a trained assistant assessed children's hunger levels.
At lunch-time, children were seated randomly in groups of 5-6 around tables in their classrooms. Boys and girls were seated alternately in order to avoid seating potentially disruptive groups of friends together. Each child was then presented with a partitioned Tupperware tray ('Party Susan') containing each item of their pre-weighed lunch in the individual segments. Children were told that they had each been given their own 'special lunch' and they could eat as much of it as they liked but they were not to share it with other children. They were told to start with their sandwiches at the front of the tray, and that if they dropped something they should inform one of the researchers. Children then ate their lunch under the supervision of the researchers, who provided extra servings of bread or water when required, and collected any discarded food in order to replace it on the correct tray to be weighed later. Children were allowed to eat until satiety under the unobtrusive supervision of the research team. When children seemed to have finished eating, an individual member of the team confirmed that they had finished, noted the time and enclosed any discarded food in the trays. Trays were then transported back to the research unit for weighing

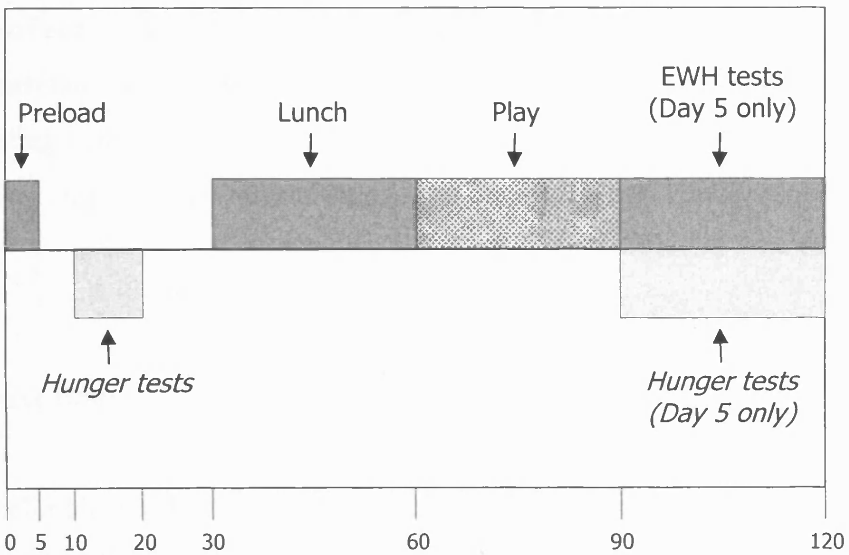
Figure 7.1: Study design



Part 1 trial days. For the Part 1 preload days, lunch was administered as on the control day. For each pair of trials, half of the participating children were allocated to receive the high calorie preload, and half the low calorie preload; they received the alternative preload on the second trial day. Half an hour before lunch-time children were given their allocated drink in a clear plastic cup with lid and straw. They were told they had 5 minutes to drink it, and researchers circulated towards the end of the drinking time to encourage children to drink any remaining liquid and to note any children who disliked the preload. Researchers then collected the cups and recorded the volume of any remaining liquid. Hunger levels were then assessed as before, and lunch was served at the normal time.

Part 2 trial days. A similar protocol was followed for the final set of trials (Part 2, Weeks 4-5). However, as drinks were visibly different, children were told that they had been divided into teams, and that next week the teams would swap over, so everyone would get the chance to try both drinks.

Figure 7.2: Timeline



7.2.5 Data analysis

Repeated measures analysis of variance was used to test whether compensation occurred and COMPX scores were calculated to give an index of the degree of compensation. Following Johnson & Birch (1994) and Faith et al (2004), COMPX is calculated using the following equation: COMPX = ((lunch calories after low cal preload - lunch calories after high cal preload) / (high cal preload calories - low cal preload calories)) x 100. This generates a percentage, where 100% represents perfect compensation (i.e. eating precisely more in the low calorie preload condition to compensate for the calorie difference between preloads), over 100% represents over-compensation for preload calories (i.e. eating too much after the low cal preload and/or too little after the high cal preload), 0-99% represents some degree of compensation (i.e. eating more after the low cal preload and/or less after the high cal preload, but not enough to compensate fully for the difference in preload calories), and under 0% is scored in cases where the calorie content of the preload had the opposite effect, such that subjects ate more after the high cal preload and/or less after the low cal preload. It should be noted that the COMPX index does not represent the absolute calorie content between preloads; instead it assumes that the degree of compensation may be reported independent of actual calorie intakes. This may give a false illusion of comparability between studies. For example, if the preload calorie difference or drink volumes differ between studies, or if the low calorie preload is higher in one study than in another, these factors could all influence compensation, and hence COMPX scores. Despite these problems, COMPX scores were used here for the sake of comparability with other studies. Independent samples t-tests and Pearson's correlations were used to test relationships between compensation and parental feeding behaviours, and also between compensation and parental demographics, child age and temperament, child adiposity and CEBQ scores.

7.3 Results

7.3.1 Response rates

Of the 149 eligible children, only 3 were denied parental permission to participate in the study, and 123 (82.6%) participated on at least one day of the study. 93 of these participated on the control day, 101 in both trials in Part 1, and 102 were present for both trials in Part 2. 82 children were present for all trials in both parts of the study. Further to those participating in each pair of trials, 7 additional children participated on Day 2; 12 on Day 3; 3 on Day 4; and 13 on Day 5. 88.6% (111/123) of the parents of participating children returned the questionnaire, and hence contributed data to the analysis of associations between parental feeding and compensation.

7.3.2 Sample characteristics

Parent characteristics. Characteristics for this group of parents are presented in Table 7.3 and were compared to characteristics of the more representative Study 2 sample. As in Study 2, the majority of parents were mothers (96% cf 92%). Mothers in this sample were slightly older, with 24% (cf 16%) aged 41 years or over, and slightly leaner, with 30% of those providing self-report data on height and weight (cf 39%) in the overweight or obese categories. 74% of participants were white British, compared to 61% in study 2. Occupational status was broadly similar, with 21% (cf 16%) in full-time employment, and 46% (cf 41%) spending all their time at home. The current sample was better educated than the Study 2 sample, with 22% cf 38% reporting having no educational qualifications, and 42% (cf 25%) owning a degree or post-graduate qualification. They were also more affluent, with only 5% (cf 15%) in the lowest income bracket. 42% of parents owned more than one car compared with 30% in the Study 2 sample, and 87% (cf 58%) owned or were buying their home, indicating a higher level of affluence. This group of parents (n=111) is subsequently used as the reference group when evaluating the similarity of characteristics of sub-groups used to the rest of the available sample.

Table 7.3 Parent characteristics (N=111)

	n	%
Gender		
Male	3	2.7
Female	107	96.4
Missing	1	0.9
Age group		
26-30 years	3	2.7
31-35 years	40	36.0
36-40 years	41	36.9
41-45 years	17	15.3
46 or over	10	9.0
BMI group (based on self-reported height and weight)		
Normal weight (18.5 – 24.999)	67	60.4
Overweight (25 – 29.999)	19	17.1
Obese (30 or over)	10	9.0
Height and weight not reported	15	13.5
Relationship with child		
Mother	107	96.4
Father	3	2.7
Other	1	0.9

Table 7.3 Parent characteristics (contd.)

	n	%
Marital status		
Married	90	81.1
Living as married	8	7.2
Separated / divorced	3	2.7
Single	9	8.1
Missing	1	0.9
Ethnicity		
White British	82	73.9
White European	10	9.0
Indian / Pakistani	1	0.9
Black African / Black Caribbean	16	14.4
Other (e.g. mixed)	3	2.0
Occupational status		
Full-time employment	23	20.7
Part-time employment	31	27.9
Full-time homemaker	51	45.9
Disabled / too ill to work	1	0.9
Student	3	2.7
Other (e.g. self-employed)	1	0.9
Missing	1	0.9
Education		
None	1	0.9
GCSE / O-levels / school certificate	23	20.7
NVQ / GNVQ	8	7.2
A-levels	13	11.7
National diploma	14	12.6
Degree	27	24.3
Post-graduate diploma	15	13.5
Higher degree (MA, MSc, PhD)	4	3.6
Other	3	2.7
Missing	3	2.7
Income		
Less than £9,999	6	5.4
£10,000 – 19,999	4	3.6
£20,000 - £29,999	14	12.6
£30,000 - £39,999	13	11.7
£40,000 - £49,999	14	12.6
£50,000 - £59,999	10	9.0
£60,000 - £69,999	10	9.0
£70,000 or over	7	6.3
Missing	33	29.7
Car ownership		
No car	7	6.3
One car	50	45.0
More than one car	47	42.3
Missing	47	6.3
Home ownership		
Own/buying	96	86.5
Rent	10	9.0
Other (e.g. live with family)	3	2.7

Child characteristics. Table 7.4 gives child characteristics for all children participating on at least one day of the study. As with Study 2, there were slightly more boys than girls (51% cf 55%). There were more 5 year olds than 4 year olds, reflecting the timing of the study which was conducted late in the school year. According to IOTF classifications, there were slightly more overweight children and slightly less obese children in the current sample (18% and 4%) compared with the Study 2 children (11% and 9%). Finally, the older age of the mothers in this sample was reflected in the family position of children in this study, with fewer children occupying the youngest position in the family (38% cf 45%). This sample of 123 children is henceforth used as the reference group for evaluating sub-group differences.

Table 7.4 Child characteristics (N=123)

	n	%
Gender		
Male	63	51.2
Female	60	48.8
Age		
4 years	48	39.0
5 years	61	49.6
Missing	14	11.4
BMI group (IOTF categories)		
Normal weight	82	66.7
Overweight	18	14.6
Obese	4	3.3
Not weighed and measured	19	15.4
Family position		
Oldest	41	33.3
Middle	15	12.2
Youngest	38	30.9
Only child	18	14.6
Missing	11	8.9

7.3.3 Child eating outcomes

Caloric compensation Part 1 (disguised preloads)

Degree of compensation. 101 children were present on both trials within the Part 1 compensation experiment. Of these, 95 children drank the full 200 ml of preload in each condition (preload energy difference = 169.20 kcal). Among those who did not complete all the preloads, one child drank only half of the low calorie version (preload energy difference = 171.51 kcal). Two additional children drank the full amount of the low calorie preload, plus over 100ml in the high calorie condition (preload energy differences = 114.32 kcal, 131.74 kcal). Three additional subjects drank less than 100ml of the high calorie version (preload energy differences = 25.47

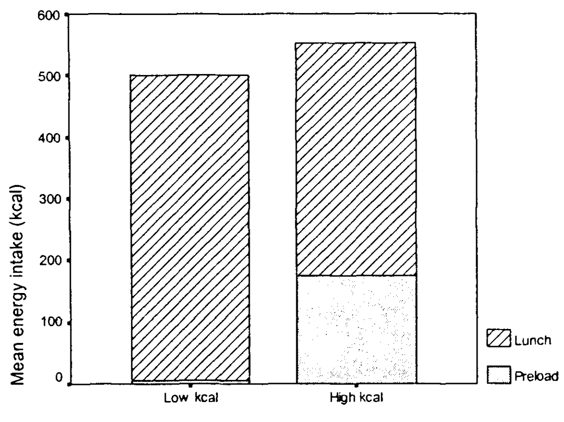
kcal, 28.08 kcal, 29.82 kcal). Table 7.5 shows mean lunch intake following each preload for those who drank the full 200 ml of each preload (n=95). On average, lunch intake was over 100 kcal higher for the low energy preload in each part, but calorie intake varied widely in each condition.

Table 7.5 Average total intake (kcal) after each preload

	N	Mean	SD	Range
After low calorie preload	95	496.47	175.80	57.38 – 1010.10
After high calorie preload	95	378.71	182.90	45.10 - 913.18

Simple repeated measures ANOVAs were conducted in order to test if compensation was significant. Results were calculated for subjects who drank all of the preloads in both conditions (n=95), in order to avoid introducing a confounding effect of drink volume on intake, and because eyeballing the data revealed that several compensation outliers were associated with non-standard differences in preload calories between low and high calorie conditions. Results indicated that lunch consumption was greater after the low calorie than the high calorie preload, indicating a statistically significant compensation effect ($F=77.33$, df 1, 94, $p<.001$). The compensation effect is illustrated in Figure 7.3.

Figure 7.3: Caloric compensation for Part 1 preloads (low and high energy squash) (n=95)



Order effects. In the simple repeated measures analysis, low and high calorie preload conditions were compared for all subjects. However, this does not take account of the fact that some individuals received the low energy drink first and others the high energy drink. Trials were spaced a week apart to limit order effects, but it is possible that learning could have influenced compensation. For example, children who drank the high energy version first may have learnt to associate the taste of the squash with an increase in satiety (learnt satiation), and failed to up-regulate their consumption as effectively as a consequence. Conversely, those who had the low energy preload first may have begun to associate the flavour with minimal effects on satiety, suppressing their down-regulation of eating in the second trial (learnt desatiation).

In order to test for these effects, two independent t-tests were conducted. The first of these compared intake after the low calorie preload between children who drank the high energy preload first (high then low), and those who drank the low energy preload first (low then high). Consistent with the occurrence of learnt satiation, the 'high then low' group showed lower intake (i.e. poorer compensation) after the low calorie preload (471.4 SD 160.7 kcal) than did the 'low then high' group (521.0 SD 187.8 kcal) (t=1.38, df 93, p=.171). This effect became significant when seven outliers were removed from the analysis (442.2 SD 118.7 kcal vs. 500.9 SD 137.9 kcal; t=2.13, df 86, p=.036).

Learnt desatiation was tested by comparing intake after the high calorie preload between children who drank the low energy preload first and those who drank the high energy preload first. However, the 'low then high' group did not show significantly higher intake after the high calorie preload (i.e. poorer compensation) than the 'high then low' group (383.4 SD 197.7 kcal vs. 374.0 SD 168.4 kcal; t=0.25, df 93, p=.803).

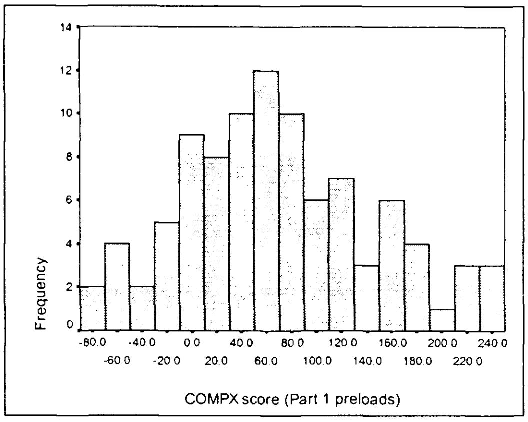
Given the evidence for a possible influence of learning on compensation scores, order of preloads was entered as a covariate in the repeated measures analysis. There was a trend towards an interaction between preload order and preload energy content (F=2.28, df 1,93, p=.135), but this did not reach significance, suggesting that the learnt satiation and learnt desatiation effects affected compensation to a similar degree. It was therefore considered acceptable to combine preload order groups in future analyses.

Sex effects. Following evidence for stronger compensation ability in boys than girls in other literature (boys 55% cf girls 35%, Johnson & Birch, 1994), the influence of child sex was examined by entering child sex as a factor in the ANOVA.

Compensation was slightly better in girls than boys, but the compensation x sex interaction was far from significant (F=0.78, df 1,93, p=.378).

COMPX scores. Figure 7.4 shows COMPX scores for all subjects drinking all of each preload (n=95). Scores were approximately normally distributed. Average compensation was 69.60% (SD 77.14), which represented good compensation but was significantly lower than perfect i.e. 100% (t=-3.84, df 94, p<.001). As in other studies, the range of scores (-87% to 234%) was substantial, indicating wide variation in compensation ability between individuals.

Figure 7.4: Distributions of COMPX scores

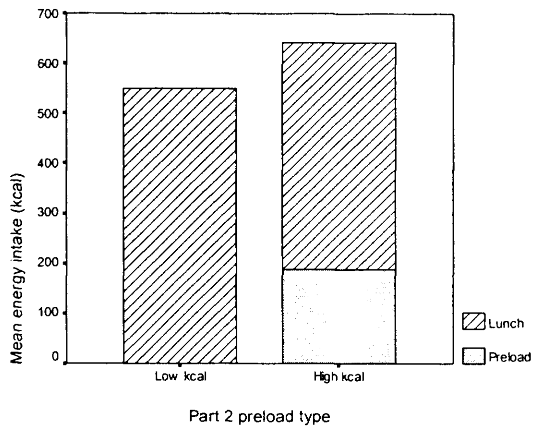


Preload order did not significantly influence COMPX, although those who drank the high calorie preload first had substantially lower scores (57.6, SD 75.4%) than those who drank the low calorie preload first (81.4, SD 77.8%), reflecting the earlier t-test and ANOVA results (t=1.51, df 93, p=.134). Girls had COMPX scores that were marginally higher than those of boys (76.8 SD 76.0 vs. 62.8 SD 78.37%; t=-.884, df 93, p=.379). The influence of child age was tested using Pearson's r correlations and was unassociated with COMPX (r=.078, p=.466, n=89).

Caloric compensation (Part 2)

Compensation was also examined among subjects completing both trials using the undisguised preloads (i.e. water and strawberry milk). 101 children participated in the low calorie condition, 101 children participated in the high calorie condition, and 97 were present for both conditions. Of these, 78 children drank all of each preload. As for Part 1, analyses were based on this sub-sample to avoid the confounding effects of calorie and volume differences between individuals. This excluded the four children who were given strawberry-flavoured soy milk and chocolate milk from the analysis group, as they did not complete their drinks. Consumption was significantly lower after the high calorie preload (452.93 kcal SD 194.39) than after the low calorie preload (548.5 kcal SD 172.0) ($F=59.4$, df 1, 77, $p<.001$), producing a group mean COMPX score of 50.9% SD 58.27, and a range of -131.4 to 200.2 (see Figure 7.5 for illustration of effect). The distribution of scores was approximately normal.

Figure 7.5: Caloric compensation for Part 2 preloads (water and strawberry milk)



Sex effects. There was some evidence for a child sex difference in compensation such that compensation was better in girls (M=61.8%, SD 60.9) than in boys (M=39.9%, SD 54.1), ~~and for girls was~~ ($t=-1.68$, df 76, $p=.096$). There was no evidence for an interaction between order of preload and degree of compensation ($F=.025$, df 1, 76, $p=.876$).

Analysis of hunger measure

In order to test for children's conscious responses to the calorie content of the preload, children's hunger levels were assessed on Days 2-5 between consumption of the preload and lunch. Children were introduced to the measure on the control day, or on Day 2 if they were absent. Although some children showed poor understanding of the measure when it was introduced to them, all responses were included in the following analyses because it was difficult to tell which children understood and which did not, and excluding data on this basis may have introduced experimenter bias. Responses on the hunger measure were scored from 1 to 3, with 1 representing 'slightly or not at all hungry' (selected small spaghetti portion), 2 representing 'quite hungry' (selected medium spaghetti portion), and 3 representing 'very hungry' (selected large spaghetti portion). Examination of the spread of scores following each preload condition (Parts 1 and 2) showed that the most common score in every condition was 'very hungry', while around 1/5 of children in each condition said they were 'slightly hungry' and at least 1/5 said they were 'quite hungry'.

Associations with lunch intake. First, validity of the measure was tested by correlating hunger levels with lunch intake, on the assumption that children who reported being more hungry prior to lunch would eat more at lunch. Analyses were also repeated using univariate ANOVAs to compare lunch intakes for each hunger category. All participants with data available were included in order to maximise the sample. No associations between hunger level and lunch intake were apparent for any of the days, demonstrating that absolute hunger level, as assessed here, did not predict intake.

Hunger levels after low and high calorie preloads. The main objective of measuring hunger levels was to detect whether children showed sensitivity to the preload calorie content, independent of adjustment of lunch intake. To test this, hunger levels after consuming the high and low calorie preloads were compared for Part 1 and Part 2, with the primary hypothesis that hunger levels would be lower after the high than the low calorie preloads, and the secondary hypothesis that the difference would be larger for the Part 2 preloads where all cues to calorie content were available.

Paired samples t-tests revealed that there was no significant difference in mean hunger level after drinking the high calorie preload (M=2.4, SD 0.8) compared with the low calorie preload (M=2.3, SD 0.9) (t=-0.80, df 98, p=.426) in Part 1. This indicates that the preload 'disguise' was successful in terms of preventing a preload effect on hunger at the early stages of ingestion, when internal satiety cues have yet to be experienced. In contrast, mean hunger levels after the high calorie preload (2.3 SD 0.88) in Part 2 were significantly lower than after the Part 2 low calorie preload (2.6 SD 0.72) (t=2.81, df 74, p=.006).

Hunger sensitivity and compensation performance (Part 1). The above result demonstrated that average hunger levels were not related to Part 1 preload calories in a simple between subjects test. That is, hunger after the low calorie preload was not generally higher than after the high calorie preload. However, it is possible that each individual child interpreted the hunger measure differently, and that a within subjects design may therefore increase power to detect any hunger difference between preloads.

To test this, each child was assigned a dichotomous 'hunger sensitivity' score, where a score of 0 represented either no change or a counter-intuitive difference in hunger levels between preloads, and a score of 1 represented a relatively higher hunger level after consumption of the low calorie preload. 3 of the 95 children with Part 1 compensation data were missing hunger assessment on one or both days, leaving 92 cases for analysis. An independent samples t-test comparing compensation in the 'not sensitive' and 'sensitive' groups showed that compensation was significantly better in the 'sensitive' (M=100.9, SD 73.86, n=19) than the 'not sensitive' group (M=62.0, SD 77.45, n=73) (one-tailed t=-1.96, df 90, p=.027).

A similar analysis was also conducted after dividing children into 'responders' (i.e. less hungry after the high calorie preload, n=19, scored +1), true 'non-responders (i.e. reported the same level of hunger for each preload, n=53, scored 0), and 'reverse responders' (i.e. reported more hunger after the high calorie preload, n=20, scored -1). A univariate ANOVA comparing all three groups demonstrated a linear pattern in which worst compensation was displayed by the 'reverse responders' (M=56.21, SD 71.46), slightly better compensation in the 'non-responders' (M=64.23, SD 80.13), and best compensation in the original 'sensitive' group M=100.85, SD 73.86) (F=1.99, df 2,89, p=.143; F test for trend=3.21, df 1, 89, p=.077).

Hunger sensitivity and compensation performance (Part 2). Applying a similar analysis to data from the Part 2 compensation experiment demonstrated that, again, compensation was slightly better in children whose hunger levels reflected the difference in preloads (i.e. more hungry after the low calorie and less hungry after the high calorie preload) (56.3% SD 61.73, n=21) than in those who reported being equally or more hungry after the high calorie preload (47.5% SD 57.61, n=54), but the difference was far from significant (one-tailed t=-.584, df 73, p=.253).

Hunger sensitivity and preload completion. In order to test the hypothesis that those who did not complete the preloads were higher in hunger sensitivity, thereby excluding the best compensators from the analyses, sensitivity was compared for 'completers' and 'non-completers'. Hunger sensitivity did not differ between those who completed and did not complete the Part 1 preloads. There was, however, some evidence for higher hunger sensitivity in those who completed Part 2 preloads than those who participated in Part 2 but did not finish the high calorie preload ($t=-2.36$, df 94, $p=.021$).

Parental questionnaire measures

Table 7.6 gives scale descriptives for the whole sample of parents who returned questionnaires and whose children participated on at least one day (n=111). Parental feeding and child eating behaviour scores were similar to norms measured in Study 2, but there was a general pattern for lower pressuring strategies and more restriction in the current sample, perhaps reflecting higher affluence in this group.

Table 7.6: Questionnaire scale descriptives for whole sample (n=111)

	M (SD)	n	Skewness (SE)	Kurtosis (SE)
Parental feeding				
Pressure to eat	2.01 (1.32)	108	-0.11 (0.23)	-1.30 (0.46)
Prompting to eat	3.09 (0.50)	109	-0.42 (0.23)	0.07 (0.46)
Food to reward food	1.55 (0.84)	109	-0.26 (0.23)	-0.24 (0.46)
Emotional feeding	0.74 (0.59)	110	0.70 (0.23)	0.17 (0.46)
Monitoring	3.28 (0.66)	111	-0.55 (0.23)	-0.52 (0.46)
General restriction	2.88 (0.89)	110	-0.87 (0.23)	0.29 (0.46)
Meal-time rules	1.74 (0.99)	110	0.02 (0.23)	0.88 (0.46)
Food to reward behaviour	1.22 (0.86)	109	0.13 (0.23)	0.98 (0.46)
Child eating behaviour				
Food responsiveness	1.26 (0.68)	110	0.94 (0.46)	1.46 (0.46)
Satiety responsiveness	2.11 (0.67)	110	0.40 (0.46)	-0.45 (0.46)
Enjoyment of food	2.48 (0.75)	111	-0.25 (0.46)	-.017 (0.46)
Child temperament				
Shyness	1.35 (0.95)	108	0.35 (0.46)	-0.91 (0.46)
Emotionality	1.64 (1.03)	108	0.32 (0.46)	-0.69 (0.46)
Sociability	3.06 (0.67)	108	-0.82 (0.46)	1.04 (0.46)
Activity	3.20 (0.73)	108	-0.87 (0.46)	0.08 (0.46)

In general, there was little evidence for skewness and kurtosis in variables. However, 'Emotional feeding' showed a slight positive skew, reflecting generally low scores for this scale, and 'Monitoring' and 'General restriction' showed slight negative skews.

Slight negative kurtosis was apparent for 'Pressure to eat', indicating a flat distribution, and 'Food to reward behaviour' showed some positive kurtosis, reflecting the high number of parents with scores around the mid-point of the scale. Child eating behaviour scores were approximately normally distributed, although food responsiveness showed some evidence of peakedness towards the lower end of the distribution. Given that most variables were approximately normally distributed, parametric tests were used in future analyses.

In order to assess whether questionnaire scale scores were significantly different for the various sub-samples (i.e. Part 1 preload completers, n=95; Part 2 preload completers, n=78; Part 1+2 preload completers, n=61) than for the remaining participants who had children participating on at least one day of the study (total n=111), independent t-tests were conducted. There were no significant differences in parental feeding scores or child temperament between those in the sub-samples and the remaining sample, with the exception that 'General restriction' was slightly higher in those children who completed all preloads compared to the rest of the sample ($t=-0.20$, df 108, $p=.048$). There were also no significant differences in CEBQ scores between those who completed the preloads and those who did not, suggesting that it was unlikely that excluding non-completers effectively excluded participants who might be expected to show greater hunger sensitivity and compensation.

Representativeness of sub-samples. In order to test whether the sub-samples used for analyses were different in terms of child and parent anthropometric and demographic factors, Chi squared analyses and independent t-tests were used to compare groups. Children who completed the drinks were more likely to have a mother at home than those who didn't ($\chi^2=10.44$, df 3, $p=.015$). They were also less likely to have parents who owned their home ($\chi^2=7.93$, df 3, $p=.047$), and had parents with lower incomes ($t=-2.23$, df 76, $p=.028$). No other differences were apparent, and results should be regarded with caution because of the small number of non-completers (n=16), and the variability in volume consumed between individuals. Conducting similar analyses for completers and non-completers of the Part 2 preloads revealed no differences, with the exception that children who were the oldest in their family were more likely to finish their drinks ($\chi^2=10.0$, df 4, $p=.040$).

7.3.4 Associations between questionnaire measures and compensation

Associations between parental feeding behaviour and compensation

Zero order correlations between parental feeding behaviours and COMPX scores are presented in Table 7.7. Compensation in Part 1 showed only one significant negative correlation, such that high 'Monitoring' was associated with poorer compensation (r=-.22, p=.037, n=91). There was also a small positive correlation with 'Food to reward food' (r=.17, p=.110, n=90). There were trends towards negative associations between compensation in Part 2 and both 'General restriction' (r=-.18, p=.138, n=67) and 'Monitoring' scales (r=-.14, p=.251, n=68).

Average compensation scores. In order to see whether combining compensation indices increased the strength of these relationships, mean COMPX was calculated for subjects who consumed all of the preloads in each part (n=61) and correlated with parental feeding scales. COMPX scores were higher for the preloads with disguised cues (73.2% SD 74.98) than for those with undisguised cues (54.5% SD 56.51) (t=1.75, df 60, p=.005), but scores were also correlated .21 (p=.100). Mean COMPX over the two occasions was 63.9% (SD=51.52). No significant associations between mean COMPX and parental feeding were apparent.

Table 7.7: Correlations between child eating outcomes and parental feeding

	COMPX Part 1 (n=95)		COMPX Part 2 (n=78)		Average COMPX (n=61)	
	r (p)	N	r (p)	n	r (p)	n
Pressure to eat	.07 (p=.499)	90	.05 (p=.678)	66	.17 (p=.222)	56
Food to reward food	.17 (p=.110)	90	-.09 (p=.480)	67	.12 (p=.378)	56
Prompting to eat	-.05 (p=.618)	90	.02 (p=.902)	66	-.07 (p=.597)	57
Emotional feeding	-.11 (p=.316)	91	-.04 (p=.739)	67	-.13 (p=.341)	57
Monitoring	-.22 (p=.037)	91	-.14 (p=.251)	68	-.16 (p=.237)	57
General restriction	-.00 (p=.970)	91	-.18 (p=.138)	67	-.17 (p=.209)	57
Meal-time rules	.02 (p=.850)	91	.06 (p=.661)	67	.07 (p=.606)	57
Food to reward behaviour	.01 (p=.922)	90	.01 (p=.919)	66	-.12 (p=.375)	56

Associations between compensation and other variables

Correlations between compensation and all variables discussed below are presented in Table 7.8.

Compensation and CEBQ. In order to test whether the compensation test was measuring the same underlying construct as psychometric measures of child eating behaviour, correlations with COMPX in Part 1 and Part 2 were calculated for those subjects completing all preloads. There were no significant associations between COMPX in Part 1 and CEBQ scores. There was a marginally significant relationship between Part 2 COMPX and satiety responsiveness (r=.22, p=.072, n=67), and no relationship with any other scales. Examining correlations with average COMPX over each part revealed a significant positive association between compensation and satiety responsiveness (r=.29, p=.032, n=65).

Compensation and adiposity. As an different form of validation, associations between compensation and adiposity were also tested, with the prediction that poorer compensation would be associated with higher child adiposity (see Table 3). Caloric compensation in Part 1 showed a negative but non-significant correlation with BMI centile such that more effective compensation was associated with lower adiposity in children (r=-.11, p=.312, n=90). A similar pattern of results was evident for compensation in Part 2, which showed a strong negative association with child weight as measured by BMI (r=-.30, p=.011, n=74) and BMI centile (r=-.19, p=.122, n=65). Examining correlations with average COMPX over each part revealed a significant negative association with BMI centile (r=-.30, p=.026, n=61).

Given indications of sex differences in the association between compensation and child adiposity in past research (Johnson & Birch, 1994), correlations between compensation and BMI centile were also conducted separately for each child sex. The correlation between compensation in Part 1 and BMI centile was substantially stronger for boys (r=-.24, p=.105, n=46) than for girls (r=-.02, p=.894, n=44). There was no difference in the magnitude of correlations between Part 2 compensation and BMI centile according to child sex (Boys r=-.18, p=.322, n=33; Girls r=-.19, p=.291, n=32).

Compensation and confounding variables. In order to test the influence of possible confounding factors such as demographic variables, child age and temperament, zero order correlations between possible confounders and COMPX scores were generated. Compensation in Part 1 showed no significant associations with any parental factors, and was not associated with child age. Average compensation over both parts was negatively correlated with children's general activity levels (r=-.36, p=.007). A trend towards lower enjoyment of food in children with better compensation was also apparent.

Table 7.8: Correlations between CEBQ scores, BMI centile, child temperament and child eating outcomes

	COMPX Part 1 (n=95)		COMPX Part 2 (n=78)		Average COMPX (n=61)	
	r (p)	n	r (p)	n	r (p)	N
Child eating behaviour						
Food responsiveness	.13 (p=.209)	90	-.02 (p=.854)	67	.02 (p=.867)	56
Satiety responsiveness	.05 (p=.639)	90	.22 (p=.072)	67	.29 (p=.032)	56
Enjoyment of food	-.05 (p=.654)	91	-.09 (p=.480)	68	-.24 (p=.074)	57
BMI centile	-.11 (p=.312)	90	-.19 (p=.122)	65	-.30 (p=.026)	57
Child temperament						
Sociability	.06 (p=.577)	90	-.09 (p=.460)	66	-.08 (p=.565)	56
Activity levels	-.14 (p=.191)	90	-.22 (p=.080)	66	-.36 (p=.007)	56
Emotionality	-.03 (p=.749)	90	.03 (p=.820)	66	-.00 (p=.991)	56
Shyness	.11 (p=.320)	90	.04 (p=.747)	66	.10 (p=.474)	56

7.4. Discussion

Study 6 demonstrated significant caloric compensation in 4-5 year olds using two variants of the preloading paradigm, one where cues to the energy content of the preload were disguised, and one where maximal cues were available. There was little evidence for a relationship between parental feeding and compensation with the exception of a small negative correlation between monitoring and compensation using undisguised preloads. However, compensation ability showed a positive association with satiety responsiveness scores and a negative association with BMI centile, suggesting that the methods used were valid ways to assess children's habitual intake regulation with consequences for adiposity. Results are discussed in more detail below.

7.4.1 Caloric compensation

Mean caloric compensation in the traditional paradigm (i.e. using disguised preloads) was 69.6% (SD 77.14), while compensation using undisguised preloads was 50.9% (SD 58.27). It is not advisable to put too much emphasis on comparing compensation between studies because of variation in the preloads and meals used. However our preload calorie difference in Part 1 was comparable to the difference achieved in Johnson & Birch's (1994) study of 3-5 year olds and Faith et al's study of 3-7 year olds (2004), supporting the drawing of comparisons. Our mean level of compensation (69.6%, SD 77.14) in the traditional, disguised preload paradigm fell in between the levels found in these two studies (45%, Johnson & Birch, 1994; 104%, Faith et al, 2004). As the undisguised preload condition was novel, it is not possible to compare our results with others. However, the demonstration of significant compensation within this paradigm indicates that it has potential as an ecological way to assess intake regulation.

It should be noted that our results (and those of the groups above) are likely to be unique to situations in which the interval between preload and test meal is no more than 30 minutes. Gastric emptying occurs at a rate of approximately 2-3 kcal/min in adults, and may be slightly faster in children. Thus the low calorie preloads would have left the stomach at the end of the 30 minute interval, while this process would still be underway for the high calorie preloads. Results may differ given a longer interval after preload consumption. For example, preload studies which use a longer, 1.5 hour interval (e.g. Cecil et al, personal communication) will test participants' responses to a wider range of intestinal, metabolic and hormonal signals.

7.4.2 Parental feeding and caloric compensation

Only limited support was found for the pairing of higher parental restriction of child food intake and poorer compensation indicated in Birch and Fisher (2000). Higher 'Monitoring' was related to lower COMPX scores (using conventional disguised preloads) in the current study. When compensation was calculated for undisguised preloads, an additional association with 'General restriction' was also apparent, although neither correlation reached significance. It is possible that the effects would have reached significance if the sample was larger or if COMPX scores were used as just one estimate of a latent 'intake regulation' variable, as in Birch & Fisher (2000).

Although our results are in line with other findings, it is not clear how they should be interpreted. A plausible explanation is that children who display characteristically poorer intake regulation inspire higher levels of 'Monitoring' in their parents.

However, such associations are more commonly interpreted as reflecting effects of parental restriction on children's regulation. For example, Birch and colleagues suggest that attempts to monitor and limit children's consumption may lead them to focus on external rather than internal cues to when and whether they should stop eating. This is consistent with broader theories of parenting and child development, which suggest that authoritarian parenting (characterised by making high demands and exercising low levels of control), prevents children from developing autonomy and may lead to unfavourable behavioural outcomes (Baumrind, 1971). In further support of the principle that children's eating style is the result of learnt behaviour, Johnson (2000) found that caloric compensation improved in children who underwent an intervention teaching them to focus on internal satiety sensations when eating.

However, it is not clear why restrictive behaviours should be associated with intake regulation and not pressure to eat or the imposition of rules about what and how much to eat at meal-times, which are the most obvious examples of asking the child to ignore internal cues to satiety and respond to adult-imposed cues. One possibility is that failure to regulate in this particular paradigm was the direct result of over-consumption of normally restricted snack foods (e.g. chocolate biscuits, cheese crackers). In support of this, chocolate biscuit intake was significantly negatively correlated with compensation in Part 1 ($r=-.22$, $p=.036$, $n=95$). The results might therefore reflect specific overeating of restricted foods among children who are normally restricted when given the opportunity to eat *ad libitum*.

Excluding commonly restricted foods may have given an estimate of compensation which was less influenced by preferences for unhealthy foods, and may have increased comparability with other compensation studies (Faith et al, 2004; Johnson & Birch, 1994). However, we felt it was important to provide a palatable lunch containing familiar items in order to promote children's eating to satiety, and that failure to compensate in the presence of highly palatable foods was likely to be important for weight regulation in an everyday context. Certainly, evidence suggests that a large proportion of children have at least one 'unhealthy' item in their lunchbox, such as chocolate, cake or biscuits (Ludvigsen & Sharma, 2004).

7.4.3 Comparing Part 1 and Part 2 compensation

Comparisons between compensation in Part 1 and Part 2 were limited by the marked reduction in sample size for Part 2, but indications were that compensation was lower in Part 2. This is contrary to what one might expect given that Part 2 preloads should have triggered external as well as internal cues to energy content, and might be because most children are accustomed to drinking high calorie drinks such as milkshake prior to the consumption of meals, and this habit overcomes their short-term satiety responses to such drinks, or has prevented them from associating the sensory properties of the drinks to later post-ingestive effects. In contrast, the disguised drinks used in Part 1 may tap more directly children's sensitivity to these physiological sensations, leading to unconscious adjustment of intake. It was interesting that although compensation was actually lower with the undisguised preloads, subjects did show more of a response in terms of hunger levels in this condition. This may be because the Part 2 preloads were designed to offer maximal external cues to satiety, which are reflected in the conscious hunger difference between preloads, but not in the degree of compensation, which relies more heavily on internal satiety cues.

Differences between Part 1 and Part 2 compensation may also have been driven by features of the preloads used. For example, a limited body of studies suggests that fat is inherently less satiating than protein or carbohydrate, and that people may therefore be less likely to adjust subsequent intake to compensate for the energy content in a high fat meal such as the milkshake preload used here (Blundell et al, 1993). However, there is growing consensus that compensation is not macronutrient-specific (Cecil et al, 1998), and that any relative difficulty people have in compensating for fat is more likely to result from its increased energy density relative to protein and carbohydrate than from unique properties of fat. Indeed, other studies have demonstrated greater appetite suppression with high fat preloads when they are ingested rather than intragastrically administered (Cecil, Francis & Read, 1999). It is therefore unlikely that differences in the physiological effects of the preloads wholly explained the present findings.

Another possibility is that the high calorie preload in Part 2 may have produced a kind of appetizing effect, whereby the milkshake was considered more palatable and therefore stimulated appetite more than the high calorie squash, having the effect of suppressing down-regulation of intake for the high calorie preload in Part 2. Pilot work and observation during the study showed that children who completed the preload drinks liked both high calorie preloads equally, suggesting that there was little difference in palatability, and in general the squash was preferred over the milk drink, as evidenced by the greater number of non-completers in the milk drink condition. However, consumption was indeed higher after the Part 2 high energy preload (strawberry milk) than after the Part 2 high energy preload (high calorie squash) ($t=-2.79$, df 60, $p=.007$), although there was no corresponding difference in hunger levels ($t=0.27$, df 58, $p=.792$). There was also some evidence that consumption ($t=-1.94$, df 60, $p=.057$) and hunger ($t=-1.40$, df 57, $p=.168$) were higher after the Part 2 low energy preload (water) than the low calorie preload (squash), despite matching for energy density. These findings suggest that the preloads used may be associated with different appetitive responses, and merit further investigation.

7.4.4 Validity of compensation indices

As a first attempt to assess the validity of each compensation index as a measure of children's habitual intake regulation, correlations with CEBQ scales were conducted. It was predicted that compensation should relate to satiety responsiveness, a measure of the degree to which children are inclined to cease eating during a meal, or to fail to initiate eating due to feeling full. Average compensation using both indices was positively associated with satiety responsiveness. It was also notable that the strongest association was with compensation using the undisguised preloads. This may be because the use of overt sensory differences in the Part 2 preloads allows expression of normal satiation, and the Part 2 compensation test is therefore a superior test of children's habitual regulation of intake.

As a second form of validity testing, correlations with BMI centile were assessed, with the prediction that poorer compensation in an obesogenic environment would lead to increased intake and ultimately to higher weight. In support of this, there was some evidence for a negative association between compensation and BMI centile such that compensation was poorer in the heavier children. This is consistent with other findings (Johnson & Birch, 1994) and supports the idea that the poor intake regulation captured here may indeed lead to increases in child weight, and ~~as~~ is therefore a phenomenon meriting study. Contrary to the findings of Johnson & Birch (1994), the relationship between compensation and adiposity was stronger for boys than girls, but our sample size (n=95) was too small to draw firm conclusions about sex differences, and Johnson & Birch's (1994) sample was even smaller (n=77). Interestingly, poor compensation has also been found in failure-to-thrive children (Kasese-Hara, Wright & Drewett, 2002), suggesting that it may not inevitably lead to increased eating, but may reflect a more general inability to adjust intake.

7.4.4 Limitations

A number of features of the experimental design may have added to random measurement error, limiting our power to detect all the associations we expected between parental feeding and child outcomes, and emphasising the need for further replication in other samples. Most significantly, compensation was assessed in two tests only. These tests spanned a total of four eating occasions and represent an improvement on other studies which use one test only. However, it is unlikely that a behavioural test can adequately capture children's habitual intake regulation, which has been shown to be better when measured over 24 hours than within a single meal protocol (Birch et al, 1991). In order to capture compensation occurring beyond the experimental situation, parents were asked if their children ate more or less than usual later in the day. No compensation was detected by this method, but this absence of an effect may have resulted from lack of measurement sensitivity. Detailed maternal food records may have provided more information but were considered to be too heavy a burden on parents.

Consistent with the failure of the tests conducted to capture habitual intake regulation, compensation in Part 1 was not related to scores on the CEBQ 'Satiety responsiveness' scale, which is designed to tap habitual intake regulation based on internal satiety cues. However, compensation in Part 2 showed a marginally significant positive association with this scale, together with a stronger negative association with BMI centile. The parent-report and child behaviour measures could perhaps be used in concert in future research, to improve measurement of the intake regulation construct. Another consideration is that the learnt satiation effect observed for the Part 1 preloads may have led to underestimation of compensation among those children who received the high calorie preload first. This is relevant to all studies using disguised preloads within a two-part meal, and is an interesting topic requiring further investigation.

Efforts were made to check for extraneous influences on children's intake. For example, children's general activity levels were found to influence compensation scores. This may reflect that eating behaviour is not an isolated phenomenon and instead forms part of a broader phenotype which includes other aspects of personality. Alternatively, temperament may specifically predict children's responses to the experimental situation, and may thus prevent observation of naturalistic eating behaviour. Other factors may also have interfered with normal compensation, e.g. child illness, child appetite on that day, interaction with other children, the child's mood on the day of testing, anticipation of a play session indoors or outdoors. Limited attempts were also made to assess children's consumption earlier that day. For example, parents completed brief questionnaires describing what their child ate for breakfast, and approximate quantities of fruit were noted for each child at the 10.30/11.00 break. These measures were unrelated to children's preload intakes or lunch intakes, and so results were not reported here.

Another weakness may have been the hunger measure, which was not associated with lunch intake, throwing some doubt as to its validity. However, prospective consumption measures are widely thought to give a better indication of current hunger rather than future intake. There was also some evidence for a group difference in hunger following the high and low calorie Part 2 preloads, and for better compensation among those children who were 'sensitive' to the preload calorie differences in both Parts 1 and 2, in terms of reported post-preload hunger levels. This suggests that the hunger measure was powerful enough to detect differential internal sensations in response to the calorie content of drink preloads, which may help certain children to compensate. A more accurate measure of hunger may help to further understanding of the mechanisms underlying compensation.

There would have been some inevitable loss of accuracy in intake data resulting from dropped food items and dehydration. These discrepancies may have compromised the accuracy of compensation estimates, although such error should have been randomly distributed across conditions and attempts were made to correct the data for all known sources of inaccuracy. Measured intake is therefore likely to be a fairly good approximation of actual intake. Further problems pertaining to the measurement of dietary choices and intake of individual foods are discussed in Chapter 8.

It is possible that the study was under-powered to detect significant associations with parental feeding. Examination of the correlations suggested that effects were smaller ($r \leq .15$) than one would predict from the results of Johnson and Birch (1994) ($r=.65$). The sub-sample for the Part 1 analysis ($n=95$) only gave 31% power to detect a significant effect of this magnitude, and the sub-sample for the Part 2 analysis only 26% power. Future research may therefore benefit from obtaining larger samples.

Finally, as our sample of schools was self-selected, it is uncertain how well our results generalise to other populations of children. However, the high participation rate within each school suggests that we may at least be confident that the results reflect parent-child dyads within the schools we sampled.

7.4.5 Conclusions

In conclusion, Study 6 demonstrated that poorer intake regulation as measured by differential intake in a conventional caloric compensation paradigm was associated with higher 'Monitoring' scores, higher satiety responsiveness and higher BMI centile, and that intake regulation as measured by compensation for calories in preloads with undisguised cues to calorie content showed an additional negative association with 'General restriction'. Neither type of compensation was associated with other parental feeding behaviours which have been theoretically linked to impaired intake regulation, such as encouraging the child to eat everything on his or her plate. Contrary to predictions, compensation was on average better for the disguised than the undisguised preload condition. Study 7 goes on to look at the association between parental feeding behaviours and other child eating outcomes as measured in the same study.

CHAPTER 8

Study 7: Associations between parental feeding style and behavioural measures of children's eating

8.1 Introduction

8.1.1 Rationale

Study 6 explored the relationship between parental feeding and children's ability to regulate their eating as indicated by performance in the caloric compensation paradigm. Other literature suggests that parental feeding may also be associated with other aspects of children's eating behaviour. For example, higher parental restriction has been associated with greater eating in the absence of hunger, maternal encouragements to eat have been associated with faster eating rate, greater overall consumption and lower fruit and vegetable intake, and both restriction and pressure to eat have been associated with greater intake of high fat foods. In Study 7, associations were tested between parental feeding style and a range of child eating outcomes: consumption during an 'eating without hunger' paradigm, average eating rate assessed over two eating occasions, average lunch consumption, and *ad libitum* dietary choices made at lunch over three separate occasions.

8.1.2 Associations between parental feeding and eating in the absence of hunger

Eating in the absence of hunger (EAH). The 'eating in the absence of hunger' test (also described as the 'free access' procedure; Fisher & Birch, 1999a) was designed with the principle aim of assessing children's consumption of normally restricted snack foods in a setting where those foods are freely available, with the hypothesis that children whose mothers restricted them more would have higher energy intakes. In the standard paradigm, children are provided with a standard lunch and then given individual interviews, in which they are asked to taste and rate ten sweet and savoury snack foods (e.g. potato chips, cookies, ice cream), and shown various toys and boxes containing generous amounts of the tasted snack foods. Each child is then left alone with the toys and snacks for ten minutes and intake is assessed.

Given a range of palatable snack foods, most children are likely to eat a substantial amount in a hungry state. In order to avoid ceiling effects and to reveal differences between children, hunger is therefore measured after the initial lunch and only those children describing themselves as 'not hungry' are included in the analyses. This feature of the paradigm means that EAH may, like caloric compensation, be thought of as a test of intake regulation. The difference between EAH and caloric compensation is that in EAH, hunger levels are held constant, and appeal of the food offered is maximised. This creates a specific test of the degree to which the child ignores their internal sensations in favour of responding to the external cue of the presentation of palatable food. That is, performance in the 'eating in the absence of hunger' test gives 'an index of individual differences in responsiveness to the food cues in the environment' (Birch, Fisher & Davison, 2003).

Associations between parental feeding and EAH. In the first study to assess EAH, Fisher and Birch (1999a) conducted individual trials with 71 preschool children (3-5 years of age). Parents completed a scale assessing degree of restriction for each of the snack foods and children's perceptions of restriction were assessed using three simple items. Analysis revealed a significant interaction between child gender and restriction, such that child and maternal reports of restriction predicted higher snack food intake, but only in girls. Subsequent studies from the same research group have found similar results in girls (Birch, Fisher & Davison, 2003; Fisher & Birch, 2002), and findings were also extended to the CFQ 'Monitoring' scale in a study which used both the 'Restriction' and 'Monitoring' scales to estimate a latent restriction variable in a structural equation model predicting EAH (Birch & Fisher, 2000).

More recent studies from the same group have used longitudinal analyses to demonstrate that parents' reports of restricting their daughters' access to foods at 5 years of age predicted EAH at 7 years (Fisher & Birch, 2002), and that girls who were overweight at 5 years and received higher levels of restriction had the highest EAH scores at 9 years, and the greatest increases in EAH from 5 years to 9 years (Birch, Fisher & Davison, 2003). These analyses provide some support for a causal model in which restriction causes children to display more eating without hunger. However, neither analysis included restriction at the second time point, leaving open the possibility that parental restriction merely keeps pace with a burgeoning tendency to eat in the absence of hunger, which may be determined by other factors, such as genetic predisposition and external environment.

8.1.3 Associations between parental feeding and speed of eating

Another approach to quantifying children's eating behaviour is to measure speed of eating. Associations between speed of eating and weight have now been reported in several studies. Nearly 30 years ago, Stunkard & Kaplan (1977) conducted a seminal study observing eating in public places, and found that obese people ate faster than normal weight people. Drabman et al (1979) and others replicated these results in children, finding that obese children ate at a faster rate, took more bites, and chewed each bite fewer times. More recently, Barkeling, Ekman & Rossner (1992) compared lunch consumption among normal weight and obese 11 year olds and found that the obese children ate faster and did not show the deceleration of eating rate towards the end of the meal that is shown in normal weight children. This lack of deceleration has since been demonstrated in a sample of 5-18 year olds (Lindgren et al, 2000), although this study did not find a broader difference in average eating rate according to weight status. Other research has also suggested that associations between eating rate and weight may be evident at a much earlier age, finding that a vigorous sucking rate during feeding at 2 and 4 weeks predicts greater skinfolds and BMI at 1 and 2 years (Stunkard et al, 1999).

Against the background of these kinds of findings, studies have examined how parental feeding relates to eating speed, with the hypothesis that parents of overweight children may be encouraging them to eat faster, longer and in greater amounts via the application of particular feeding behaviours. Klesges et al (1986) observed families eating evening meals at home, and found that parental encouragements to eat (e.g. "Eat your steak") were positively associated with the percentage of time their preschool child spent eating. Taking a different approach, Drucker et al (1999) video-recorded 77 3-5 year olds eating a laboratory-based buffet lunch accompanied by their mothers, and divided overall intake by time spent eating to calculate average eating rate. Eating rate was positively associated with encouragements to eat, but contrary to the findings of Klesges et al (1986), meal time overall was shorter for the encouraging mothers. The expected link between faster eating and higher child weight was not apparent, suggesting that these one-off behavioural observations may not reflect characteristic intake with ultimate effects on weight. A third study of older children did not measure parental feeding directly, but found that overweight children ate faster, took larger bites and ate faster towards the end of a meal, but only when their mother was present (Laessle et al, 2001).

These results suggest that higher parental pressure to eat may be correlated with higher eating rate or with greater time spent eating, depending on the success of the parent's attempts, and on other aspects of the eating situation. For example, if the meal is of determinate size and the parent is successful in his/her attempts, ~~and~~ we would expect encouragements to be associated with a fast eating rate and short eating time. This may be particularly true when the test occurs in a laboratory setting, creating an unnatural situation which parents may wish to bring to a swift conclusion (e.g. Drucker et al, 1999). Alternatively, if the mother and child are in more relaxed circumstances (e.g. own home vs. lab), we might expect to see an association between pressure to eat and longer eating time (Klesges et al, 1986). If additional helpings are available, we might also see increased time spent eating.

Another important feature of the studies discussed above is that they were observational and therefore examined the immediate influence of the mother. In the current study maternal pressure is measured psychometrically and the child's eating is free from immediate influence. Pressure scores are therefore more likely to be a reflection of mothers' habitual behaviours, while children's eating is a reflection of how they will tend to eat when outside the influence of the family, which may give a better indicator of obesity risk. Based on evidence for a negative association between pressure to eat and adiposity, it was therefore predicted that pressure to eat would be greater for children who spend a short time eating or have a slow eating rate, both of which we assume to be indices of low interest in and intake of food.

8.1.4 Associations between parental feeding and children's intake

Influence of pressure to eat on intake. Rather than directly assessing children's eating in defined experimental situations, a number of studies in the 1990s looked at associations between parental feeding behaviours and various measures of children's food intake. For example, one study used videotapes of urban African-American preschool children eating at home at noon and in the evening (Iannotti et al, 1994). Intake was not measured directly, but parental commands, actions and rationales were observed to be successful ways of encouraging the child to eat, while threatening the child with negative consequences was ineffective. In another naturalistic study, Koivisto, Fellenius and Sjoden (1994) videotaped evening meals in the homes of 50 Swedish families with 3-7 year old children, and found that children's energy intake was positively correlated with taking food on the recommendation of a parent.

In contrast, other studies suggest that in some situations, encouragements to eat may actually be associated with poorer intake. For example, Drucker et al (1999) found that higher prompting to eat (as measured by rates of food offers, food presentations and total number of prompts to eat) was associated with *lower* total calories consumed. More studies are required before conclusions can be drawn, but it seems likely that where pressuring to eat is effective, intake increases, and where it is an ineffective response to a child with poor appetite, it is accompanied by low levels of intake. Where habitual rather than current parental pressure is measured, and children's eating is observed outside of the influence of their parents, we might therefore expect higher pressure to eat to be associated with lower intake.

Influence of restriction on intake. Another feeding behaviour which has been associated with children's intake is parental restriction of their children's consumption of energy dense snack foods. For example, Klesges et al (1991), asked 52 4-7 year olds to select food for lunch from a cafeteria setting, and then to re-select a tray of food that would be inspected by their mothers. The tray of food was then actually modified by mothers (i.e. additions, removals) before consumption with the child. Results showed that both actual maternal 'monitoring' and the threat of monitoring lowered total caloric content of the selected foods. ~~Similar~~ results were found in a study of 197 mothers and their 5 year old daughters: the CFQ Restriction scale was ~~neg~~atively correlated with daily energy intake as assessed from mothers' 3-day 24 hour recalls (Birch & Fisher, 2000).

A small number of studies have also experimentally manipulated restriction and assessed effects on immediate intake. Fisher and Birch (1999a) report two studies of

3-5 year olds recruited from a university day care program, the second of which demonstrated a direct effect on intake. This study used a within-subjects design, in which all children participated in four unrestricted snack sessions followed by four restricted snack sessions. Each child had his or her own 'target' snack, which was selected for initial high preference, reflecting how restriction is practised by most parents. Trials were similar to those in the first study, but with a relatively longer period of access to the target food (5 minutes), allowing better comparison with intake of the unrestricted food. Children showed significantly more positive and negative comments and behaviours in the restricted condition, and this time both intake and snack selection were significantly greater for the target food. This result suggests that although restricting foods may decrease intake when foods are consumed largely in the presence of the mother, it may also have the paradoxical effect of heightening children's preferences for these foods, which could impact upon their *ad libitum* dietary choices.

8.1.5 Associations between parental feeding and dietary choices

Associations between parental feeding and the particular constituents of children's diets have been demonstrated at a variety of levels. Studies looking at 'healthy eating' practices in later childhood and adolescence have found associations between parental feeding and children's intake of particular types of food as demonstrated by multi-category or single category food frequency data, 24 hour dietary recalls, child food records and healthy food choices. Experimental studies have also highlighted links between feeding strategies and young children's preferences for foods as indicated by behavioural observations. Evidence is reviewed below.

<u>Influence of parental feeding on children's dietary composition</u>

Studies examining cross-sectional associations between measures of parental feeding and children's actual dietary intake have highlighted differences in feeding strategies associated with fruit and vegetable intake, with the consumption of energy dense foods such as high fat items, sweets and soft drinks, and with general nutritional adequacy in terms of vitamin and mineral intake.

Fruit and vegetable intake. Studies measuring fruit and vegetable intake have produced a mixed picture of relationships with parental feeding, possibly because of diversity in parental feeding measures and child age group. Cullen et al (2000) assessed food socialisation practices in parents of 11 year olds. These practices included various methods of encouraging the child to eat (e.g. 'tell your child that it's good for his/her health / if he/she eats it you will give him/her dessert'), and of discouraging intake (e.g. 'tell your child it's not nutritious', 'put it somewhere your child can't find it', 'take away things your child likes to do for eating it'). None of the practices were associated with fruit and vegetable intake as assessed by student food records. In a related study using 230 9-11 year olds as informants, Cullen et al (2001) examined associations between fruit, juice and vegetable consumption based on two-day records, and three measures of parental feeding: parent control (e.g. 'she makes sure I eat my vegetables before I can eat dessert'), permissive eating (e.g. 'she lets me eat whatever I want for lunch') and food self-preparation (e.g. 'she lets me prepare my breakfast'). Parental control showed a small positive correlation with juice consumption, but no other associations emerged. The authors suggest this may be because child food records were too insensitive as measures of child intake. The age of the children may also have contributed to the negative results, as parents may be less influential for older children.

Using a wider range of child ages, a recent American study reported data from parents with children aged 0-17 years (Bourcier et al, 2003). Higher scores on a 'pressuring' scale were associated with higher intake of fruit and vegetables based on a single frequency question. 'Pressuring' was operationalised here with a diverse four-item measure (α=0.52) assessing frequency of the following behaviours: 'making a negative comment', 'trying a little food', 'offering a bribe' and 'serving a food again until your family tried it'. In a Flemish study of parents of 2-7 year olds, Vereecken, Keukelier & Maes (2004) examined associations between frequency of fruit and vegetable consumption and a wide range of well-defined feeding practices. Vegetable consumption was negatively associated with permissiveness (e.g. 'If my child asks for sweets or biscuits, I will give it to him/her') and catering on demand of the children (e.g. 'When I compose a meal, I let my child choose from several suggestions'), and positively associated with pressure to eat (e.g. 'my child has to finish his/her plate'), negotiation (e.g. 'if my child does not like something we agree that he/she only has to eat a small amount') and verbal praise (e.g. 'I praise my child if he/she eats vegetables'). Fruit consumption showed positive associations with verbal praise, verbal encouragement through rationale (e.g. 'tell child "Fruit is good for you"'), and parental restraint from negative modelling behaviour (e.g. 'If I would like to eat sweets, I would restrain myself because of the presence of my child').

In contrast, other studies using younger children have found a negative association between pressure to eat and fruit and vegetable intake. For example, Fisher et al (2002) assessed 5 year old girls' consumption of fruit and vegetables via three 24 hour dietary recalls conducted with their mothers, and found that higher scores on the CFQ 'Pressure to eat' scale were associated with lower consumption. We have recently replicated this association in a large UK sample of 2-6 year old boys and girls (Wardle, Carnell & Cooke, 2005).

Other indirect evidence that pressure to eat might be associated with fruit and vegetable intake can be seen in intervention research. For example, Gribble et al (2003) administered a nutrition intervention to 9 pairs of 10-12 year old children and their mothers. The 10 session intervention covered exposure, monitoring, restriction, reward/punishment and encouragement to eat in relation to food intake. Post-testing revealed a decrease in CFQ 'Restriction', 'Monitoring' and 'Encouragement to eat' in the intervention group, and a concurrent increase in fruit intake. However, it was not possible to assess which component of the intervention affected fruit intake, and post-intervention preferences did not differ between intervention and control participants.

These mixed findings suggest a strong need for studies relating a comprehensive range of validated parental feeding measures to reliable and valid measures of children's fruit and vegetable intake. Existing research suggests that subtle, 'authoritative' forms of encouragement such as verbal praise, increasing the appeal of foods, and flexibility regarding portion size are likely to show positive associations with fruit and vegetable consumption. In contrast, pressuring behaviours such as forcing the child to eat fruit and vegetables, or rewarding their consumption are likely to have a negligible or negative impact.

Intake of energy dense foods. A number of the studies above also reported specific associations between parental feeding and intake of high fat or high sugar foods. For example, Vereecken, Keukelier & Maes (2004) found that parent-reported frequency of their 2-7 year olds' sweet consumption and soft drink intake was positively associated with permissiveness. Sweet consumption was additionally correlated with using food as a reward and catering to the child's demands. Consistent with these findings, a study of Mexican American and white families with 4 year olds found a negative correlation between parental control over the child's fat intake and the child's percentage energy from fat (~~Murphy~~ Zive et al, 1998), while giving food as a reward was unrelated to fat intake. Bourcier et al (2003) also found a negative association between a parental feeding scale incorporating behaviours such as 'monitoring' and 'getting them to eat foods you make' and intake of high fat foods in a large sample of 2-17 year olds. Studies of adolescents also suggest that higher parental control at an earlier age may lead to healthy choices and lower intake of foods that are high in fat and sugar (De Bourdeaudhuij, 1997).

Other evidence suggests that parental control over feeding may have negative consequences in terms of fat intake. In a study designed to compare the characteristics of 5 year old girls meeting or exceeding recommendations for total dietary fat, Lee et al (2001) compared maternal feeding styles in 'high fat intake' and 'low fat intake' groups, based on data from three 24 hour recalls. When controlling for child BMI, both maternal restriction and pressure to eat were higher for girls in the high fat intake group, suggesting that where feeding strategies are not a response to weight, both are related to decreased 'healthiness' of the diet instead. This pattern of associations is consistent with research relating parental restriction of pre-schoolers to higher 'eating without hunger' when children are given unlimited access to a wide range of palatable snack-foods (Fisher & Birch, 2002; Fisher & Birch, 1999b).

<u>Influence of parental feeding on children's food preferences</u>

A separate body of work has tested the more precise hypothesis that parental feeding may influence children's food preferences, which could not only influence current intake patterns, but also the future composition of the diet. Experimental evidence suggesting that restricting foods may increase preferences for them has already been discussed (Fisher & Birch, 1999a). Only one retrospective study has examined the influence of pressuring children to eat, finding that 72% of college students who had experienced forced consumption in childhood reported that they would not willingly eat the target food on the day of questioning (Batsell et al, 2002). However, it is not clear whether forced consumption caused dislike, or dislike motivated the parent to try to force consumption.

Instrumental feeding. There has been greater research interest in the impact of using food in a means-end contingency (i.e. instrumental feeding) on food preferences. The food item of interest may occupy either or both places in a contingency. For example, it might be used as the route to a non-food reward e.g. "If you eat your peas I'll take you to the cinema", or as a reward in itself, used to reinforce desirable behaviour, e.g. "If you tidy your room you can have an ice-cream". Parents commonly employ healthy foods as means, and less healthy foods as ends, sometimes simultaneously (e.g. "If you eat your peas, you can have an ice-cream").

Food as a reward. To date, the literature suggests that using a food as a reward increases preferences for that food, while using food as a means to an end decreases preferences for it. For example, Birch, Zimmerman & Hind (1980) presented children with food rewards for the performance of certain behaviours, and found that preference for the reward food increased, and was maintained for six weeks following the intervention. A further experiment demonstrated that enhanced preference also generalised to foods that were perceived as similar to the rewarded food, suggesting that using one high energy snack food as a reward may result in higher preferences for other food in that category (Birch, 1981).

Food as a means to an end. Birch et al have also tested the impact of using food as a 'means to an end'. For example, Birch, Marlin & Rotter (1984) used movie tickets and verbal praise to reward preschool children for consuming an initially novel beverage (flavoured milk), and found that their post-intervention preferences for the milk were comparatively lower than those of a mere exposure group. Newman and Taylor (1992) demonstrated similar effects with food rewards, finding that 4-7y olds whose consumption of a target snack (Snack A) was rewarded by consumption of another snack (Snack B) showed decreased preferences for Snack A relative to Snack

B, and relative to temporal order and mere exposure control groups. These findings suggest that where parents use less healthy foods to reward the consumption of healthy foods, they may simultaneously increase preferences for the former while decreasing preferences for the latter.

8.1.6 The current study

The current study tests associations between a variety of well-defined parental feeding behaviours and the following child eating outcomes: consumption in an 'eating without hunger' paradigm, eating rate, overall intake, and dietary choices made at lunch. Based on existing literature and earlier studies in this thesis, the following hypotheses were tested: i) Pressuring to eat will be negatively associated with eating rate, overall intake and fruit and vegetable intake; ii) Restricting behaviours will be positively associated with 'eating without hunger' intake, eating rate, time spent eating, overall intake and snack food intake.

We were also interested in the association between the newly generated 'Food to reward food' and 'Food to reward behaviour' scales, and children's *ad libitum* dietary choices, which we assumed would be driven directly by children's preferences. Given evidence that children develop preferences for foods used as rewards, and these are most often energy-dense snack foods or desserts, we predicted both scales would be associated with consumption of chocolate biscuits and cheesy crackers. Given that foods used as means to an end are most often fruit and vegetables, we expected that 'Food to reward food' might additionally be associated with lower fruit and vegetable consumption. Based on evidence for the success of 'softer' ways of encouraging consumption of healthy foods, an additional prediction was that scores on 'Prompting to eat' would be associated with higher fruit and vegetable intake.

8.2 Methods

8.2.1 Procedure

Lunch session. Children's lunch intake was recorded on three separate days in consecutive weeks – a) on a 'control' day, following the routine scheduled fruit snack break at 10.30/11.00, b) on Days 2 and 3, following a low energy (5.02 kcal) or high energy (174.22 kcal) orange squash preload consumed half an hour before lunch. Low and high calorie preloads were counterbalanced such that half of the children had the low calorie preload on Day 2 and the high calorie preload on Day 3, while the other half experienced the conditions in reverse order.

Although lunch intake data were also available for two subsequent days where water and strawberry milkshake preloads were administered (Days 4 and 5), these days were not included in the current analyses because while it is normal for children to be offered a drink of squash in the morning, it is less usual to be given a rich milkshake, and we wanted the dietary intake measured to reflect *ad libitum* eating under relatively normal circumstances. However analyses were also conducted using data from all occasions, and from low calorie days only, with almost identical results.

Lunches consisted of: 5 chicken slices (Sainsbury's Chicken Slices, J Sainsbury plc, M=60.6 g, 70.9 kcal), 4 cheese slices (Sainsbury's Medium Cheddar Slices, J Sainsbury plc, M=50.5 g, 207.2 kcal), 3 halves of white bread roll (Tesco's Bridge Rolls, Tesco plc / Sainsbury's Hot Dog Rolls, J Sainsbury plc, M=53.6 g, 143.7 kcal), approximately 35 g of mini cheese biscuits (McVities Mini Cheddars, M=36.0 g, 190.6 kcal), approximately 50g of mini chocolate biscuits (McVities Mini Chocolate Digestives, M=50,7 g, 261.9 kcal), and approximately 98 g white grapes (M=98.3 g, 63.4 kcal). A portion of vegetables was also provided. For School A this was 8 cherry tomatoes (M= 102.5 g, 18.5 kcal); for School B-D this was approximately 54 g carrot sticks (M= 54.1 g, 18.9 kcal). Extra pre-weighed portions of bread rolls were offered where children finished their servings, and water was provided. Lunch tray contents were weighed before lunch and after lunch in order to calculate lunch intake. The time each child finished their lunch was recorded on Days 2 and 3 in order to calculate time spent eating and speed of eating.

Eating without hunger test. After lunch on Day 3, an 'eating without hunger' (EWH) test was conducted as soon as possible after lunch. In practice this was approximately half an hour after lunch, with a play period intervening. Children were taken out of the classroom individually and hunger levels were assessed. School A children were then offered a name-labelled bag containing approximately 15 Mini Jammie Dodgers

(McVities, 4.48kcal/g). As six of the participating 15 children at this school ate all of the biscuits (thus limiting variation in intake data), this amount was increased to approximately 18 biscuits in Schools B-D. On average, each individual School A bag weighed 78.4 g (SD 1.25) and contained 351.0 kcal (SD 5.6). Schools B-D bags weighed 93.3 g (SD 2.75) and contained 417.9 kcal (SD 12.32). Researchers told children they could take the bag and eat as many biscuits as they liked during the next class session, but they should not share with their friends, and the bags would be collected in about ten minutes time. They were also given the option to refuse the bag. This method was based on Birch and colleagues' 'eating in the absence of hunger' test, and adapted from a simplified version employed by Cecil, Hetherington et al (Cecil, personal communication).

Parent questionnaires. Parents were given the questionnaire described in Chapter 7. A sample questionnaire can be found in Appendix VI.

8.2.2 Data analysis

Calculating 'eating without hunger' consumption. Intake of biscuits in grammes was estimated by calculating the difference between pre- and post- weights of the distributed bags. Eight children refused bags, one of whom was allergic to strawberries, four of whom said they didn't like the biscuits, and two of whom explained that they weren't hungry and therefore did not want the bag. Future analyses were conducted after excluding those who refused due to liking or allergies (n=5) and those who refused bags due to lack of hunger (n=2) were included in the dataset as zero scores.

Calculating speed of eating. The length of time spent eating was calculated from start and finish times recorded on Days 2 and 3. Day 2 time spent eating ranged from 10 to 48 minutes (M=23.6, SD 6.59) and Day 3 time spent eating ranged from 9 to 60 minutes (M=24.5, SD 8.24). As the correlation between days was substantial ($r=.49$, $p<.001$), the mean of both days was calculated in order to represent average time spent eating. Eating rate was then calculated, by dividing total lunch energy (kcal) for days 2 and 3 by total minutes spent eating to give an average eating rate in kcal/min.

Calculating average lunch intake for individuals. In order to represent children's average *ad libitum* lunch intake over a range of possible situations, the mean of lunch calories consumed on the control, low calorie preload (Part 1) and high calorie preload (Part 1) days was calculated. Where data were missing for one or two days, means were calculated using data from the remaining day/s. The disadvantage of this approach to missing data is that values for individuals who participated on only one day may not be as representative of their behaviour as those for individuals participating on 2 or 3 days. However, given the small numbers and potential for inaccuracy in the current dataset, it was important to increase numbers in order to maximise power to detect associations between parental feeding and children's intake.

Calculating average intake of individual foods. Average intake of individual foods was generated by summing the weight in grammes of each food consumed on the control, low calorie preload and high calorie preload (Part 1) days, and calculating the mean. Again, where data were missing for one day, means were based on the remaining data. Energy content (kcal) for each processed food used was calculated using manufacturers' information (i.e. chocolate biscuits, cheesy crackers, chicken slices, cheese slices), and average calorie contents from McCance and Widdowson's The Composition of Foods (Food Standards Agency, 2002) were used to calculate energy content for the remaining foods (tomatoes, carrots, grapes, bread rolls). Percentage calorie intakes for each food were calculated by dividing the total calories consumed on each day by the calories of the individual food consumed and multiplying by 100. The mean percentage intake over the control and experimental days was then derived.

Calculating average intake by food group. Children's dietary choices and total intake were hypothesised to be predictors of later obesity risk which might be associated with parental feeding strategies. However, intakes of individual foods varied widely between individuals, depending on their liking for specific foods. In order to create variables representing children's liking for particular food groups (which were assumed to be less variable than liking for individual foods), individual foods were therefore divided into four categories with differing associated obesity risk: 'Fruit and vegetables' (tomatoes/carrots, grapes - Low risk), 'Bread rolls' (Medium risk), 'Protein foods' (chicken, cheese - Medium risk), and 'Snack foods' (chocolate biscuits, cheese crackers - High risk). The high risk foods are energy-dense items, shown to be associated with higher weight (Newby et al, 2003; Drapeau et al, 2003); the 'Low risk' foods have been shown to be protective against obesity, possibly by replacing more energy-dense foods in the diet (e.g. Fisher & Birch, 1995). The medium risk categories represent foods which have not been specifically associated with obesity, but over-consumption of which would result in increased weight.

Food group intakes were calculated by taking the mean of the average weights consumed of each food in each food group over the control and Part 1 preload days. For example, fruit and vegetable intake was calculated by taking the mean of the average tomatoes consumed, average carrots consumed and average grapes consumed. An averaging rather than summing method was chosen in order to represent children's average liking for items within each food category; it was felt that a summing method could be distorted by heavy consumption of one item (e.g. grapes) in the context of minimal consumption of the others (e.g. carrots), and that this would not therefore represent the child's average consumption for the category.

Where children were not offered all the foods in a group (e.g. 4 vegetarian children were provided with extra cheese instead of chicken, 13 children received tomatoes, not carrots; 82 received carrots, not tomatoes), calorie intakes were calculated based on the available foods. As carrots were more popular than tomatoes, children offered only tomatoes may have had accordingly lower 'Fruit and vegetable' estimates, but grape intake also contributed to the score and was comparable between schools. Cheese was more calorific than chicken but cheese intake was correspondingly lower, so protein calories are likely to be comparable for vegetarian and non-vegetarian children. It is possible that the lack of variety for vegetarian children depressed their protein intake, but this would only have occurred in 4 children so is unlikely to have affected group-wide associations. An alternative approach would have been to omit cases with differing food profiles from the analysis, but it was thought preferable to retain as many cases as possible. Average intakes in kcal and percentage calorie intake were also derived for the food group data, using similar methods to those described above.

8.3 Results

8.3.1 Eating without hunger

112 children participated in the 'eating without hunger' test, representing 91% of children who participated in our experiments on at least one day (112/123). Mean weight of food consumed was 50.9 g (SD 27.89), equating to approximately 10 (SD 5) jam biscuits, and providing approximately 227.9 kcal (SD 124.95). Intake ranged from 0 g (0 kcal, n=6) to 95.8 g (429.18 kcal, n=1). There was no significant difference in intake between children in School A who were offered 15 biscuits (M=52.7 kcal, SD 28.96) and children in Schools B-D who were offered 18 biscuits (M= 50.6 kcal, SD 27.85) (t=0.29, df 110, p=.776).

The overall distribution of consumption in the 'eating without hunger' test was approximately normal, although there was some evidence of kurtosis (-.15, SE .23; -.97, SE .45). An independent samples t-test was used to test any sex differences in intake for the whole sample. There was no significant difference between boys' (M=51.2 SD=29.67, n=60) and girls' (M=50.5 SD=25.97, n=52) intake (t=.130, df 110, p=.897), and no correlation between child age and 'eating without hunger' intake (r=.11, p=.26), although intake was slightly greater in older children.

Although in the majority of studies using an 'eating without hunger' paradigm, children are only included in the analyses if they report that they are not hungry prior to the test (Birch, Fisher & Davison, 2003; Fisher & Birch, 2002; Fisher & Birch, 2000; Fisher & Birch, 1999b), data from all subjects is reported here. This is because assessment of hunger prior to the test showed that 3 children reported not being hungry at all, 49 reported being slightly hungry, 20 reported being quite hungry, and 38 reported being very hungry. Given that assessment was conducted very soon after lunch, when children were expected to be full, this may indicate a lack of sensitivity in the hunger measure. Alternatively the majority of the children may genuinely have been hungry. Either way, to exclude children on this basis would radically compromise the sample size.

8.3.2 Speed of eating

Time spent eating. Time spent eating lunch was calculated for 120 cases, for whom time of lunch completion was available on Days 2 and/or 3. This figure ranged from 9 to 55 minutes (M=24.4, SD 6.96), and scores showed a broadly normal distribution, with a slight positive skew created by the very small number of children (n=2) taking over 45 minutes to finish their lunches. As these children took only 10 and 13 minutes longer, respectively, these values were not considered outliers and were included in subsequent analyses.

In order to test whether time spent eating reflected greater intake or lesser intake (via slower eating rate), meal duration was correlated with lunch intake on Day 2 and Day 3. Time spent eating showed a strong positive correlation with calories consumed on both Day 2 ($r=.57$, $p<.001$, $n=105$) and Day 3 ($r=.57$, $p<.001$, $n=112$), leading to a similar correlation with average calories consumed over these two days ($r=.51$, $p<.001$, $n=120$).

Eating rate. Rates varied from ~~0.06~~ 3.6 kcal/min to ~~0.60~~ 36 kcal/min, with a mean of ~~0.3~~ 18 kcal/min (SD ~~0.11~~ 6.6). Average eating rate showed a trend towards a negative correlation with time spent eating ($r=-.10$, $p=.262$, $n=120$), but this effect was not significant. Eating rate showed a strong positive correlation with average energy intake from lunch ($r=.74$, $p<.001$, $n=120$).

Figures 8.1 and 8.2 show scatter-plots representing the relationship between time spent eating and intake, and eating rate and intake, and demonstrates that whereas the latter is linear, there is wide variation in calories consumed among those taking between 15 and 30 minutes to finish their lunch, representing the fact that of those children who took a long time to eat lunch, some ate a great deal and others were very reluctant to eat; each of these behaviours delayed meal termination. Since eating rate showed the clearest relationship with intake, this index was used as the main index of eating speed in subsequent analyses.

Figure 8.1: Relationship between time spent eating and lunch intake

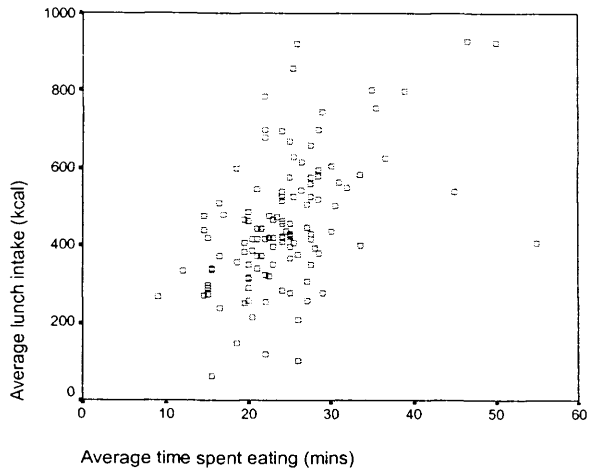
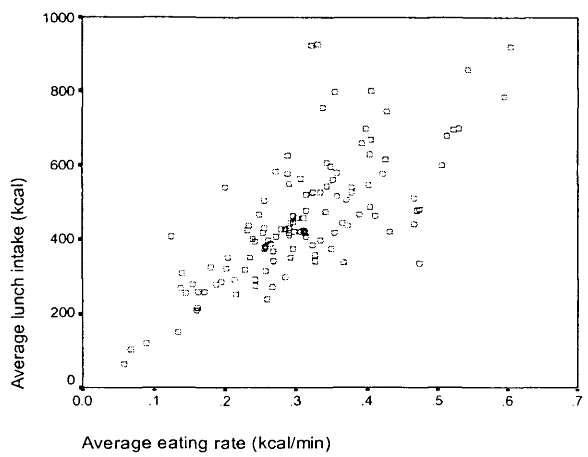


Figure 8.2: Relationship between eating rate and lunch intake



8.3.3 Overall intake

Ninety-three children ate lunch on the control day, 108 on Day 2 (of whom 54 received the low calorie preload, and 54 received the high calorie preload), and 113 on Day 3 (of whom 56 received the low calorie preload, and 57 received the high calorie preload). Table 8.1 gives basic descriptive data on calorie intake during each lunch session together with average intakes over all three lunches. Combined intakes (i.e. preload plus lunch intake) are also presented.

Differences between lunch intake after high and low calorie preloads. As explored in greater detail in Chapter 7, lunch intake was lowest in the high calorie preload condition (M=374.9 kcal, SD 183.6), and highest in the low calorie condition (M=504.7 kcal, SD 175.5). Average control intake fell in between these two values

(M=483.4 kcal, SD 164.2). A series of paired samples t-tests showed that control intake was significantly higher than intake after the high calorie preload (t=7.51, df 88, p<.001), and intake after the low calorie preload was significantly higher than intake after the high calorie preload (t=9.15, df 100, p<.001), but control intake was not different from the low calorie preload (t=1.23, df 88, p=.222).

Given that lunch consumption was lower after the high calorie preload and higher after the low calorie preload, combined intake (i.e. preload plus lunch) was also compared between conditions to see whether combined calorie contents were more comparable that those for lunch alone. Combined intake was greater in the high calorie (M=541.1 kcal, SD 184.56) than the low calorie (M=501.5 kcal, SD 174.49) condition, reflecting the absence of complete compensation. Combined intake in the high calorie conditions was significantly higher than for the control condition (t=-.413, df 84, p<.001), and combined intake in the high calorie condition was significantly higher than intake in the low calorie condition (t=-3.31, df 100, p=.001), but there was no difference in combined intake for the control condition and combined intake for the low calorie condition (t=-1.57, df 84, p=.120). As combined intakes showed a very similar pattern to lunch intakes, the latter were adopted for future analyses.

Table 8.1 Lunch intake (kcal) and combined intake (kcal) for each condition (n=95)

	n	Mean (SD)	Range
Control day lunch intake			
Control day	93	483.45 (164.20)	85.09 - 932.75
Lunch intake Days 2 and 3			
After low calorie preload	110	504.74 (175.50)	57.38 - 1010.10
After high calorie preload	111	374.89 (183.57)	45.10 - 913.18
Average after control, Day 2, Day 3	*120*	*454.48 (166.87)*	*62.53 - 925.80*
Combined intake (preload + lunch) Days 2 and 3			
Low calorie preload condition Part 1	101	501.53 (174.49)	62.40 - 1015.12
High calorie preload condition Part 1	103	541.13 (184.56)	162.80 - 1087.40

Finally, independent t-tests were conducted to test sex differences in each intake measure. Boys consumed slightly more calories than girls on every index but these differences were not statistically significant. For example, boys consumed an average of 469.3 kcal at lunch (SD 168.11), while girls consumed 438.6 kcal (SD 165.56) (t=1.01, df 118, p=.317). The strongest sex difference (t=1.48, df 109, p=.141) was for lunch intake after the high calorie preload (Boys: M=399.9, SD 188.66 kcal; Girls:

M=348.5, SD 175.94 kcal), reflecting the fact that boys were poorer at compensating than girls.

As sex differences in intake were negligible, and because we wanted to reflect children's intake at a standard meal over a range of situations (i.e. more hungry/less hungry, unfamiliar/familiar foods, unfamiliar/familiar eating location), individuals' lunch intakes in the control, low calorie preload and high calorie preload conditions were averaged (sample mean=454.5 kcal, SD 166.87), and these figures are used in future analyses. It is recognised that these figures may slightly underestimate intake due to the inclusion of a condition where a high calorie preload was first consumed, but intake figures were very similar when calculated using different methods. The current method was therefore chosen as a compromise between sampling intake over a range of conditions, and holding prior energy intakes fairly constant.

8.3.4 Intake by food group

Intake of individual foods. Mean intakes in grammes, mean intakes in kcal, and intakes as a percentage of total lunch energy for each individual food are presented in Table 8.2. All means for tomato and carrot consumption are based on reduced numbers, as tomatoes were offered at one school only (n=17) and carrots were offered in the remaining schools (n=103). Chocolate biscuits made up the highest percentage of overall lunch intake, forming 38% (34g, 176 kcal) of average intake over control and low and high calorie preload days. Bread rolls were the next largest component, constituting around 17% (29g, 77 kcal) of average intake. Cheese crackers provided 17% of overall average calorie intake (15g, 77 kcal). Cheese provided 15% of calories (18g, 72 kcal) and chicken constituted 7% of average intake (25g, 29 kcal). Grapes, tomatoes and carrots provided the lowest percentages of overall intake: 6% (33g, 21 kcal), 0.3% (5g, less than 1 kcal) and 0.73% (9g, 3 kcal) respectively.

As we were interested in obtaining an absolute measure of children's consumption of each food in the experimental situation rather than an estimate of relative dietary composition, absolute intakes rather than percentages were used in subsequent analyses.

Table 8.2: Mean intake of individual foods over control and Part 1 preload days (n=120)

	Intake (g)		Intake (kcal)		% of total energy intake	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Tomatoes (n=17)	4.5 (12.66)	0 - 51.8	0.8 (2.28)	0 - 9.3	0.0 (0.19)	0 - 1.9
Carrots (n=103)	9.4 (12.88)	0 – 54.5	3.3 (4.50)	0 – 19.1	0.7 (1.33)	0 – 10.7
Grapes (n=120)	33.0 (33.79)	0 - 105.2	21.3 (21.78)	0 - 67.8	5.6 (9.86)	0 - 88.3
Bread rolls (n=120)	28.7 (19.70)	0 – 102.0	76.9 (52.80)	0– 273.2	17.3 (11.40)	0 – 52.0
Chicken (n=120)	24. 6 (20.77)	0 - 65.4	28.7 (24.30)	0 - 76.5	6.8 (6.15)	0 – 32.0
Cheese (n=120)	17.6 (15.99)	0 - 52.6	72.2 (65.56)	0 – 215.7	14.8 (13.50)	0 - 57.4
Crackers (n=120)	14.5 (11.51)	0 - 36.3	76.8 (60.91)	0 - 192.2	16.6 (13.32)	0 - 63.5
Biscuits (n=120)	34.1 (15.67)	0 - 52.5	175.8 (80.85)	0 - 270.4	38.2 (18.22)	0 - 96.4

Intake by food group. Table 8.3 shows intake data by food group. Snack food intake made up over half of percentage calorie intake. Protein foods formed, on average, 21% of lunch intake, and the starchy element (bread rolls) contributed 18% of intake. Fruit and vegetables contributed only 6% to total calorie intake. Although intakes of some individual foods showed positive skews (e.g. tomatoes, carrots, grapes), and some showed negative skews (e.g. biscuits), total lunch intake and average intakes by food group were approximately normally distributed, so parametric tests were used in subsequent analyses.

Table 8.3: Mean intake by food group over control and Part 1 preload days (n=120)

	Intake (g)		Intake (kcal)		% of total energy intake	
	Mean (SD)	**Range**	**Mean (SD)**	**Range**	**Mean (SD)**	**Range**
Fruit & vegetables	41.7 (38.01)	0.1 - 148.5	24.2 (22.90)	0.1 - 80.5	6.4 (10.25)	0.0 - 88.33
Bread rolls	28.7 (19.70)	0.3 - 102.0	76.9 (52.80)	0.9 - 273.2	17.3 (11.40)	0.2 - 51.98
Protein foods	42.2 (29.89)	0.5 - 117.2	101.0 (76.68)	0.6 - 290.8	21.6 (14.62)	0.2 - 66.94
Snack food	48.6 (20.71)	0.6 - 86.4	252.6(108.00)	3.1 - 450.4	54.8 (19.59)	1.1 - 98.37

8.3.5 Associations between behavioural eating outcomes

Table 8.4 shows inter-correlations between measures of eating without hunger intake, eating rate, overall lunch intake, and intake of the four food groups. All correlations were positive. Eating without hunger (EWH) intake showed significant positive correlations with eating rate and lunch intake. Faster eating rate was associated with greater lunch intake, especially of bread rolls, protein foods and snack foods. Among food categories, correlations were strongest between bread rolls and protein foods, and non-significant between either fruit and vegetables and snack food, and fruit and vegetables and protein foods.

Table 8.4: Intercorrelations between behavioural eating outcomes

	EWH intake (n ≥102)	Eating rate (n ≥ 109)	Lunch intake (n ≥109)	F&V (n ≥109)	Bread (n ≥109)	Protein (n ≥109)
Eating rate	.21 (p=.030)					
Lunch intake	.28 (p=.003)	.73 (p<.001)				
Fruit & vegetables	.24 (p=.012)	.13 (p=.155)	.35 (p<.001)			
Bread rolls	.10 (p=.238)	.43 (p<.001)	.61 (p<.001)	.16 (p=.091)		
Protein foods	.30 (p=.001)	.46 (p<.001)	.63 (p<.001)	.20 (p=.028)	.40 (p<.001)	
Snack food	.12 (p=.219)	.56 (p<.001)	.73 (p<.001)	.11 (p=.236)	.16 (p=.088)	.04 (p=.693)

8.3.6 Associations between questionnaire measures and eating outcomes

Associations between parental feeding and eating outcomes

Zero order correlations between parental feeding measures and behavioural measures of children's eating are presented in Table 8.5. Group sizes given at the top of each column represent the lowest n for each analysis in that column; n varied slightly due to missing data for each parental feeding scale.

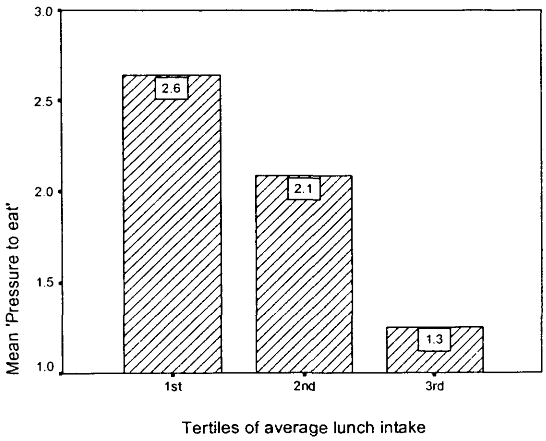
Table 8.5: Correlations between parental feeding and child eating outcomes

	EWH intake (n ≥100)	Lunch intake (n ≥106)	Eating rate (n ≥106)
Pressuring			
Pressure to eat	-.09 (p=.363)	-.47 (p<.001)	-.28 (p=.003)
Food to reward food	-.09 (p=.394)	.02 (p=.891)	.01 (p=.884)
Prompting to eat	.13 (p=.208)	-.11 (p=.241)	-.02 (p=.815)
Emotional feeding	.06 (p=.537)	.09 (p=.352)	.15 (p=.126)
Restricting			
Monitoring	-.19 (p=.056)	.12 (p=.209)	.13 (p=.184)
General restriction	-.04 (p=.676)	.08 (p=.432)	.04 (p=.668)
Meal-time rules	.01 (p=.904)	-.05 (p=.590)	-.03 (p=.736)
Food to reward behaviour	.08 (p=.445)	.01 (p=.919)	.07 (p=.493)

EWH intake. Intake in the 'eating without hunger' test showed one marginally significant negative correlation with 'Monitoring', such that higher scores were associated with lower biscuit intake (r=-.19, p=.056, n=102). As these were planned comparisons, and the data lacked power to detect the small effects anticipated, attention was also given to non-significant correlations. Associations between EWH intake and all of 'Prompting to eat' (r=-.13, p=.21, n=100), 'Pressure to eat' (r=.09, p=.363, n=100) and 'Food to reward' food (r=-.09, p=.394, n=100) were negative. These relationships all became stronger when excluding participants who reported being more hungry after lunch, and the negative relationship with 'Monitoring' became significant (r=-.30, p=.007, n=77).

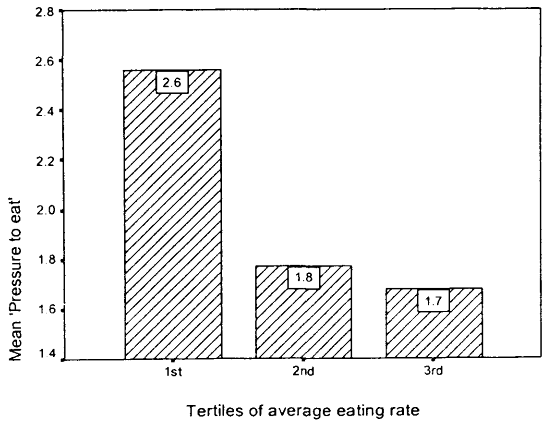
Lunch intake. Average lunch intake showed a highly significant negative association with 'Pressure to eat' (r=-.45, p<.001, n=106) (see Figure 8.3) but there were no associations between intake and other parental feeding scales.

Figure 8.3: Pressure to eat by tertitles of average lunch intake



Eating rate. 'Pressure to eat' was highest in children who had the slowest eating rates (r=-.28, p=.003, n=106) (see Figure 8.4), although this association disappeared when lunch intake was partialled out (r=.06, p=.522, n=103). There was also some tentative evidence for a positive relationship between eating rate and 'Emotional feeding' (r=.15, p=.126, n=108).

Figure 8.4: Pressure to eat by tertitles of average eating rate



Intake of food groups. Table 8.6 shows correlations between parental feeding and food group intakes. 'Pressure to eat' showed the clearest relationships with all indices, being significantly negatively associated with all types of food. Other forms of encouragement to eat ('Food to reward food', 'Prompting to eat'), were unassociated with food intake. 'Monitoring' showed only one relationship, a positive association with snack food intake (r=.23, p=.019, n=103).

Table 8.6: Correlations between parental feeding and intake (kcal) by food group

	F&V (n≥101)	Bread (n≥106)	Snack food (n≥101)	Protein foods (n≥101)
Pressuring				
Pressure to eat	-.30 (p=.002)	-.34 (p<.001)	-.30 (p=.002)	-.29 (p=.003)
Food to reward food	.08 (p=.450)	-.01 (p=.915)	.01 (p=.917)	-.07 (p=.459)
Prompting to eat	-.198 (p=.052)	-.06 (p=.510)	-.07 (p=.499)	-.04 (p=.708)
Emotional feeding	.088 (p=.415)	-.05 (p=.640)	.13 (p=.176)	-.03 (p=.793)
Restricting				
Monitoring	-.138 (p=.190)	.02 (p=.835)	.23 (p=.019)	-.1 (p=.278)
General restriction	.01 (p=.934)	.14 (p=.141)	.12 (p=.219)	-.06 (p=.534)
Meal-time rules	.05 (p=.612)	-.03 (p=.731)	.03 (p=.746)	-.14 (p=.169)
Food to reward behaviour	-.05 (p=.614)	.11 (p=.281)	.05 (p=.610)	-.09 (p=.382)

Associations between child eating behaviour, child adiposity and eating outcomes

In order to test whether the behavioural measures of children's eating taken here a) reflected habitual styles of child eating behaviour, and b) predicted child adiposity, zero order correlations between eating outcomes and both CEBQ scales and child BMI centile were calculated (Table 8.7).

EWH intake, eating rate and average lunch intake. EWH intake showed a significant negative correlation with satiety responsiveness (r=-.32, p=.001, n=101), and some evidence for a positive association with enjoyment of food (r=.18, p=.065, n=102), but was unrelated to BMI centile (r=-.01, p=.919, n=100). Eating rate was also negatively correlated with satiety responsiveness (r=-.30, p=.002, n=108) and showed significant positive associations with enjoyment of food' (r=.28, p=.004, n=109), food responsiveness (r=.19, p=.049, n=108) and BMI centile (r=.26, p=.007, n=103). Average lunch intake showed strong, significant, positive correlations with food responsiveness (r=.28, p=.003, n=108), enjoyment of food (r=.44, p<.001, n=109) and BMI centile (r=.34, p<.001, n=103). A strong, significant negative correlation was apparent with satiety responsiveness (r=-.46, p<.001, n=108).

Table 8.7: Correlations between child eating behaviour/adiposity and child eating outcomes

	EWH intake (n ≥100)	Eating rate (n ≥103)	Lunch intake (n ≥103)
Food responsiveness	.04 (p=659)	.19 (p=.049)	.28 (p=.003)
Satiety responsiveness	-.32 (p=.001)	-.30 (p=.002)	-.46 (p<.001)
Enjoyment of food	.18 (p=.065)	.28 (p=.004)	.44 (p<.001)
BMI centile	-.01 (p=.919)	.26 (p=.007)	.34 (p<.001)

Intake of food groups. Correlations with intake of food from each food group are shown in Table 8.8. BMI centile was positively correlated with intake of all foods, but associations were significant only for the snack food group (r=.28, p=.0~~50~~55, n=100), and bread rolls (r=.28, p=.005, n=100), not with fruit and vegetables (r=.10, p=.335, n=100) or protein foods (r=.12, p=.234, n=100). Examination of the associations with CEBQ measures revealed that both food responsiveness and enjoyment of food showed positive relationships with intake of all types of food, although the associations with food responsiveness were only significant for fruit and vegetables (r=.28, p=.005, n=102) and bread rolls (r=.27, p=.004, n=108). Similarly, satiety responsiveness was negatively associated with intake of all foods, with the strongest association for bread rolls (r=-.37, p<.001, n=108), and the weakest for snack food (r=-.21, p=.033, n=102).

Table 8.8: Correlations between child adiposity/eating behaviour and intake (kcal) by food group

	F&V (n ≥100)	Bread (n ≥103)	Protein foods (n ≥100)	Snack food (n ≥100)
Food responsiveness	.28 (p=.005)	.27 (p=.004)	.13 (p=.193)	.15 (p=.127)
Satiety responsiveness	-.39 (p<.001)	-.37 (p<.001)	-.32 (p=.001)	-.21 (p=.033)
Enjoyment of food	.29 (p=.003)	.38 (p<.001)	.29 (p=.003)	.26 (p=.008)
BMI centile	.10 (p=.335)	.28 (p=.005)	.12 (p=.234)	.28 (p=.005)

Associations between confounding factors and eating outcomes

Finally, in order to test for the influence of confounding factors on child eating outcomes, correlations with child age, child temperament and family SES were calculated. Findings are summarised below and a full correlation table can be found in Appendix X.

EWH intake. Higher intake in the 'eating without hunger' paradigm was significantly associated with lower child shyness (r=-.21, p=.039, n=99) and higher activity levels (r=.28, p=.006, n=99). There was also a non-significant positive correlation between intake and child sociability (r=.18, p=.069, n=99). The same relationships increased in strength when excluding children who reported being more hungry after lunch than before lunch on the day of the eating without hunger test. No associations with child age or family SES were apparent.

Eating rate. Faster eating rate was weakly associated with higher parental perceived weight (r=.17, p=.076, n=107). Eating rate also showed a significant positive correlation with activity levels (r=.32, p=.001, n=107) and a smaller, negative correlation with shyness (r=-.22, p=.023, n=107). There were no associations with child age or family SES.

Lunch intake. Several associations between lunch intake and child temperament were evident, such that activity levels were positively associated with higher average intake (r=.20, p=.036, n=107), while higher shyness was associated with lower intake (r=-.21, p=.027, n=107). Emotionality was associated with lower intake (r=-.25, p=.020, n=107), particularly of snack foods (r=-.18, p=.072, n=102). There were no associations between overall intake and child age or family SES, and no evidence of other associations between confounding factors and individual food groups.

Although there were several associations between child temperament and child eating outcomes, these were not adjusted for on the grounds that observed associations were small and may reflect the fact that temperamental factors form part of a more broadly defined phenotype which is associated with obesity risk. They are, however, taken into account when interpreting the results.

8.4. Discussion

The current study tested associations between parental feeding behaviours and four types of child eating behaviour with known associations with child eating behaviour: intake during an 'eating without hunger' paradigm, eating rate, overall lunch intake and *ad libitum* intake of foods from different food groups. The strongest result was a pattern of negative associations between measures of enhanced eating (overall intake, eating rate) and parental pressure to eat. The relationship with intake held for all types of food assessed, with lower pressure being associated with higher intake of fruit and vegetables, bread rolls, snack food and protein foods. There was also some suggestion that higher 'Monitoring' was associated with lower eating without hunger, and that higher 'Prompting to eat' was associated with lower fruit and vegetable intake. Results are discussed in the context of previous findings below.

8.4.1 Associations with 'eating without hunger'

Contrary to studies finding a negative association between consumption during an 'eating in the absence of hunger' paradigm and parental restriction, we did not find a significant association between consumption in our eating without hunger test and the 'General restriction' scale. This may be attributable to problems with our design. For example, if the hunger measure was accurate, it was apparent that the majority of children still expressed some degree of hunger after lunch. This may have been because too long an interval occurred between children finishing lunch and participating in the test and in some cases they went outside to play, which may have increased appetite. It may also be the case that children do not habitually eat to the point of satiety during lunch at school. Either way, this may have weakened our measurement of the 'eating without hunger' construct, thus limiting variance in consumption that was available to explain by 'General restriction', although examination of the distribution did suggest some variation was present. Alternatively, the hunger measures may have been inaccurate and failed to indicate which subjects were still hungry and should have been omitted from the analysis.

Despite the lack of the predicted positive association between eating without hunger and 'General restriction', it was interesting that 'Monitoring' showed a marginal negative correlation with eating without hunger, which became significant when excluding subjects who showed a lack of sensitivity to lunch in terms of the hunger assessment ($r=.30$, $p=.007$, $n=77$). The size of the correlation was comparable to the association between a latent restriction variable and intake regulation as assessed by caloric compensation and eating in the absence of hunger reported in Birch & Fisher (2000) ($\beta=.26$, where β represents a standardised regression coefficient), and suggests that the association with 'Monitoring' here was a genuine effect. One interpretation of this finding might be that monitoring children is protective against over-consumption, perhaps by teaching children that they should not eat too much energy-dense snack food. However it is notable that 'Monitoring' also showed a positive association with intake of chocolate biscuits and cheese crackers at lunch. It is also possible, then, that restriction by monitoring enhances snack food at the first opportunity for consumption so much that satiety and/or sensory-specific satiety occurs, and a reverse effect is seen at the second opportunity.

8.4.2 Associations with speed of eating

We did not replicate the finding of Drucker et al (1999) that eating rate was positively associated with encouragement to eat. Instead, eating rate was negatively associated with 'Pressure to eat', suggesting that children's *ad lib* intake here was indicative of a general eating style which was related to parents' efforts to press the child to eat. Consistent with this interpretation, total time spent eating was also negatively associated with pressure, suggesting that children who habitually spend less time eating and eat slowly, inspire ineffectual parental attempts to pressure them to eat.

8.4.3 Associations with overall lunch intake

We found that overall lunch intake was negatively associated with 'Pressure to eat'. Although studies relating parental feeding scores to dietary intake have not reported associations with pressure to eat, this is what we would predict given the negative association between 'Pressure to eat' and adiposity found in Study 4 and elsewhere (Spruijt-Metz et al, 2002; Lee et al, 2001). Our findings is also consistent with Birch and Fisher (2000), who found that restriction predicted eating in the absence of hunger, which in turn predicted higher overall calorie intake calculated from 24 hour food recalls. This is the first study to report an association between parental feeding and children's intake in a controlled but familiar setting, outside of maternal influence, and over three separate occasions. The results suggest that mothers may respond to objectively low intake in the child by applying pressure to eat. Alternatively, maternal pressure may somehow result in habitually lower intake in children. There were no other significant associations between parental feeding and overall lunch intake. However, there was a trend towards a positive association between 'Monitoring' and overall lunch intake.

8.4.4 Associations with intake of food groups

Notably, the 'Pressure to eat' association was evident across all food groups, with the strongest associations evident for bread rolls. This suggests that the pressure captured by the 'Pressure to eat' scale is a response to lower intake overall rather than a specific response to lower intake of 'healthy' foods such as fruit and vegetables. In contrast, 'Prompting to eat' was negatively associated with fruit and vegetable intake only (specifically grape consumption). This is likely to be because whereas 'Pressure to eat' items describe parents' response to an undereating child, 'Prompting' items describe encouraging children to try new foods and trying to make initially disliked foods more appealing to the child. The association may arise because children with a low fruit and vegetable intake inspire more prompting from parents. Alternatively, higher prompting may put children off fruit and vegetables. Certainly, there was no evidence for the predicted benefits of adopting behaviours described in the 'Prompting to eat' scale.

8.4.5 Evidence for specific effects of using food as a reward

Two parental feeding scales directly assess the use of food in a means-end contingency: 'Food to reward food', and 'Food to reward behaviour'. 'Food to reward behaviour' has previously been considered as a form of parental restriction but did not show the expected associations here. 'Food to reward food' can be thought of predominantly as a pressuring behaviour, with an element of restriction. Experimental research would suggest that preferences and selection should be enhanced for foods frequently used as rewards (i.e. snack foods) and depressed for foods commonly used as a means to an end (i.e. fruit and vegetables). However, no associations were apparent between either scale and children's food intake. This suggests that the occurrence of undesirable effects from using food in a reward contingency may be negligible, or at least not detectable when children eat *ad libitum* at 3-5 years old. The lack of association between reward behaviours and eating outcomes supports the independence of these behaviours from other feeding practices; rewarding behaviours may be determined by general parenting style rather than being specifically related to child eating behaviour, and may not have large effects on child adiposity. A second interesting relationship between parental feeding and food group intake was between higher 'Monitoring' and higher snack food intake. This has already been discussed in section 8.4.1 and suggests either that parents monitor children with high preferences for snack foods, or monitoring causes increased interest in and intake of those foods.

8.4.6 Associations between child eating outcomes and other measures of child eating behaviour

It is unclear whether observed child eating behaviour in an experimental setting, or parental report questionnaire scales, give the better approximation of habitual child eating behaviours with implications for obesity. However, comparison between the two methods provides some evidence for triangulation and for convergent validity, and the importance of the measured behaviours for obesity risk can be assessed by associations with BMI centile.

Consistent with low lunch intake, slower eating and low intake during the 'eating without hunger' test acting as markers for heightened satiety responsiveness, those who had higher satiety responsivity scores ate less lunch overall, ate more slowly, and ate less in the 'eating without hunger' test. Conversely, consistent with high intake and fast eating acting as indicators of habitually high intake, both variables were positively associated with enjoyment of food and food responsiveness, both of which traits would dispose an individual to eat more. Intake and eating rate also showed a positive association with BMI centile, suggesting that these behavioural habits may be conducive to weight gain.

8.4.7 Limitations

A number of features of the experiments described limit the conclusions that may be drawn. For example, intake measures were calculated by averaging across several conditions, in which prior consumption was variable. In one sense this increases the ecological validity of the measure, as children's snack intake before lunch is also likely to vary. However, it may also have introduced greater variability in the data, limiting our ability to detect effects. Another point is the degree to which each eating outcome assessed the distinct construct it was designed to address. In support of their distinctiveness, measures all showed fairly small (albeit significant) inter-correlations. However, the effect of eating rate disappeared when controlling for overall intake, suggesting that their relationships with pressure to eat were not independent.

The reliability and validity of the hunger measure has already been discussed to some degree in the previous chapter. Analyses suggested that the measure may have been sensitive to differences in hunger levels within-subjects but not between-subjects, making it difficult to use it as an exclusion criterion. The decision to assess hunger via selection of a portion of spaghetti bolognese may have been problematic because some children answered according to liking of the food rather than desired amount of a generic foodstuff. However, the fact that the association with 'Monitoring' strengthened when excluding children who said they were more hungry after lunch (vs less hungry or the same amount), suggests that the measure was of some use.

Extraneous factors may also have affected results. For example, the heightened intake among children who were more sociable and active, and less shy, was probably because the more outgoing children enjoyed playing with their food and then eating it. For example, some children played with the rolled slices of chicken and tried to fit as many crackers and biscuits in their mouth as they could. Another possibility is that children who are more active expend more energy and have greater energy needs which are expressed by greater lunch intake. These associations with general child temperament could be problematic if they led children to eat in an uncharacteristic manner. Alternatively, they may merely reflect general behavioural traits which necessarily accompany children's general eating style, and have a consistent influence on eating behaviour. That is, children's general behavioural style forms part of their adiposity phenotype and therefore affects eating behaviour in all situations, not just the experimental situation in question.

Intake may also have been influenced by the unusual eating environment: children ate in the classroom rather than the dinner hall and were supervised by the research team in addition to normal staff and student helpers. However, any effects of the environment were likely to apply equally to all children, and observation of the children suggested that any inhibition of eating ceased entirely by the second session. Our inclusion of two highly palatable snack foods in children's lunches may have inflated calorie intake beyond that of a normal lunch. However, anecdotal evidence suggests that such foods are frequently included in children's lunch-boxes (Ludwigsen & Sharma, 2004; Roberts, Blinkhorn & Duxbury, 2003).

Additionally, the inclusion of these foods was necessary to distinguish between children's dietary choices and to maximise each child's inclination to eat *ad libitum*, which was the behaviour of interest. In experiments requiring adults to eat *ad libitum*, portions of all foods offered are replenished when depleted. This was not considered suitable in the present experiment as the lunch included popular energy dense snack foods, which many parents and teachers considered acceptable only in limited portions, and excessive consumption of which would influence children's intake of alternative foods. The servings of each food offered were, however, far in excess of normative portion sizes for pre-school age children, giving ample opportunity for maximum consumption. We also placed another minor constriction on *ad libitum* eating. In order to maintain order and give the lunch a semblance of normality, we told the children to try to eat some of their sandwiches before going on to the chocolate biscuits etc. There was considerable between-school and between-child variability in conformity to this request.

Despite the research team's best efforts, some inaccuracy was inevitably introduced when calculating weighed intake. This was largely the result of unidentified discarded food items and dehydration of food between packing, eating and weighing. One child spilt water over his meal, altering the post-lunch weights. However, weights were adjusted where possible to take account of these factors. The high correspondence with psychometric measures of eating behaviour and child adiposity suggests that despite these inaccuracies, intakes were capable of reflecting relative differences in eating and weight; they were not intended to give an accurate absolute estimate of habitual, free-living intake. There may also have been some degree of inaccuracy in the speed of eating measure. Although attempts were made to accurately record each child's lunch finishing time, it was not always possible to see when a child had finished. Furthermore, finishing times were also influenced by other factors, such as the time allocated for lunch in each school, and mutual influence between the children, some of whom finished in groups as they saw their friends finishing and wanted to join them. As data were averaged over two days, this should have decreased some of the variability resulting from effects unique to one lunch occasion.

8.4.8 Conclusions

In conclusion, the results of Study 7 provided some support for predictions based on previous findings on the association between parental feeding and a range of child eating outcomes. Eating without hunger was negatively associated with 'Monitoring', and eating rate was negatively associated with 'Pressure to eat'. 'Pressure to eat' showed an additional negative association with the overall amount of food consumed. We additionally found that pressure was associated equally with intake of each food group, that 'Prompting to eat' showed a negative association with fruit and vegetable intake only, and that 'Monitoring' showed a food-specific positive association with intake of energy-dense snack foods.

These findings extend earlier conclusions, and suggest that while CFQ 'Pressure to eat' shows robust negative associations with food intake of all types of food, and 'Monitoring' is positively associated with snack food intake during lunch, many other types of parental control are unassociated with behavioural measures of children's eating, at least at age 3-5 years. For example, 'General restriction' and 'Food to reward behaviour' appear to be driven more by parental factors, and show no relationship with either child weight or eating behaviour. 'Food to reward food' and 'Prompting to eat' showed weak relationships with child weight in Study 4, but were not associated with behavioural measures of child eating.

However, behavioural eating outcomes did show predictable associations with psychometric measures of child eating behaviour and child BMI centile, suggesting that they were important indicators of obesity risk. Together these results suggest that only a small number of parental feeding behaviours are associated with children's eating behaviour at 3-5 years of age, and conclusions should not be generalised beyond the precise behavioural constructs assessed.

CHAPTER 9

General conclusions

This thesis aimed to explore the relationship between parental feeding and child eating behaviour and adiposity using a variety of methodologies. Particular attention was paid to developing a measure of parental control that could capture the full range of parental feeding behaviours. This measure was then used to assess associations between parental feeding and demographic factors, and to test for associations between parental feeding and child adiposity. Causal relationships between parental feeding and child weight were explored using mediation models and longitudinal analyses. Finally, children's eating behaviour was assessed in an experimental context, and relationships with parental feeding were tested.

9.1 Summary of main findings

1. Parental control is multi-dimensional.

The factor analyses in Studies 1 and 3 revealed a number of distinct parental feeding scales within existing parental control measures. For example, several scales measuring types of pressure to eat emerged ('Pressure to eat', 'Food to reward food', 'Prompting to eat', 'Meal-time rules'), together with two varieties of restriction ('Monitoring', 'General restriction') and two forms of instrumental feeding ('Food to reward behaviour', 'Emotional feeding').

Each of these behaviours displayed a different pattern of associations with other scales within the feeding questionnaires (Study 1). For example, 'General restriction' was positively associated with 'Concern about overweight', but 'Food to reward behaviour' was not. Each one also showed a different pattern of associations with demographic predictors (Study 3). For example, 'General restriction' was positively associated with SES, but 'Food to reward behaviour' showed a negative association.

In further support of the distinctiveness of each scale, differential associations with authoritarian parenting style were apparent. For example, 'Pressure to eat' was positively correlated, while 'Prompting to eat' showed no correlation. Parents' spontaneous reports of their feeding practices also illustrated the existence of different dimensions of parental feeding (Study 2).

2. Parental control is motivated by a variety of reasons.

It was immediately apparent from the qualitative data (Study 2) that parental feeding was only rarely consciously motivated by a concern about overweight. Instead, parents spontaneously explained their feeding practices as motivated by concerns for their children's short- and long-term health and wellbeing, general views on discipline, and practical considerations such as concern about wasting food and keeping to demanding time schedules. A number of parents also reported modifying their feeding practices according to their child's general and eating-related behaviour.

This diversity of motivations was reflected in the results of both Study 3 and Study 4. For example, Study 3 found that pressuring behaviours were more common in less affluent groups: this may reflect a concern that the child should finish his/her meal in order to avoid wasting money. Study 4 directly tested the contribution of concerns about weight and reports of children's eating behaviour to the prediction of parental feeding behaviour, and found that although they could explain a lot of the variation in 'Pressure to eat' scores, much of the variance in other feeding strategies (e.g. 'Prompting to eat', 'Monitoring') was left unexplained, suggesting that other motivations may be more important.

3. Parental feeding behaviours are associated with socio-economic status and ethnicity.

The results of Study 3 revealed a number of demographic predictors of parental feeding behaviour. Socio-economic status and ethnicity had the most pronounced effects, with educated, affluent, white parents being more likely to restrict their children's consumption of energy-dense snack foods, and less educated, less affluent, non-white parents being more likely to pressure their children to eat, and to use food to manipulate their children's affect and behaviour.

<u>4. Lower child adiposity is associated with higher pressure to eat.</u>

Study 4 showed good replication of the negative association between 'Pressure to eat' and child adiposity that has been reported elsewhere, and demonstrated that the association was created by the presence of higher 'Pressure to eat' scores for children in the lowest quintiles for adiposity. Additional associations were also observed between child adiposity and both 'Food to reward food' and 'Meal-time rules' scores, suggesting that each of these scales describe behaviours which parents might employ to increase children's intake.

<u>5. Restriction and instrumental feeding were not associated with child adiposity.</u>

Despite evidence in other studies for both negative and positive associations between parental restriction and child adiposity, neither 'General restriction' nor 'Monitoring' were related to child adiposity in Study 4. This could be either because restriction does not affect children's weight at this age, or because parents have not yet begun to respond to children's adiposity levels by restricting their food intake. Although using food instrumentally has been associated with enhanced preferences for energy-dense foods in experimental studies, and emotional feeding is hypothesised to lead to increased weight, neither 'Food to reward behaviour' or 'Emotional feeding' were associated with adiposity here.

<u>6. The relationship between adiposity and pressure to eat may be partly explained by parents' responses to children's eating behaviour and weight.</u>

It was hypothesised that the relationship between parental pressure and child adiposity could be explained by parents' applying pressure in response to concerns about their child's weight and conceptions of their characteristic eating style, e.g. encouraging a satiety responsive child to eat more. Results showed that while the association between 'Pressure to eat' and BMI centile could be accounted for by this parental response hypothesis, residual associations between BMI centile and both the

'Food to reward food' and 'Meal-time rules' scales still remained. This suggests either that these two parental feeding scales directly cause low adiposity in children, or that other factors (e.g. parents' attitudes towards healthy eating, parents' responses to broader aspects of child temperament) explain the remainder of the association.

7. Higher pressure to eat is associated with lesser weight gain from 4 to 7 years.

Higher levels of pressure to eat at 4 years old were found to predict smaller degrees of weight gain from 4 years to 7 years. This result is consistent with a causal interpretation: higher pressure leads to lesser weight gain in children either by causing them to eat more healthy foods at meal-time (and consequently less fattening, energy-dense snacks), or by causing children to react against parental pressure by eating less. However, an equally plausible interpretation is that children have an adiposity phenotype, which both predicts their weight trajectory, and elicits certain parental feeding responses. This interpretation does not rule out the possibility that pressure to eat in childhood promotes weight later in life, but the interval here may have been too small to see such an effect.

8. Caloric compensation showed few associations with parental feeding behaviour.

Study 6 found little evidence to support the hypothesis that increased parental control, and restriction in particular, is associated with poorer intake regulation in children as indicated by caloric compensation performance. There was a trend towards an association between higher 'Monitoring' scores and poorer compensation when preloads with disguised energy content were used, but the relationship did not reach significance. However, the fact that compensation also showed trends towards the predicted associations with adiposity and CEBQ scales suggests that findings may reflect genuine rather than spurious effects.

9. Slower eating rate and lower meal intake were associated with higher pressure to eat.

Study 7 failed to replicate the positive association between parental restriction and eating in the absence of hunger which has been reported in a number of published studies. This could be a result of methodological differences between studies. However, 'Pressure to eat' scores showed strong negative associations with children's eating rate and meal intake in *ad lib* eating conditions. This suggests that parents may respond to characteristically slow eating and low intake in children by pressuring them to eat. However, this habitual pressure does not result in increased eating when children are outside the influence of their parents.

9.2 Contributions to the literature

The research described in this thesis contributes to the literature on parental control and childhood obesity in a number of ways.

First, the establishment of multiple types of parental feeding may explain discrepancies in past results. For example, studies using the CFQ measure of 'Pressure to eat' consistently find a negative association with child adiposity (Spruijt-Metz et al, 2002; Lee et al, 2001), but Wardle et al (2002) failed to find an association between 'Prompting to eat' and weight, and Baughcum et al (2001) failed to find an association with their 'Pushing to eat' scale. This may be because 'Pressure to eat' directly assessed parents' tendencies to respond to reluctant eating in their child with pressure, whereas the other scales assess more parentally-driven behaviours which do not show such strong relationships with adiposity.

The existence of sharply-defined sub-factors within several of the scales also suggests that some negative findings may have resulted from the confounding of different types of control within one scale. For example, the six-item scale used by Robinson et al (2001), and the general control factors used by Saelens, Ernst & Epstein (1995) contain items describing diverse kinds of parental feeding, each of which may relate differently to children's weight status. It may also be misleading to use scales made up of several different behaviours with a common aim. For example, conclusions relating to the CFQ 'Restriction' scale should not strictly be generalised to the restriction sub-scale, 'Food to reward behaviour', which may have no discernible associations with the variables of interest.

Themes arising from the qualitative data, together with the results of multiple regressions predicting parental feeding behaviours, also have implications for the interpretation of existing findings. For example, the diversity of motivations underlying parental feeding decisions suggests that the focus on concern about overweight as a determinant of parental feeding may be erroneous, particularly for behaviours such as 'Monitoring' and 'Prompting to eat' which are related to concerns about healthy eating, and behaviours such as 'Emotional feeding' and 'Food to reward behaviour' which are motivated by the need to control the child's affect and behaviour.

Parents, especially parents of young children, may be more motivated by health-related, cost-related and other practical considerations, which may collectively explain far more of the variance in parental feeding behaviour than weight-related factors alone. The preponderance of health-related motivations may also help to explain positive correlations between the ostensibly opposing scales, 'Pressure to eat' and 'Restriction' (Spruijt-Metz et al, 2002): high scores on each scale characterise a parent who pressures his/her child to eat foods perceived as healthy at mealtimes, and limits the child's consumption of less healthy, energy-dense snack foods.

The systematic study of demographic differences in parental control (Study 3) replicated previous findings in American samples of higher restriction in higher SES groups and more pressuring to eat and instrumental feeding among lower SES groups (Vereecken et al, 2004; Baughcum et al, 2001; Hupkens et al, 1998; Olvera-Ezzell et al, 1990). The existence of ethnic differences in control was also confirmed in this UK sample, suggesting that caution should be used when generalising from all studies conducted on predominantly white parents. The associations with parental weight expanded on existing findings of lower parental control among heavier parents (Wardle et al, 2002; Baughcum et al, 2001), demonstrating that heavier parents were more likely to use food to reward behaviour but leaner parents were more likely to pressure their child to eat.

An important contribution of Study 4 was to replicate and extend the negative association between parental pressure to eat and child weight that has been reported in studies form the US (Spruijt-Metz et al, 2002; Lee et al, 2001). This was the first study to demonstrate this association in a socio-economically diverse sample of UK parents, and to extend it to other scales measuring different types of pressure. The absence of an association between restriction and child weight, on the other hand, was in opposition to other findings, and likely to be attributable to the very low levels o parental concern about overweight in this sample, which was socio-economically diverse and included mothers of very young children. This has two important implications: i) the positive relationship between restriction and weight seen in other studies is likely to result from parents responding to higher weight by restricting their child, and ii) the high levels of weight concern reported in affluent, American mothers of preschoolers may not be apparent in other populations.

Experimental studies suggest that using food instrumentally may lead to enhanced preferences for energy-dense foods which could increase obesity risk (Newman & Taylor, 1992; Birch, Zimmerman & Hind, 1980. The multi-dimensional measure of parental control used in Study 4 also allowed explicit testing of whether particular instances of instrumental feeding ('Food to reward food', 'Emotional feeding', 'Food to reward behaviour') were associated with child weight. However, only use of certain foods to reward others was associated with child weight, and this relationship was negative, suggesting either that instrumental feeding is relatively innocuous at this age, or that effects on adiposity are not seen until later in life.

Three elements of the research in this thesis contribute significantly to debate about the causal relationship between parental feeding and child adiposity. First, the qualitative observation that parents perceived themselves as responding to the child suggest that existing results could be interpreted as demonstrating not only effects of the parent on the child, but also effects of the child on the parent. Subsequent studies explored this possibility further. Study 4 took the novel approach of controlling for parents' attitudes towards children's weight and eating behaviour, and suggested that negative cross-sectional associations between 'Pressure to eat' and child weight (Spruijt-Metz et al, 2002; Lee et al, 2001) could be partly explained by parents applying more pressure to eat to children for whom they had concerns about underweight, and felt had a poor appetite. Study 5 added to the limited longitudinal literature on parental control and weight (Faith et al, 2004; Lissau, Breum &

Sorensen, 1991), demonstrating a negative prospective association between pressure to eat and weight gain from 4 to 7 years in a population sample.

Finally, the extensive experimental protocol undertaken for Studies 6 and 7 allowed testing of the replication of several key findings in the parental control literature. Study 6 provided only limited support for Birch et al's finding (Birch & Fisher, 2000; Johnson & Birch, 1994) of decreased ability to compensate among children whose parents applied more restriction. Additionally, the use of the highly differentiated measure of control developed in Studies 1 and 3, suggests that there was no evidence of associations with other forms of parental control. Study 6 adds to the very small body of studies which have attempted to replicate the results of the Birch group (Faith et al, 2004; Cecil, Hetherington et al, personal communication), and extends them by taking two measures of compensation. Indeed, the stronger association between scores on the 'satiety responsiveness' scale and caloric compensation when using a non-disguised set of preloads, suggests that this may prove to be a useful behavioural test of habitual intake regulation.

Study 7 broadly failed to replicate Birch et al's robust association between parental restriction and eating in the absence of hunger (Birch, Fisher & Davison, 2003; Fisher & Birch, 2002; Fisher & Birch, 2000). This may be attributable to methodological differences, and suggests that the association may only hold when children are completely satiated at the time of testing, and are presented with a wide range of palatable snack foods and play activities. These conditions are increasingly likely to occur together in the modern, obesogenic environment. The negative association between eating rate and pressure to eat was ostensibly inconsistent with past findings that encouragement to eat leads to faster eating at that meal occasion (Drucker et al, 1999), but consistent with the theory that the parent encourages (generally with little success) a child who habitually eats slowly and has a 'poorer appetite'. It is therefore understandable that a negative association was found here, where habitual parental feeding behaviour and children's *ad lib* (rather than parent-determined) eating were assessed. The negative association between pressure to eat and average lunch intake is novel, but consistent with associations between pressure to eat and child weight (Spruijt-Metz et al, 2002; Lee et al, 2001). The finding that 'Pressure to eat' is associated equally with all food groups confirmed that the scale assesses pressure to eat any kind of food as well as specific pressure to eat healthy foods, and the association between 'Prompting to eat' and lower fruit and vegetable intake gave some suggestion that this scale may be a better way to assess specific pressure aimed at improving the healthiness of children's diets. Finally, the absence of associations between either form of parental feeding or emotional feeding and behavioural outcomes of children's eating suggested that these types of control may not have any effects on eating at this young age.

9.3 Limitations

9.3.1 Population representativeness

Despite the many strengths and contributions of the studies described here, there were also a number of limitations. For example, with the exception of Study 5, the samples used in this thesis were not population-representative. The parents surveyed in Studies 1-2, and Studies 6-7 were drawn from opportunistic samples of schools, and for Studies 6-7, relatively more affluent (although still state-funded) schools were deliberately selected in order to achieve the attendance rates needed for the demanding experimental protocol. Studies 3-4 used parents from schools which were selected to represent a range of deprivation, but there was a response bias such that white parents with higher socio-economic status were more likely to take part.

There was a sizeable non-white group, but the ethnic diversity within this group prevented making comparisons between ethnicities. For example, it was not possible to assess whether black parents in the UK showed similar levels of parental control to black parents in the USA. This problem is common to much research in London, where lower SES groups are likely to be from a vast array of ethnic minorities who may be unable to read or write English. The over-representation of white, affluent parents is likely to have limited the variance in some of the demographic factors, and may have affected mean parental feeding scores. Children from less affluent backgrounds may have displayed higher levels of overweight and exhibited more problematic eating behaviours. The generalisability of the results shown here is therefore limited, as are many existing studies, which also recruit from populations where English is the first language and compliance is likely to be higher.

9.3.2 Design issues

Several elements of the study designs chosen affect the conclusions that can be drawn. First, the majority of studies were cross-sectional, making any conclusions about cause-effect relationships purely speculative. One study (Study 5) used longitudinal data, but was limited by the lack of a measure of parental control at the second time-point, making it difficult to infer temporal stability of parental control. Neither does longitudinal data entirely solve the causal problem, as it remains possible that a third factor (e.g. children's eating behaviour phenotype) might influence both parental control and children's weight trajectories.

A second problem was the lack of power in Studies 6-7 to detect significant relationships between parental control and children's eating outcomes. Unfortunately it was not possible to increase the sample size further due to practical constraints. However, it should be noted that our sample size was comparable to that of other studies in the literature. A number of other elements of the experimental design in these studies may also have affected results. It was less than ideal to have the Part 2 preload conditions following the Part 1 preload conditions in all cases. This design was chosen in order to give priority to obtaining data from Part 1, leaving participation in Part 2 optional for each school. It is therefore possible that order effects influenced the Part 2 results. However, experimental conditions took place a week apart, and children did not seem to alter their behaviour significantly throughout the course of the study.

The choice of foods within the lunch meal was necessarily different to the American foods used in other studies in order to ensure familiarity and therefore food acceptance (Faith et al, 2004; Johnson & Birch, 1994). However, the inclusion of palatable, energy-dense snack foods may have had two effects on results. First, it could have deflated mean compensation in the sample by making it harder for all children to compensate because they all had strong preferences for these foods. Compensation in Part 1 (M=69.6%) was indeed lower than that found by Faith et al (2002) (M=103.6%), but was higher than that found by Johnson & Birch (1994) (M=45.0%). Second, the inclusion of the snack foods may have inflated the negative correlation with parental restriction, reflecting relationship between restriction and snack food consumption rather than intake regulation *per se*. However, these foods are becoming increasingly available in children's environments, and intake regulation in this context is likely to be highly relevant for adiposity.

Another design issue in Studies 6-7 was the possibility of clustering effects resulting from the use of five different classes of children in four different schools. However, preliminary analyses showed no evidence of clustering either by school or by class in terms of demographic factors, parental feeding or children's eating.

9.3.3 Data analysis issues

For most analyses reported here, a number of different methods were employed in order to test systematically the hypotheses of interest, and the analysis most representative of the results is presented. However, in some cases, analyses violated their statistical assumptions and results should therefore be regarded with some degree of caution. For example, the limited variance in measures of parents' perceptions and concerns relating to child weight may have decreased the likelihood that these variables could explain the associations between parental control and child weight. Similarly, the longitudinal analysis in Study 5 may have been compromised by a lack of variance in the dependent variable, weight change, as there was little overall change in adiposity within the sample.

Another point is that the multiple regression techniques used are affected by the accuracy of the measures used, meaning that one variable might show more prediction of the dependent variable merely because it is better measured than another. However, it is hoped that the use of validated measures largely prevented this. A problem affecting several of the correlation and regression analyses conducted here was the possibility of biased 'missingness', particularly in the case of household income data, authoritarian parenting scores, and self-reported weight among parents. Evidence suggests that those not supplying data were likely to be less affluent, more authoritarian, and heavier than those who did supply data, meaning that a number of the more extreme values had to be omitted from analyses. This limits generalisability of findings to the population as whole. The inability to draw causal inferences from multiple regression analyses has also been discussed in detail.

One problem with the experimental studies was the question of how to deal with outliers. A conservative approach was adopted for the compensation analyses: limiting them to those children who drank all of the preloads each time eliminated all of the outliers for lunch intake. A more inclusive approach was taken to analyses of other eating outcomes in order to be able to comment about the whole range of eating behaviour. A problem with the first approach is that the probability of a Type II error is increased due to the diminished sample size; a problem with the second approach is that results can be distorted by extreme values. However, it was felt that caution was important regarding the compensation analysis, where replication of past results was the main objective, whereas maximum numbers were more important for the other eating outcomes, for which analyses were more exploratory.

9.3.4 Scope of thesis

The study of parental feeding and obesity is rapidly developing, and it was not possible to address all of the questions of interest within this thesis. For example, it is possible that a number of parental feeding strategies of relevance to obesity were not measured here. Only major measures of parental control at the time of initiating the study were included, and the focus was on behaviours related to obesity rather than healthy eating behaviours. The imposition of a regular eating schedule, family meal-times and the use of more authoritative methods to encourage or restrict eating, such as reasoning, negotiation and verbal praise, were all found within the qualitative data. These specific behaviours may all prove to be important for child adiposity in terms of influencing the type and amount of foods consumed, but were not explicitly captured in the scales used here.

Only 3-5 year old children and their parents were sampled here. This age group was chosen for the sake of comparability with other research, and on the grounds that 3-5 years may be a critical period for development of eating habits. However, the results of a number of other studies suggest that parental control may have greater impact at other life stages. For example, there is evidence both that moderate restriction as a child might lead to healthier eating habits later in life (DeBourdeaudhuij, 1997; Lissau, Breum & Sorensen, 1991), that pronounced pressure to eat might create long-lasting food aversions (Batsell et al, 2002) and that parental use of food as a reward might lead to emotional eating in adulthood (Puhl & Schwartz, 2003). Consistent with this idea that control may have a more distal impact on weight by leading to eating disordered behaviour, parental restriction has been linked to higher restraint and disinhibition in girls as young as 5 years old (Carper, Fisher & Birch, 2000), both of which eating styles have been linked to weight gain in other populations. It was beyond the scope of the current thesis to investigate these ideas further.

9.4 Future research

Measurement and sampling. An important implication of the work on measurement of control described here is that it is important in future research to use more differentiated measures of control, as only some are associated with children's eating and weight, and in many cases associations with weight may explained by differential relationships with other variables such as socio-economic background and authoritarian parenting style. It would also seem advisable to over-sample lower SES groups and ethnic minorities in future work, in order to achieve a more representative sample from which to make generalisations about the population as a whole.

Causal mechanisms. Undoubtedly, the most important step for parental feeding research in the future is to explore the causal mechanisms underlying associations with eating and weight more thoroughly. To do this, prospective cohort studies are needed, preferably beginning in early childhood and continuing on into adolescence and young adulthood in order to detect the effects of different types of parental control at a range of ages. Additional experimental studies where control is manipulated may also help to support the argument for parental control as a causal factor, as the small body of studies from the Birch group have yet to be replicated in other settings.

Parent-led interventions, however, are more likely to produce the long-term effects on children's eating style that are hypothesised to result from parental control. To my knowledge, only one such study has been reported (Gribble et al, 2003), and did not assess the effect of the individual components of the intervention. In order for these to illuminate causal mechanisms, care should be taken to introduce only one change in feeding style at a time, so that the active elements of the intervention can be seen.

An additional problem is that the evidence base is as yet undeveloped. It is currently difficult to know which feeding behaviours are indicated and contraindicated, and thus difficult to design an ethical intervention.

Genetically-sensitive designs. Another way to tackle the problem of cause and effect might be to incorporate a genetic element into study designs. Two methods may be of use here. First, a basic indication of causal relationships may be given using a twin design. Using data from samples of monozygotic (MZ) and dizygotic (DZ) twins allows heritability estimates to be made. These give an estimate of how much variance in a particular variable is attributable to genetics, how much to shared environment (features of the environment that make siblings the same), and how much to non-shared environment (features of the environment that make siblings different). Heritability estimates are most frequently made for trait variables, such as weight, height, intelligence, and temperament. More recent studies have also examined the heritability of adult eating behaviours such as restraint and disinhibition, and found them to be substantially heritable (Tholin et al, 2005; Bouchard et al, 2004).

However, a similar approach may also be applied to parental feeding styles to assess how much parental feeding is genetically-mediated. For example, if the heritability estimate for 'Pressure to eat' is high (i.e. scores for MZ twins are more similar than for DZ twins), we may infer that pressure comes in response to genetically-determined aspects of the child, most likely their weight or eating style. Conversely, if shared environment is important (i.e. scores for DZ twins are similar to those for MZ twins), this suggests that pressure is more a matter of parental policy, applied equally to both children regardless of their genotype. If estimates of non-shared environment for pressure are high (i.e. MZ twins are not well-correlated), this suggests that the parent is interacting with each child differently, and that these non-shared elements of the environment could lead to differences between twins.

A second genetic approach to the problem of cause and effect is to investigate *gene-environment interaction*, that is, the possibility that parental feeding behaviour influences children's adiposity, but only in children of particular genotypes. A growing number of studies are addressing this possibility but are limited by their measure of the genetic component, using parent weight or current child weight as a proxy for genetic obesity risk. In order to detect the small effects that interactions are likely to produce, a large dataset is required, including precise measures of the active elements of parental control, and a range of well-defined eating behaviours in children, in order to achieve enough variance in phenotypes and environmental influences to be able to assess the effect of different combinations on children's weight. As work on the molecular genetics of eating behaviour develops, it may also become possible to examine the interactions between parental control and actual genes associated with eating behaviour, rather than phenotypes which are assumed to have a genetic basis.

The ultimate aim of projects such as this will be to develop a clearer understanding of how genetic and environmental factors conspire to influence adiposity, and to use this understanding to develop informed advice for parents on how they can give the best possible response to their children's eating behaviour.

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Appendix I: Table of published papers on parental control and children's eating behaviour and adiposity

Authors and journal	Design	Participants	Control measure/ manipulation	Child outcomes	Results
Encouragement to eat					
Klesges et al (1986) *International Journal of Eating Disorders*	Observation of evening meal at home	White US 3-5y olds + parents, n=30, community sample	Number of encouragements to eat	Percentage time spent eating, weight centile	Greater number of encouragements → more time eating, greater weight
Stanek, Abbott & Cramer (1990) *Journal of the American Dietetic Association*	Cross-sectional survey	US 2-5y olds + parents, n=427, random community sample	Food-related parenting behaviours	One day diet record	Involvement in food-preparation, reasoning, exposure to healthy foods → more servings from basic food groups
Koivisto, Fellenius & Sjoden (1994)	Family meal observation at home	Swedish 3-7y olds + parents, n=50, community sample	Physical encouragement of eating, direct prompting, verbal food offers	Meal intake, 7 day weighed food record	Negative comments → decreased meal intake. Taking food on suggestion → increased meal intake
Iannotti, O'Brien & Spillman (1994) *Perceptual & Motor Skills*	Observation of noon and evening meals over 3 days at home	Urban African US 2-5y olds + mothers, n=45, no details re sample	Encouragements, discouragements, use of rewards, punishments, rationale	Intake after prompting	Encouragements, comm.-ands, actions, rationales most successful
Drucker et al (1999) *Developmental and Behavioural Pediatrics*	Observation of lunch intake in laboratory	White US 3.5y olds + mothers, n=77, community sample	Rates of food presentations, food offers, total prompts	Eating rate, intake, weight	Food presentations, offers, prompts → increased eating rate, decreased intake. More discouragements, higher weight
Fisher et al (2002) *Journal of the American Dietetic Association*	Cross-sectional survey	White US 4-6y olds, n=191, cohort	CFQ Pressure to eat	3 day 24h dietary recall	Higher pressure to eat, lower fruit & vegetable intake
Batsell et al (2002) *Appetite*	Retrospective survey	White US 18-25y olds, n=407, undergraduates	Forced childhood consumption questionnaire	Current rating of target food	Forced consumption → food aversion,picky eating
Wardle, Carnell & Cooke (2005)	Cross-sectional survey	White UK 2-6y olds, n=564, community sample	Pressure to eat	Fruit and vegetable frequency questionnaire	Higher pressure to eat, lower fruit & vegetable intake

Authors and journal	Design	Participants	Control measures	Child outcomes	Results
Restriction					
Klesges et al (1991) *American Journal of Clinical Nutrition*	Experimental manipulation	White 5y olds + mothers, n=53, community sample	Anticipated and actual maternal monitoring of lunch selection	Non-nutritious foods chosen, energy content	Monitoring decreased non-nutritious foods & overall energy
Lissau, Breum & Sorensen (1993) *International Journal of Obesity*	Prospective survey	Dutch 9-10y olds + mothers, n=552, random school sample	Knowledge & acceptance of sweet eating, provision of money for sweets 9-10y	Overweight (exceeding 90th BMI centile) at 20-21y	Knowledge, acceptance, sweet money 9-10y → overweight 20-21y
De Bourdeaudhuij (1997) *Journal of Health Psychology*	Retrospective surveys	Belgian 12-20 y olds + mothers & fathers, n=429 + n=522, school sample	Obligation, Restriction at 10y	Food frequency questionnaire, family food choice questionnaire	Permissiveness → Higher fat/sweet/snack intake; less healthy choices
De Bourdeaudhuij & Van Oost (1998) *American Journal Health Promotion*	Cross-sectional survey	Belgian families with 2 parents + 2 adolescents, n=92, school sample	Family food rules (obligation, restriction of sweets)	Family food choice questionnaire	Food rules → healthier family food choices
Fisher & Birch (1999a) *American Journal of Clinical Nutrition*	Experimental manipulation	White US 3-5y olds + parents, n=31, n=37, university daycentre	Access to target snack visibly restricted	Snack intake, selection, behaviour, weight-for-height	Increased desire, selection & intake of restricted food, especially in boys
Fisher & Birch (1999b) *Appetite*	Cross-sectional survey	White US 3-6y olds, n=40, university daycentre	Restricted access questionnaire	Snack intake in free access procedure	Restriction → increased selection of restricted food
Birch & Fisher (2000) *American Journal of Clinical Nutrition*	Cross-sectional survey	White US 4-6y olds, n=197, cohort	Monitoring, Restriction, restricted access questionnaire	Caloric compensation, eating in the absence of hunger (EAH), energy intake (3 days 24h recall)	Restriction → poorer intake regulation & higher energy intake, girls only. Intake → higher weight
Fisher & Birch (2000) *Journal of the American Dietetic Association*	Cross-sectional survey	White US 4-6y olds, n=197, cohort	Restricted access questionnaire (parent- and child- report)	Eating in the absence of hunger, negative self-evaluation of eating	Restriction → higher EAH & negative evaluation of eating
Davison & Birch (2001) *Pediatrics*	Cross-sectional survey	White US 4-6y olds, n=197, cohort	Restriction	Weight-for-height centile, perceived physical/cognitive ability	Restriction+higher weight → lower perceived ability
Fisher & Birch (2002) *American Journal of Clinical Nutrition*	Longitudinal survey	White US 4-6y olds, n=192, cohort	Restriction	Eating in the absence of hunger (EAH)	Restriction 5y → EAH 7y
Birch, Fisher & Davison (2003) *American Journal of Clinical Nutrition*	Longitudinal survey	White US 4-6y olds, n=140	Restriction	Eating in the absence of hunger (EAH)	Restriction+overweight 5y → EAH 9y ↑

Authors and journal	Design	Participants	Control measures	Child outcomes	Results
Mixed scales from Child Feeding Questionnaire					
Johnson & Birch (1994) *Pediatrics*	Cross-sectional survey	White US 3-5y olds, n=77, university day centre sample	Parental Control Index (6 items)	Caloric compensation	Parental control → poorer compensation
Carper, Fisher & Birch (2000) *Appetite*	Structured interviews over 2 days	White US 4-6y girls, n=197, cohort	Pressure to eat, Restriction (parent- & child-report)	Dietary restraint, emotion-al & external disinhibit-ion, weight	Pressure to eat → higher scores on all measures. Restriction → higher external disinhibition
Saelens, Ernst & Epstein (2000)	Discordant sibling analysis	US families with obese and non-obese 7-12y olds	Early version of CFQ	Obese / nonobese	No differences in control between obese / nonobese
Robinson et al (2001) *Obesity Research*	Cross-sectional survey	Mixed US 8-9y olds, n=792, community sample	Parental Control Index (6 items)	BMI, triceps skinfolds	Parental control → lower adiposity
Lee et al (2001) *Pediatrics*	Cross-sectional survey with longitudinal adiposity measure	White US 5y girls, n=192, community sample	Pressure to eat, Monitoring, Restriction	Dietary intake (3 days 24h recall), BMI, skinfolds	Restriction + Pressure to eat → higher fat intake. Higher fat intake → higher adiposity 5-7y.
Spruijt-Metz et al (2002) *American Journal of Clinical Nutrition*	Cross-sectional survey	White & African US 7-14y olds, n=74, community sample	Pressure to eat, Monitoring, Restriction	Fat mass (DEXA), energy intake (3 days 24h recall)	Restriction → higher fat mass. Pressure to eat → lower fat mass
Faith et al (2003) *Archives of Pediatric & Adolescent Medicine*	Prospective survey	White US 3y olds + mothers, n=57, high and low obesity risk sample	Pressure to eat, Monitoring, Restriction	BMI z score at 3y, 5y, 7y	Low risk + Monitoring 3y → decreased weight gain. High risk + Restriction → → increased weight gain. High risk + Pressure → decreased weight gain.
Gribble et al (2003) *Journal of the American Dietetic Association*	Parental feeding inter-vention	White US 10-12y olds + mothers, n=9	10-session intervention including training on monitoring, restriction, rewarding/ punishing, encouragement	Fruit knowledge, preference, 3 day food record	Increased fruit knowledge & intake
Faith et al (2004) *Pediatrics*	Cross-sectional survey	Mixed US 3-6y olds + mothers, n=1083	Single item mother-allotted food choice	BMI z score	More food choice → lower BMI

Instrumental feeding and other					
Birch, Zimmerman &Hind (1980) *Child Development*	Experimental manipulation	White US 3-5y olds, n=64, community sample	Target snack presented as reward	Food preferences	Preference for target food increased
Birch, Marlin & Rotter (1984) *Child Development*	Experimental manipulation	White US 3-5y olds, n=12, community sample	Target juice presented as means to an end	Food preferences	Preference for target food decreased
Newman & Taylor (1992) *Journal of Experimental Child Psychology*	Experimental manipulation	White US 4-7y olds, n=86, private school sample	Target snack presented as means to an end	Food preferences	Preference for target food decreased
Puhl & Schwartz (2003) *Eating Behaviors*	Retrospective survey	White US 19-85y olds, n=122, community sample	Recalls of parents' rules re eating	Restraint, binge eating, weight history	Recall instrumental feed-ing → bingeing, restraint
Sallis et al (1995) *International Journal of Obesity*	Cross-sectional survey	Mexican and Anglo- US 3-5y olds + mothers, n=347, school sample	Food given as reward, parental control of eating	Obesity risk (maternal BMI and skinfolds)	No associations between parental feeding & obesity risk
Cullen et al (2000) *Public Health Nutrition*	Cross-sectional survey	Mixed US parents of 4th-6th grade children, n=109, parochial school sample	Food-socialization encou-raging & discouraging practices	2 day food records	No associations with fruit/ vegetable intake
Cullen et al (2001) *Health Education Research*	Cross-sectional survey	Mixed US 7-10y olds, n=230, parochial school sample	Parent control, Permissive eating, Food self-preparation	2 day food records	Parental control → higher juice intake
Baughcum et al (2001) *Developmental and Behavioural Pediatrics*	Cross-sectional survey	Mixed US 2-5y olds, n=634, sample included low income group	Pushing to eat, Using food to calm, Child control, Structure during feeding	Weight-for-height percentile, obesity risk (maternal weight status)	No differences b/w over- & normal weight children. Less structure → obesity risk
Wardle et al (2002) *Obesity Research*	Cross-sectional survey	White UK 3-5y olds, n=214, high and low obesity risk sample	Control, Prompting to eat, Instrumental feed-ing, Emotional feeding	BMI, obesity risk (parental weight status)	Prompting → higher child BMI. Control → lower obesity risk
Bourcier et al (2003) *Appetite*	Cross-sectional survey	White US 54y mothers with 0-17y old children, n=282, church sample	Self-reliance (eg model-ling), Pressure (eg bribe), Positive (eg comment)	Single item fat and fruit/ vegetable intake measure	Self-reliance → lower fat intake. Pressuring → fruit/vegetable intake
Vereecken, Keukelier & Maes (2004) *Appetite*	Cross-sectional survey	Belgian 2.5-7y olds + mothers, n=316, school sample	Incl. restrictions, praise, negotiation, disc-ouraging sweets, food as a reward	Four-item food frequency questionnaire	Praise→veg . Permissive-ness→soft drinks, sweets. Food rewards → sweets.
Hughes et al (2005) *Appetite*	Cross-sectional survey	Hispanic & African-American 3-5y olds + mothers, n=231	Authoritative, authorit-arian, indulgent, uninvolved feeding styles	BMI z scores	Authoritative 0.72, auth-oritarian 0.52, indulgent 1.01, uninvolved 0.62

Appendix II: Questionnaire used in Study 1

ID

DIET IN PRESCHOOLERS SURVEY

This survey is being conducted by the Health Behaviour Unit at University College London. It aims to help us understand more about diet in children.

We are interested in **3-5 year-olds**, so please answer the questions for your child of that age. If you have more than one, please answer about your **youngest 3-5 year-old child**.

There are no right or wrong answers to any of the questions and your responses will be **anonymous and confidential**.

The questionnaire takes about **25-30 minutes** to fill in. You may find some of the items a bit repetitive. We apologise for this but please answer everything - all your responses are important to us.

Thank you very much for participating.
All those returning the questionnaire will be entered into a prize draw to win a £30 WHSmith voucher!

If you have any questions please contact:
Susan Carnell
Health Behaviour Unit
Department of Epidemiology and Public Health
University College London

THE FIRST SECTION ASKS YOU FOR SOME GENERAL INFORMATION ABOUT YOU AND YOUR CHILD.

What is your relationship with the 3-5 year old child in the nursery / reception class?

❑ Mother ❑ Father ❑ Guardian ❑ Other

If other please state: ____________

How old is your child? [ ] years [ ] months

What sex is your child? ❑ Male ❑ Female

What position in the family is s/he?

❑ Oldest ❑ Youngest ❑ Middle ❑ Only child

If applicable, how many brothers and sisters does your child have? *(Please give numbers)*

[ ] brothers [ ] sisters

How tall is your child? [ ] feet [ ] inches OR [ ] cms

How much does your child weigh? [ ] stones [ ] pounds OR [ ] kgs

Is your child eligible for free school / nursery meals? ❑ Yes ❑ No

How does s/he generally eat lunch?

❑ School / nursery meal ❑ Packed lunch ❑ At home

Please add any further background information you think may be relevant, eg food allergies, special diets:

MOTHERS AND CAREGIVERS FEED THEIR CHILDREN IN MANY DIFFERENT WAYS. THIS SECTION IS ABOUT HOW YOU FEED YOUR CHILD.

	Never	Seldom	Half of the time	Most of the time	Always
When your child is at home, how often are you responsible for feeding him/her?	❑	❑	❑	❑	❑
How often are you responsible for deciding what your child's portion sizes are?	❑	❑	❑	❑	❑
How often are you responsible for deciding if your child has eaten the right kind of foods?	❑	❑	❑	❑	❑

How would you describe your own weight at each of the 4 time periods listed below?	Very under-weight	Under-weight	Normal	Over-weight	Very over-weight
Your childhood (5-10 years old)					
Your adolescence					
Your twenties					
Currently					

How would you describe your child's weight at each of the 3 time periods listed below?	Very under-weight	Under-weight	Normal	Over-weight	Very over-weight
Your child during his/her first year of life					
Your child as a toddler					
Your child at the moment					

How concerned are you about the following?	Un-con-cerned	A little con-cerned	Con-cerned	Fairly con-cerned	Very con-cerned
Your child eating too much when you are not around him/her					
Your child having to diet to maintain a desirable weight					
Your child becoming overweight					
Your child being overweight at the moment					
Your child becoming underweight					
Your child being underweight at the moment					

How much do you agree or disagree with the statements below?	Disagree	Slightly dis-agree	Neut-ral	Slightly agree	Agree
I have to be sure that my child does not eat too many *sweet things (eg sweets, ice cream, cake, biscuits, chocolate)*.					
I have to be sure that my child does not eat too many *high fat foods*.					
I have to be sure that my child does not eat too much of his/her *favourite foods*.					
I intentionally keep some foods out of my child's reach.					
I offer *sweet things (eg sweets, ice cream, cake, biscuits, chocolate)* to my child as a reward for good behaviour.					

	Disagree	Slightly dis-agree	Neut-ral	Slightly agree	Agree
I offer my child his/her *favourite foods* in exchange for good behaviour.	❑	❑	❑	❑	❑
If I did not guide or regulate my child's eating, s/he would eat too many *junk foods*.	❑	❑	❑	❑	❑
If I did not guide or regulate my child's eating, s/he would eat too much of her *favourite foods*.	❑	❑	❑	❑	❑
My child should always eat all of the food on her plate.	❑	❑	❑	❑	❑
I have to be especially careful to make sure my child eats enough.	❑	❑	❑	❑	❑
If my child says "I'm not hungry," I try to get him/her to eat anyway.	❑	❑	❑	❑	❑
If I did not guide or regulate my child's eating, s/he would eat much less than s/he should.	❑	❑	❑	❑	❑

Please tick the box which best corresponds to your answer:

	Never	Rarely	Some-times	Mostly	Always
How much do you keep track of the *sweet things (eg sweets, ice cream, cake, biscuits, chocolate)* that your child eats?	❑	❑	❑	❑	❑
How much do you keep track of the *snack food (eg crisps, cheesy crackers)* that your child eats?	❑	❑	❑	❑	❑
How much do you keep track of the high fat foods that your child eats?	❑	❑	❑	❑	❑

NOW THINK ABOUT YOUR CHILD'S EATING FROM THE TIME S/HE WAS 18 MONTHS OLD UNTIL NOW.

	Never	Rarely	Some-times	Often	Always
Was your child a picky eater?	❑	❑	❑	❑	❑
Did you let your child decide when s/he wanted to eat his/her meal?	❑	❑	❑	❑	❑
Was it hard to get your child to eat new foods?	❑	❑	❑	❑	❑
Did you have to make special meals for your child because s/he was a picky eater?	❑	❑	❑	❑	❑
Was it a struggle to get your child to eat?	❑	❑	❑	❑	❑
Did you feed your child yourself if s/he did not eat enough?	❑	❑	❑	❑	❑
Did you let your child decide how much of his/her meal to eat?	❑	❑	❑	❑	❑

	Never	Rarely	Some-times	Often	Always
Did you think about putting your child on a diet to keep him/her from becoming overweight?	❑	❑	❑	❑	❑
Did you have to stop your child from eating too much?	❑	❑	❑	❑	❑
At dinner, did you let your child choose the foods s/he wanted from what was served?	❑	❑	❑	❑	❑
Did you make your child eat all the food on his/her plate?	❑	❑	❑	❑	❑
Did you offer your child a dessert after a meal to get your child to eat foods that were good for him/her?	❑	❑	❑	❑	❑
When your child became agitated, was giving him/her something to eat or drink the *first* thing you would do?	❑	❑	❑	❑	❑
Did you ever punish or remove privileges to get your child to eat more?	❑	❑	❑	❑	❑
Did you ever give your child something to eat or drink if s/he was bored even though you thought s/he was not hungry?	❑	❑	❑	❑	❑
Did you get upset that your child did not eat enough?	❑	❑	❑	❑	❑
Did you worry that your child was eating too much?	❑	❑	❑	❑	❑
Did you use foods that your child liked as a way to get him/her to eat 'healthy' foods s/he didn't like?	❑	❑	❑	❑	❑
Did you make your child finish all of his/her dinner before s/he could have a dessert?	❑	❑	❑	❑	❑
Did you make your child eat all of the food on his/her plate by feeding him/her yourself?	❑	❑	❑	❑	❑
Did you get upset if your child ate too much?	❑	❑	❑	❑	❑
Did you ask your child what s/he wanted you to buy him/her to eat?	❑	❑	❑	❑	❑
Did your child have a poor appetite?	❑	❑	❑	❑	❑
Did you ever give your child something to eat or drink if s/he was upset even though you thought s/he was not hungry?	❑	❑	❑	❑	❑
If your child did not like what was being served, did you make something else?	❑	❑	❑	❑	❑
Did you allow your child to eat snacks whenever s/he wanted?	❑	❑	❑	❑	❑
Did you allow your child to play with toys at mealtimes?	❑	❑	❑	❑	❑
Did you worry that your child was not eating enough?	❑	❑	❑	❑	❑
Did you offer your child something to eat to stop his/her temper tantrums?	❑	❑	❑	❑	❑
If your child did not like a new food, did you stop giving it to him/her?	❑	❑	❑	❑	❑

PARENTS AND GUARDIANS CONSIDER MANY DIFFERENT THINGS WHEN BUYING FOODS FOR THEIR CHILDREN.

When buying food for your child/ren, how important to you are each of the following?

*When selecting **individual foods** I think it is important to buy foods that…*	Not at all important	Not very important	Important	Very important
Are fresh	❑	❑	❑	❑
Look appetising	❑	❑	❑	❑
Are easy to prepare	❑	❑	❑	❑
Have health claims on the packaging	❑	❑	❑	❑
Are low in calories	❑	❑	❑	❑
Will help my child grow and develop properly	❑	❑	❑	❑
Will not go off quickly	❑	❑	❑	❑
Appear to be of high quality	❑	❑	❑	❑
My child will eat	❑	❑	❑	❑
The rest of the family will eat	❑	❑	❑	❑
My child's friends will eat	❑	❑	❑	❑
My child pesters me to buy	❑	❑	❑	❑
Taste good in my opinion	❑	❑	❑	❑
Are affordable	❑	❑	❑	❑

*When choosing what **mix of foods** to buy I think it is important to …*	Not at all important	Not very important	Important	Very important
Buy lots of fruit and vegetables	❑	❑	❑	❑
Buy some 'treat' foods that my child will really enjoy	❑	❑	❑	❑
Buy a balanced range of foods	❑	❑	❑	❑
Buy enough different foods for my child to develop a broad range of tastes	❑	❑	❑	❑
Buy enough different foods for my child not to get bored	❑	❑	❑	❑
Keep to my shopping habits / routine	❑	❑	❑	❑
Try to do my shopping as quickly as possible	❑	❑	❑	❑

It is important to me to ***avoid buying*** *...*	Not at all important	Not very important	Important	Very important
High fat foods	❑	❑	❑	❑
Foods / drinks that will damage my child's teeth	❑	❑	❑	❑
Foods / drinks that will make my child hyperactive	❑	❑	❑	❑
Foods that will make my child fat	❑	❑	❑	❑
Foods that have been linked with health scares	❑	❑	❑	❑
Foods that I will be tempted to eat myself	❑	❑	❑	❑

THIS SECTION IS ABOUT HOW YOU INTERACT WITH YOUR CHILD IN GENERAL.

	Never	Once in a while	Half of the time	Very often	Always
I am responsive to my child's feelings and needs.	❑	❑	❑	❑	❑
I use physical punishment as a way of disciplining my child.	❑	❑	❑	❑	❑
I take my child's desires into account before asking him/her to do something.	❑	❑	❑	❑	❑
When my child asks why s/he has to conform, I state: because I said so, or I am your parent and I want you to.	❑	❑	❑	❑	❑
I explain to my child how I feel about his/her good and bad behaviour.	❑	❑	❑	❑	❑
I spank when my child is disobedient.	❑	❑	❑	❑	❑
I encourage my child to talk about his/her troubles.	❑	❑	❑	❑	❑
I find it difficult to discipline my child.	❑	❑	❑	❑	❑
I encourage my child to freely express him/herself even when s/he disagrees with me.	❑	❑	❑	❑	❑
I punish by taking privileges away from my child with little if any explanation.	❑	❑	❑	❑	❑
I emphasise the reasons for rules.	❑	❑	❑	❑	❑
I give comfort and understanding when my child is upset.	❑	❑	❑	❑	❑
I yell or shout when my child misbehaves.	❑	❑	❑	❑	❑
I give praise when my child is good.	❑	❑	❑	❑	❑
I give in to my child when s/he causes a commotion about something.	❑	❑	❑	❑	❑
I explode in anger towards my child.	❑	❑	❑	❑	❑
I threaten my child with punishment more often than actually giving it.	❑	❑	❑	❑	❑

Please give your weight: ☐ stones ☐ pounds OR ☐ kgs

What educational qualifications have you obtained?

- ❑ No qualifications
- ❑ School certificate, GCSE, O level
- ❑ A level
- ❑ National diploma (HND, ONC)
- ❑ University degree / higher degree
- ❑ Other *Please state* ____________

Are you currently:

- ❑ Employed full time
- ❑ Employed part time
- ❑ Unemployed
- ❑ Disabled / too ill to work
- ❑ Full time homemaker
- ❑ Retired
- ❑ Student
- ❑ Other *Please state* ____________

If employed or only temporarily not working, please describe your usual job:

____

If you have a partner who is employed or only temporarily not working, please describe his usual job:

____

Do you own or rent your home?

❑ Own it / buying it ❑ Rent it ❑ Other

Does your household have a car?

❑ No ❑ Yes, 1 car ❑ Yes, more than 1 car

We are very interested in hearing your thoughts on any aspect of this questionnaire, so please write any further comments you have in the box below. (Add extra paper or write on the back if necessary).

FURTHER RESEARCH

Diary study
As part of this research project we are asking some parents to fill in a diary about their child's eating for just two days of one week.
If you would be interested in taking part, *please tick the following box* ❑

Questionnaire interview
We would also like to contact parents to ask them about how easy they found the questionnaire to complete.
If you are willing to be contacted about this, *please tick the following box* ❑

Second questionnaire
We plan to create an improved version of this questionnaire on the basis of our findings from this one.
If you would be willing to fill in the new questionnaire, *please tick the following box* ❑

Contact details If you have agreed to be contacted for either of the reasons above, please give your contact details below:

Name

Address

Postcode

Telephone numbers: Home
Work
Mobile

Email

Thank you very much for taking the time to complete this questionnaire.

Please now return it to your child's class teacher.

You will then be entered into a prize draw to win a £30 WH Smith voucher!

Appendix III: Example of completed diary used in Study 2

2100

DIET IN PRESCHOOLERS: DIARY

This study is part of a project conducted by the Health Behaviour Unit at University College London.

It is an extension of the 'Diet in Preschoolers' questionnaire, so please complete the diary for the *same child*.

If you have any questions please contact:
Susan Carnell
Health Behaviour Unit
Department of Epidemiology and Public Health
University College London

Instructions

Please use this diary to record all food- or drink- related interactions you have with your child on two days: once during the ***week***, and one during the ***weekend***.

These might include your response to your child's request for a snack, an overall account of a particular mealtime, or an occasion where you gave your child some food.

Remember we are interested in ***all food- or drink- related interactions***, so please record any time food is eaten or mentioned by your child.

An example is given below:

Time of day: 18.00
Food/drink involved: Roast chicken, peas, carrots and chips
What happened?
We were having our evening meal. Ben left his vegetables on his plate so I asked him to finish them. He ate a few then refused to eat any more.
Why do you think you and your child behaved in this way?
He left the vegetables because he doesn't like them. I asked him to finish his veg because I think they are good for him.

Please try to record each event as soon as it has happened, as this will help you to remember it more accurately, and use more paper or write on the back of the diary if necessary.

Thank you very much for your help with our research!

Day: THURSDAY Date: 5 DEC 02

Time of day	Food / drink involved	What happened?	Why do you think you and your child behaved in this way?
8AM	GLASS OF MILK	HE DRANK THE WHOLE GLASS	LIKES MILK FIRST THING
8.30AM	BOWL OF CRUNCHY NUT CORNFLAKES	ATE A LITTLE BIT THEN "I'M NOT HUNGRY".	HE CAN BE LAZY IN THE MORNINGS IF HIS FAVOURITE CARTOONS ARE ON. I INSIST HE HAS TO FINISH OTHERWISE HE CANNOT WATCH ANY CARTOONS, SO HE DOES.
9-12	AT NURSERY HE HAS A PIECE OF FRUIT & SQUASH.		
12.30	VEGETABLE PIE	HE EATS IT FULLY	HE LIKES IT.
1.30	GLASS OF MILK	FINISHES IT.	
3.30	2 BISCUITS	EATS THEM.	
4.30	WATER	DRINKS HALF A GLASS	HE PREFERS A SWEET TASTE BUT I DO BUY THE "NO ADDED SUGAR".
5.30	"	DRINKS A GLASS WITH ROBINSONS DILUTE ADDED TO IT.	
6.30	BOILED RICE, PIECE OF CHICKEN & SALAD.	EATS ALL THE CHICKEN AND SALAD. THE RICE IS LEFT ON THE PLATE.	I THINK HE WAS FULL BUT I SAID EAT SOME RICE SO HE EATS AT LEAST HALF OF IT.
7.00	APPLE, SATSUMA	EATS THE FRUIT.	HE LOVES FRUIT, ACTUALLY CUT UP OR PEELED AND WILL EAT IT STRAIGHT AWAY
8.00pm	MILK	DRINKS MILK	READY TO SLEEP, LIKES MILK LAST THING BEFORE SLEEPING.

Day: SATURDAY Date: 7TH DEC 02

Time of day	Food / drink involved	What happened?	Why do you think you and your child behaved in this way?
9am	GLASS OF MILK	FINISHED MILK REALLY QUICKLY.	
9.30	EGG ON TOAST	EATS HALF OF IT, AND SLOWLY.	I ASKED HIM TO FINISH IT OTHERWISE HE CANNOT COME SHOPPING WITH ME. HE EATS A LITTLE BIT MORE.
11 AM	BANANA, SATSUMA	HE ATE HIS FRUIT.	
12 NOON	SOME MORE MILK	HE DRANK IT.	I WAS WITH HIM AND I INSIST HE EATS + DRINKS HIS FOOD FOR HIM TO BE A STRONG BOY.
1pm	BOILED CHICKEN, BRUSSEL SPROUTS, BROCOLLI, CARROTS. GRAVY.	ATE THE CHICKEN AND SOME VEGETABLES BUT NOT ALL.	I SAID YOU HAVE TO EAT SOME MORE AND FINISH YOUR PLATE HAD A FEW MORE MOUTHFULLS BUT DID NOT FINISH THE WHOLE LUNCH.
2pm	HALF A BOUNTY BAR.	ATE THE CHOCOLATE	
	GLASS OF ROBINSONS	DRANK HIS SQUASH.	
3pm	GLASS OF MILK	DRANK HIS MILK	
6pm	SLICE OF TOAST	ATE HIS TOAST.	
7pm	SOME GRAPES	ATE THEM.	
8pm	GLASS OF MILK	FINISHED IT.	

Appendix IV: Framework outline used in Study 2

CHART A: Sample characteristics and knowledge

1. **Relationship** with target child
2. **Parent** characteristics (age, marital status)
3. **Children** and **ages**
4. **SES** indicators (occupation, partner occupation, education, home ownership, car ownership)
5. **School, area, nursery / reception** class
6. **Monitoring** (Knowledge of child's eating at school, outside home, at special events (eg birthday parties)

CHART B: Child influences on use of control

1. **Illness**
2. **Tiredness** / boredom / laziness
3. **Excitability** / distraction
4. Response to **peers** / siblings
5. **Age** of child
6. **Tastes** of child
7. **Neophobia** / fussiness / faddiness
8. **Enjoyment** of food / food responsiveness / fast eating / good appetite
9. **Lack of interest** in food / satiety responsiveness / slow eating
10. Child **temperament** (eg contrary, distractable, easygoing)

CHART C: Environmental / parental influences on use of control

1. **Time pressure** / other **practicalities** eg being busy with more children, week versus weekend day, eg avoid creating mess
2. Recognised **exceptions** / treats (eg don't mind about birthday parties / Christmas)
3. **Inability to monitor** (eg at nan's / birthday parties, but do mind a little bit)
4. Influence of **parenting experience** (eg less concern with more children, as opposed to specifically realise children are able to control intake)
5. **Habit** (ie when parent conformity to habit overrides general control policy)

CHART D: Parental control of environment

1. **Availability** of **type** of foods (ie parental control over what buy, what in house, what presented at meals and snacks versus child choice, controlled / limited choice)
2. Availability of **amount** of food (ie parental control over how much food generally presented at meals / snacks – portion control, rules about second helpings versus child choice of how much on plate)
3. **Accessibility** (ie parental control of when children allowed to eat foods, whether children can access foods from fridge / cupboards themselves)
4. **Appeal** of food (ie parental manipulation of palatability of food eg mix with liked foods, presentation of food eg not too much on plate)
5. **Socialisation** / social context (eg eating as family, teaching to eat with others)
6. **Structure** (eg eating at table versus in front of TV, manners) versus child choice about way eat food (eg what order eat things in, what eat with, what use to eat food)

CHART E: Parental control individual level – pressure to eat

1. **Bargaining**
2. **Rewarding** consumption of target food (or something is contingent on consumption)
3. **Spoon-feeding**
4. Using **game** / distraction
5. **Verbal** (Discussion / explanation eg must eat to grow big and strong)
6. **Type** of food (eg meal versus snack, vegetables versus other parts of meal)
7. **Child choice** re **type** of food (eg what to eat of dinner)
8. Child choice re **amount** of food (eg how much to eat at dinner)
9. Child choice re **how** to eat food

CHART F: Parental control individual level – restriction

1. **Rules** (including contingencies eg not until you've done X, retrospective contingencies, often motivated by balance)
2. Target **food as reward** (including contingent on other behaviour/ food intake
3. **Verbal** instructions
4. Suggestion of **alternatives**
5. **Type** of food (snacks, high fat/sugar, desserts)
6. **Child choice** re **type** and **amount** of snack (including how often eat)

CHART G: Motivations for (enduring) control policy / general feeding

1. **Energy** short-term and long-term (eg eat enough to keep going)
2. **Folk beliefs** and short-term **health** (eg avoid hyperactivity, illness, eat for warmth)
3. **Balanced diet** / proper meals (including want child to eat dinner versus snacks, not worried about certain things because OK if get overall balance)
4. **Long-term health** of diet (eg avoid sugar, fat, include vitamins and minerals)
5. **Weight control** (including lack of control because exercise more important)
6. Fear of **eating disorders** / creating issue around food (including fear of consequences of over-restriction)
7. Faith in **children's own internal regulation** of intake (or lack of internal regulation, including more relaxed over years, attribute this to increased faith in intake regulation)
8. **Practicalities** (ie when desire to avoid waste etc helps form policy)
9. Teach enjoyment of food **/ socialisation**
10. **Parent-child relationship** (eg guilt that not eating, fear of creating battle)
11. **Modelling** on own parents

Chart A: Sample characteristics and eating knowledge

ID	***1) Relationship with target child***	***2) Parent characteristics (age, marital status, ethnicity)***	***3) Children and ages***	***4) SES indicators (occupation, partner occupation, education, home ownership, car ownership)***	**5) School, area, school class**	**6) Monitoring (memory of what child ate, nowledge of child's eating at school, outside home (eg childminder, friend, relative), special events (eg birthday parties, inc talking about food w child**
2059	Mother	27y, married, Black African	4y11 male, 3 brothers (8y, 9y, 12y), 1 sister (3y)	GCSEs, full-time employment, operation assistant, husband night auditor, 2 cars, rent home		Remembers well what daughter had for lunch at home, and son had at school & snack & home (p3-4)
2061	Mother	31y, married, White British	4y11 female, 1 sister (1y)	Education not completed, full-time employment, bank assistant manager (non-manual), husband warehouse manager, 2 cars, own/buying house		Discusses what oldest had at school lunch at end of day. Not really aware of what eats at childminders. Questioned what had at school Xmas dinner(p1). Can't see what's left as well with lunchbox (p2). Doesn't know what eats at dad's / childminder's. Doesn't cook for her much (p3).
2020	Mother	37y, separated, White British	3y4 male, only child	GCSEs, full-time homemaker, 1 car, own/buying house		Good knowledge of nursery snack *routine, dinner at friend's.* Can't remember what had for lunch (p1).
2070	Father	42y, married, White British	3y7 female, 1y9 sister	City & Guilds qualification, self-employed carpenter, wife is quality assurance manager for retailer, 2 cars, own/buying house		Good knowledge of what had for breakfast, and dsome knowledge of school snacks/fruit. Fed them through most of day (p1). Always say what have you had *to eat or ask my mum* what she's had, so I'll know what to give them in the evening (p2). Describes types of foods eaten at 3 parties and says just let her get on with it 'She was just getting on with a group of girls, they were older and looking after her and she was quite happy to eat with them (p3). Good agreement between husband and wife re what

Chart B: Child influences on use of control

ID	1) Illness	2) Tiredness / boredom / laziness	3) Excitability / distraction	4) Social factors (inc response to peers / siblings)	5) Age / developmental stage / learning of child	6) Tastes of child	7) Neophobia / fussiness / faddiness	8) Enjoyment of food / food responsivess / fast eating / good appetite	9) Lack of interest in food / satiety responsiveness, slow eating / poor appetite	10) Child temperament (eg contrary, easygoing, attention-seeking, relationship with mother, shy)
2059	Didn't eat much because thinks got cold at moment (p3).	Thinks maybe has to spoon-feed because just lazy (p3)			Thinks just grew out of poor appetite because didn't do anything (p4).	Had Lunchables, then got fed up of that, then sandwiches. When he gets home, does eat properly so maybe just got fed up of sandwiches (p4). Daugther requests cake and apple. Son requests Peppearami (p5).	Daughter was fussy eater when little (p1). Smells biscuits before eats them (p2). Doesn't eat a lot of things, just a few things she sticks to (p3). Daughter was very different from sons from the beginning, just chose that (p5).		Daughter would sit for an hour [not eating food] (p3).	Daughter wants to eat when mother eating so will feed her. Eats herself when husband home (p3)
2061				Switched to school dinners because only 2 of them had packed lunches and had to sit on different tables, wanted to get with friends (p1). Very led by what others eating (p2). Ate pears because friends ate at school (p4).		Very into eating meat and potatoes, a bit stubborn with vegetables (p2). Likes traditional things eg meat pie, roast dinners, toad-in-hole. Must get from mum (p3).	Usually (only?) eats Weetabix for b-fast (p1). Is so fussy that was hard to find things to go in lunchbox (p1). Younger one much more willing to try new foods. Hannah was fussy from 18mo but baby eats curry and hot chilli (p4). Won't eat anything new (p4).	Is type of child who would always pick at something for the sake of eating - banana, apple, packet of crisps (p2). Would never over-indulge, might have a couple of chocolates because they were there (p6).		Hannah was much easier, quieter baby, more relaxed, forward, faster developer. Changed slightly at terrible twos (p4).
2020		Thinks might have to spoon-feed in evening because tired (p2).	Better at eating when eat with him because otherwise wonders what doing (p4).	Was sitting at a table with older boys who ate all food and was so pleased, eat there and ate the whole lot (p2). Eats better with mother there - if go off he wonders what I'm doing (p4).		Would live on toast and cereal for breakfast, lunch and tea. Tell him what's for tea and he wants Rice Krispies (p2).		Elliot would ask for things all day but doesn't necessarily finish them (p3).		Thinks doesn't have meal in evening because being lazy, quite tired by 6.30 (p2).
2070			For a while, difficult to get Lauren to sit at table but better at that now. Doesn't eat properly when up and running but now sitting back at table eats more again (p4).			[Encouragement to eat not needed?] Cooked up pasta with smoked salmon, broccoli and some cream just for some sauce, which my two really like (p3). Older one eats most things without too much fuss and Lauren's a fairly typical 2 year old - she'll love something one day and hate it the next (p4).				

Chart C: Environmental / parental influences on use of control					
ID	**1) Time pressure / other practicalities (eg with more children, week vs weekend day, avoid creating mess)**	**2) Recognised exceptions / treats / importance of enjoying treats (eg birthday parties, Christmas, when friends visit, 'now and again') Flexibility**	**3) Inability to monitor (ie children outside control)**	**4) Influence of parenting experience (eg less concern with more children)**	**5) Habit (eg parent conformity to habit overrides general control policy)**
2059	Left to her she would sit for an hour (at dinner) and I don't have the time for that so I feed her myself (p3).	Will let them have one or two things they want for Christmas when take them shopping (p5).	Knew didn't eat lunch from lunch-box and expect to eat so going to talk to teacher (p4).	Gives impression that son with sickle cell disease may make more cautious with slim daughter.	
2061	Makes them rush to eat in the morning (p1). If thinking would say no, don't need these, but normally a big tantrum whether eaten or not, but sometimes just allow it for an easier life (p3). More likely to offer something new at the weekend or to ask what want to eat (p5).	Has McDonald's and proper meal at grandparents at weekend (p5). Won't restrict chocolate/crisps on Xmas day because wouldn't over-indulge. If asked for a bit more, would allow because Xmas (p5).	Doesn't tend to ask/know what child eats at dad's / grandparents' / childminders.	Stick to what know because immense trouble getting oldest to eat (p1). Started just preparing one meal when youngest was 2 months old, giving her our food mushed down (p5).	
2020	He's always keen to have *breakfast but lunch is a* problem - could be getting on for 1.30/2 before can give him lunch (p1). Thinks eat quite a bit at nursery snacktime because likes snacky things (p1). Didn't offer a pudding because at friends' so kids just went out to play (p4).	*[How much make him eat] depends* on how have eaten throughout day - if ate all lunch and had some fruit and stuff in the afternoon then not such a big deal (p4). Won't try to stop him eating sweet things for Xmas because lots about, everyone eating it, and it's only a couple of days so not a problem (p4).			Has biscuit in morning out of habit, routine, started from when had rusk (p1).
2070	Doesn't seem to force child to eat if in rush in morning 'if we're running late or something it's down to me she eats less because I say brush your teeth and get up and go (p1).	When my friends came they hadn't eaten so we ate our proper dinner at 3.30 which was an unusual time for them (p3). Sometimes on an occasion like that they'd have sweeties but I don't think they did that day (p3). They might have had a tree decoration but not very much really (p3). Thought might give them a little bit of fruit later but in fact they were both really tired and went to bed early that night (p3). Suppose there's more chocolate around [at Xmas] which might spoil their appetite [seems happily resigned to this]. No particular changes in our household (p4).			When it's bedtime she'll have a little cup of milk while we read a story. I just think it's a comfort thing- she likes to listen to a story with her milk in her beaker (p2).

Chart D: Parental control of environment

ID	1) Availability of type of foods (ie parental control over what buy, what in house, what presented at meals and snacks vs child choice (pester power), controlled / limited choice (shared responsibility), inc adjusting what offered to balance over days)	2) Availability of amount of food (ie parental control over how much food presented at meals / snacks (portion control, rules re second helpings) vs child choice of how much on plate)	3) Accessibility (ie parental control of when children allowed to eat foods, whether children can access foods from fridge, cupboards themselves, inc child choice re WHEN to eat)	4) Appeal of food (ie parental manipulation of palatability of food (eg mix with liked foods), presentation of food (eg don't put too much on plate), inc child choice of prep of food	5) Socialisation / social context (eg eating as a family, teaching to eat with others, family culture of enjoyment of food)	6) Structure (eg eating at table vs in front of TV, manners vs child choice or where to eat, how to eat)
2059	Daughter wants everything that's Tweenies, not going to eat it, just likes it because of the pictures so I don't (p5). Will limit them to buying one or two things they want at Xmas. Going to cut down this year (p5).	Think she would have had a kid's bowl but I would have preferred her to eat more then that (p3).	Put crisps in cupboard where can't reach (p2). Am going to pack in [Xmas food], take it off the table. So will hide it where they can't reach and say it's finished. They don't accept it, my older son knows I'm lying but I'll say it anyway (p6).	She used to have [milkshake] in a beaker but now she has it in a cup, she likes that (p4).		
2051	*Doesn't vary what offered because breakfast is* rushed affair - have had immense trouble so stick to what know (p1). Duaghter comes shopping and might have choice of sort of *crisps / fruit / cakes, but with normal meals will* have what I buy and cook (p3). 'Admits' that when cook, use a lot of convenience food, good old kids things (p3). Made a point of *offering broccoli at Xmas dinner because* Hannah likes (p5).			Likes Weetabix with hot milk, as grandad ate it so was a bit of naughty thing, a treat, because it's not something we'd normally try here, so usually has that (p1).		
2020	When thought child much better from cold said had to start eating proper meals and he said no but did eat it (p2). Son is mostly with me when do a shop, eg likes Dairylea cheese dippers and if walking round and he sees those he'll ask for them and I'll get them (p3). At the end of the day a lot of the time he'll eat what I eat. At the end of the day I drcide what goes in the trolley. Can't think of a time when asked for something I didn't want to buy him (p3).					
2070	Very often children come shopping. Normally put basket on back of pram and let them put stuff in - what apples do you want, red grapes or white grapes, what yoghurts they want but they can choose (p4). I know what they like to eat and what they will eat. So I tend to stick to that as well with the odd thing thrown in (p4). Had liver and bacon once but didn't go down too well so we steer clear of that (p4).	Had her porridge, probably half to three quarters of what an adult would eat, quite a nice bowl size. I put it in until I see there's a nice little load in her bowl, the most through experience she would eat (p1).	Will eat sweets if lying around (p1).	Normally stir a bit of dried fruit, raisins and things into porridge, which they absolutely love - the little one loves snacking on raisins as well so it just encourages them to eat the porridge really. Very occasionally we might stir in a bit of milkshake mix to make it a bit different. It's just porridge with raisins in and a little bit of sugar, my husband puts honey in quite often as well (p3). Rose likes making little cakes and jellies and things and she'd made some jelly frogs and we put some cubes of pineapple into that and some cake things so it wasn't just pure jelly (p3).	[Appeal cont] I know this week their eating times have been a bit irregular, so I'll probably cook a little chicken soup for them - chicken and vegetables - in order to get it down them nice and easily (p3). I occasionally buy something different to get out of the norma of the regular meals I suppose (p4).	Dad - we'll normally sit down at the table and eat together when we come home. Mum - Wish that we could sit down the four of us together but so difficult. Wish it could be more of an occasion. But sat down together this evening and they didn't eat very well. Just the social thing, all sitting at the table and being as a family (p4).

Chart E: Parental vs child control of individual - pressure to eat									
ID	**1) Bargaining**	**2) Rewarding consumption of target food (or something is contingent on consumption)**	**3) Spoon-feeding**	**4) Using game / distraction (inc repeated exposure)**	**5) Verbal (discussion / explanation (eg must eat to grow big and strong), instructions, imploring)**	**6) Type of food (eg meal vs snack, veg vs other parts of meal)**	**7) Child choice re type of food (eg what to eat of dinner, offering alternatives)**	**8) Child choice re amount of food (eg how much to eat at dinner, absence of parental pressure)**	**9) Child choice re how to eat food (eg when to have lunch, which order to eat items in)**
2059	She said to me "Mum, I'm full" and I said to her "Eat two more spoons". But when I realised she was holding her stomach I thought I don't want her to be sick so I let her have drinks (p3).		Feeds children herself. Want them to eat it themselves but do once in a while to be happy they've eaten (p1).		Told son have to eat lunch and will speak to teacher (p4). Said if you want to be stronger than your brother, if you want to beat one of them up! (p4)		Didn't have much of main meal, only chicken, so try and make her have slice of bread. See if she can have a bowl of Weetabix and if she doesn't, make her a milkshake (p4).		
2061		At Xmas, knew she had special present so had incentive - eat your food and you'll get this treat. But would have eaten that anyway (p5).		Would always try new foods more than once, eg jars of baby food. Easier when younger because didn't know what was eating! (p4)				Has days where daughter only has two mouthfuls but don't offer anything else - if you don't want to eat it, you go hungry (p1). Ate about 3/4 of banana and to be honest I just said have you finished now, are you sure you don't want anymore, and threw the rest away (p3).	
2020			Feeds him sometimes in evenings because thinks he is tired (p2).		Will often try and leave table before finished, and will have to say come on finish this. Pleased that ate it all (p4).		Son chooses whether to have cereal or toast or both (p1). Offered selection of liked fillings for lunchtime, he chose jam (p3). He normally eats what I eat but if I'm having a curry or something like that I will do something different, eg fishfingers, mashed potatoes and carrots (p3?)	Gave him a child bowl of cereal, which I think is sufficient for his age, but if he asks for toast, give it to him because feel he is still a little bit hungry (p2).	If say let's have lunch and he says no, don't make a big issue out of it (p1). Around 12.15 asked him if he wanted lunch and he said no so I thought I'd ask him in a little while. He said no 15 minutes later and said he wanted an apple and a tangerine and ate that. Eventually had lunch around 1.15 (p3).
2070	Have been times when we've tried to make them eat more than they wanted and they've ended up being sick (p4).			You just say well you do like this and if she just won't eat it you let it go and a couple of weeks later she probably will eat it (p4).			[At breakfast] I normally ask her what she wants. Normally she just has cereal of porridge. Sometimes she just has yoghurt, a bit of toast and some fruit (p1).	Sometimes we have a pudding or some fruit but she said she'd had enough and that was it really (p2).	

Chart F: Parental vs child control of individual - restriction						
ID	1) Rules (inc contingencies eg not until you've done x?, retrospective contingencies?, motivated by balance?)	2) Target food as reward (inc contingent on other (eating?) behaviour?	3) Verbal, instructions	4) Suggestion of alternatives	5) Type of food (snacks, high fat/sugar, desserts)	6) Child choice re type and amount (inc how often eat) of snack
2059	Any snack has to be after 12. Any cake or crisps has to be after lunch (p1). Only let them have a packet a day because if let would have 3-4 packets (p2). On brother's birthday allowed them one chocolate bar each (p2). No drinks after 7, bedtime (p3).			If there's no crisps, he'll have a yoghurt or a glass of milk (p2).	Don't let them have too much salt ie crisps (p2) Cut down on sugary things, let them have a lot of fruit. Brought them up not having chocolate. For them, they like biscuits and crisps.	Lets daughter eat cake because very slim when little and happy for her to eat anything she can eat (p1).
2061	Whether allow crisps depends on what just ate, time of day. Said no to packet of crisps early in day. Not before bed (p2).				Restricts crisps, anything eaten just for the sake of eating (p3).	Has habit of running into kitchen to see what can find, points up to the cupboard, eating for the sake of eating. Sometimes allow it for an easier life (p3).
2020	Wouldn't let him have fruit if continually kept asking for things (p2). Can't have fruit before dinner		Said can't have [crisps/fruit] if going to waste (p?)		Wouldn't be able to have sweets or a cake or biscuit (p3).	Could have fruit if asked after breafast (p2). Asked for banana and said yes because knew dinner wouldn't be for another hour (p3).
2070						There's always some fruit available so she would ask, she'll say can I have some bread or a sandwich and we'll make her something to eat or she'll grab a bit of fruit or something, or sweets obviously if they're lying around (p1).

Chart G: Motivations for control policy / feeding strategies

ID	1) Wanting child to have energy, short-term and long term (eg eat enough to keep going)	2) Folk beliefs and short-term health (eg avoid hyperactivity, illness, warmth, eat something/don't eat before bed)	3) Balanced diet / variety / 'proper' meals (inc want child to eat dinner vs snacks, not worried re certain things because concerned w diet overall)	4) Wanting child to be healthy, more long-term (eg avoid sugar, fat, include vitamins and minerals, health scares, inc desire to establish gd habits, medical reasons)	5) Weight control (inc lack of control because exercise more important)	6) Fear of eating disorders / creating issue around food / consequences of over-restriction, over-pressuring eg effect on preferences	7) Faith (or lack of) in child's self-regulation of amount and type fo foods (inc more relaxed over years because learn able to regulate)	8) Practicalities (eg desire to avoid waste etc help form policy). Also influence of own diet on what feed child.	9) Enjoyment of food, socialisation (inc manners, want to teach to share etc)	10) Affective factors (eg guilt that not eating, fear of creating battle, don't want to upset child)	11) Modelling on own treatment (eg do as parents did, avoid what don't like oneself) Also expert, family advice
2059		Offer her something else if didn't eat enough dinner because worried will go to bed with no food (p4).		Read in paper that too much salt not good. When come have packet of crisps, lips go white. Has high blood pressure and has to cut down on salt herself (p2). Sugary food no good for their health (p2). Lets drink because of sickle cell disease (p3).	Press to eat and don't restrict because when daughter little was very fussy, very slim, wouldn't eat. And younger boy was underweight with sickle cell disease. Happy for them to eat to put on weight (p1). Glad son eats because can see his ribs and very very worried (p4).					Feels bad when has big plate of dinner and they're not eating anything, feel guilty, feel it's not right (p5).	
2081		Would like her to have something warm in the evening (p1). Don't like her eating late in the evening (p2).						Works quite late and so is often a gap before eating. Don't want to cook (p2).		Allow her to eat for the sake of it to avoid a tantrum (p?).	
2020		Because doesn't really eat lunch, worry that he's gone a few hours and will be going to bed on an empty stomach (p2).	Allowed banana at 4pm because knew dinner wouldn't be for another hour (p3). Don't let him have fruit 15 minutes before dinner (p3).	Don't like him to have too many sweet things because of teeth (p3).			Don't worry about him not eating much lunch because know will eat all dinner because he's hungry (p1).	Yesterday afternoon asked for tangerine, peeled it and he ate half of it. Then asked for a packet of crisps and he just ate a few. Thought of the waste - if not going to eat these things you're not having it (p3).			
2070		[Balance cont] My mum was cooking some beans, sausage and scrambled egg - more snacky. If it was up to me we'd sit down (p1).	Sometimes they get too tired to eat and it's bathtime, so I make sure the next day they have a proper meal during the day (p1). For example, recently they had a couple of parties and cakes and that sort of stuff and didn't really eat in the evening. So the following afternoon I did a carbonara with a bit of fish and brocoli (p2).	We used to force her to eat to make sure she got all her nutrients, eg fish and veg, the healthier food. The fish oils are meant to be quite good aren't they? (p2). If have been eating irregularly, not as well as they normally do, I make them chicken soup so know they've had something nutritious (p3).			She always keeps herself quite occupied really, and she'll tell you if she's hungry (p1). Have been occasions where I'd make her eat a bit more than she'd really like but we've stopped doing that now and let her eat what she wants - just thought she'd probably be the better judge of it (p2).	[Faith cont] Was one particular night she was complaining she felt sick and I just thought maybe we shouldn't force her to eat kind of thing (p2).			

ID

THE PARENTAL FEEDING SURVEY

We want to understand more about **how children eat** and **how parents feed them** so we can develop better advice for parents.

We are interested in hearing about your **3-5 year old child**, however easy or difficult he or she is to feed.

You may find the questionnaire a bit **repetitive**. We apologise for this **but please answer all the questions** – all your responses are important to us.

And don't forget there are **no right or wrong answers**!

When you have completed the questionnaire please **return it to your child's class teacher within two weeks.**

PRIZE DRAW! To thank you for participating you have already been entered in a prize draw to win a £30 Boots voucher!

Thank you very much for your help with this important research

If you have any questions please contact:
Susan Carnell, Cancer Research UK Health Behaviour Unit, Dept of Epidemiology and Public Health, University College London,

Please remember that all your responses will be completely anonymous and confidential to the university research team. You will not be contacted by any third parties.

THE FIRST SECTION ASKS YOU FOR SOME GENERAL INFORMATION ABOUT YOU AND YOUR CHILD.

What is your relationship with the 3-5 year old child in the nursery / reception class?

☐ Mother ☐ Father ☐ Guardian ☐ Other

If other please state: ______________________

How old is your child? [ ] years [ ] months

What sex is your child? ☐ Male ☐ Female

What position in the family is he/she?

☐ Oldest ☐ Middle ☐ Youngest ☐ Only child

If applicable, please give the ages of your child's brothers and sisters below:

Brother/s [ ] [ ] [ ] [ ] Sister/s [ ] [ ] [ ] [ ]

How tall is your child? [ ] feet [ ] inches OR [ ] cms

How much does your child weigh? [ ] stones [ ] pounds OR [ ] kilos

How did you find out your child's weight?

☐ Assessment by nurse at school ☐ Visit to GP or clinic ☐ Guessed / estimated

☐ Weighed child for this survey ☐ Regularly weigh my child

Is your child or any of your other children eligible for free school meals? ☐ Yes ☐ No

How does your child generally eat lunch?

☐ School meal ☐ Packed lunch ☐ At home

Please add any further background information you think may be relevant (eg food allergies, special diets, illnesses):

THIS SECTION IS ABOUT HOW YOUR CHILD GENERALLY EATS.

Please show how true you think each statement is by ticking one of the boxes:

	Never	Rarely	Some-times	Often	Always
My child loves food.	☐	☐	☐	☐	☐
My child has a big appetite.	☐	☐	☐	☐	☐
My child finishes his/her meal very quickly.	☐	☐	☐	☐	☐
My child is interested in food.	☐	☐	☐	☐	☐
My child eats slowly.	☐	☐	☐	☐	☐
My child is always asking for food.	☐	☐	☐	☐	☐

	Never	Rarely	Some-times	Often	Always
If allowed to, my child would eat too much.	☐	☐	☐	☐	☐
My child leaves food on his/her plate at the end of a meal.	☐	☐	☐	☐	☐
My child takes more than 30 minutes to finish a meal.	☐	☐	☐	☐	☐
Given the choice, my child would eat most of the time.	☐	☐	☐	☐	☐
My child looks forward to mealtimes.	☐	☐	☐	☐	☐
My child gets full before his/her meal is finished.	☐	☐	☐	☐	☐
My child enjoys eating.	☐	☐	☐	☐	☐
My child gets full up easily.	☐	☐	☐	☐	☐
Even if my child is full up, he/she finds room to eat his/her favourite food.	☐	☐	☐	☐	☐
My child eats more and more slowly during the course of a meal.	☐	☐	☐	☐	☐
My child cannot eat a meal if he/she has had a snack just before.	☐	☐	☐	☐	☐
If given the chance, my child would always have food in his/her mouth.	☐	☐	☐	☐	☐

THIS SECTION IS ABOUT HOW KEEN YOUR CHILD IS TO TRY NEW FOODS.

	Strongly disagree	Disagree	Agree	Strongly agree
My child is constantly sampling new and different foods.	☐	☐	☐	☐
My child doesn't trust new foods.	☐	☐	☐	☐
If my child doesn't know what is in a food, he/she won't try it.	☐	☐	☐	☐
My child is afraid to eat things he/she has never had before.	☐	☐	☐	☐
My child is very particular about the foods he/she will eat.	☐	☐	☐	☐
My child will eat almost anything.	☐	☐	☐	☐

PEOPLE FEED THEIR CHILDREN IN MANY DIFFERENT WAYS.
THIS SECTION IS ABOUT HOW YOU FEED YOUR CHILD.

	Never	Seldom	Half of the time	Most of the time	Always
When your child is at home, how often are you responsible for feeding him/her?	☐	☐	☐	☐	☐
How often are you responsible for deciding what your child's portion sizes are?	☐	☐	☐	☐	☐
How often are you responsible for deciding if your child has eaten the right kind of foods?	☐	☐	☐	☐	☐

How would you describe <u>your child's weight</u> at each of these time periods?	Very under-weight	Under-weight	Normal	Over-weight	Very over-weight
Your child during his/her first year of life	☐	☐	☐	☐	☐
Your child as a toddler	☐	☐	☐	☐	☐
Your child at the moment	☐	☐	☐	☐	☐

How would you describe <u>your own weight</u> at each of these time periods?		Very under-weight	Under-weight	Normal	Over-weight	Very over-weight
Your childhood (5-10 years old)		☐	☐	☐	☐	☐
Your adolescence		☐	☐	☐	☐	☐
Your twenties		☐	☐	☐	☐	☐
Your thirties	☐ N/A	☐	☐	☐	☐	☐
Currently		☐	☐	☐	☐	☐

How concerned are you about the following?	Un-con-cerned	A little con-cerned	Con-cerned	Fairly con-cerned	Very con-cerned
Your child eating too much when you are not around	☐	☐	☐	☐	☐
Your child eating too much in general	☐	☐	☐	☐	☐
Your child having to diet to maintain a desirable weight	☐	☐	☐	☐	☐
Your child becoming overweight	☐	☐	☐	☐	☐
Your child being overweight at the moment	☐	☐	☐	☐	☐
Your child not eating enough when you are not around	☐	☐	☐	☐	☐
Your child not eating enough in general	☐	☐	☐	☐	☐
Your child having to eat high energy foods to maintain a desirable weight	☐	☐	☐	☐	☐
Your child becoming underweight	☐	☐	☐	☐	☐
Your child being underweight at the moment	☐	☐	☐	☐	☐
Your child eating so much of one thing that he/she feels ill	☐	☐	☐	☐	☐
Your child appearing greedy to others	☐	☐	☐	☐	☐
Your child not eating enough at mealtimes then getting hungry later	☐	☐	☐	☐	☐
Your child looking under-nourished to other people	☐	☐	☐	☐	☐
Your child not growing as well as he/she should	☐	☐	☐	☐	☐

Please tick the box which best corresponds to your answer:	Never	Rarely	Some-times	Mostly	Always
How much do you keep track of the *sweet things (eg sweets ice-cream, cake, biscuits, chocolate)* your child eats?	☐	☐	☐	☐	☐
How much do you keep track of the *snack food (eg crisps, cheesy crackers)* that your child eats?	☐	☐	☐	☐	☐
How much do you keep track of the high fat foods that your child eats?	☐	☐	☐	☐	☐

How much do you agree or disagree with the statements below?

	Disagree	Slightly dis-agree	Neut-ral	Slightly agree	Agree
I have to be sure that my child does not eat too many *sweet things (eg sweets, ice-cream, cake, biscuits, chocolate)*.	☐	☐	☐	☐	☐
I have to be sure that my child does not eat too many *high fat foods*.	☐	☐	☐	☐	☐
I have to be sure that my child does not eat too much of his/her *favourite foods*.	☐	☐	☐	☐	☐
I intentionally keep some foods out of my child's reach.	☐	☐	☐	☐	☐
If I did not guide or regulate my child's eating, he/she would eat too much of his/her *favourite foods*.	☐	☐	☐	☐	☐
If I did not guide or regulate my child's eating, he/she would eat too many *junk foods*.	☐	☐	☐	☐	☐
I offer *sweet things (eg sweets, ice-cream, cake, biscuits, chocolate)* to my child as a reward for good behaviour.	☐	☐	☐	☐	☐
I offer my child his/her favourite foods in exchange for good behaviour.	☐	☐	☐	☐	☐

	Disagree	Slightly dis-agree	Neut-ral	Slightly agree	Agree
I have to be especially careful to make sure my child eats enough.	☐	☐	☐	☐	☐
If my child says "I'm not hungry," I try to get him/her to eat anyway.	☐	☐	☐	☐	☐
If I did not guide or regulate my child's eating, he/she would eat much less than he/she should.	☐	☐	☐	☐	☐
My child should always eat all of the food on his/her plate.	☐	☐	☐	☐	☐
If I did not insist that my child eats everything on his/her plate he/she would not eat enough.	☐	☐	☐	☐	☐
If I did not insist that my child eats everything on his/her plate he/she would not eat a good balance of different foods.	☐	☐	☐	☐	☐

THIS SECTION ASKS YOU MORE ABOUT THE WAY YOU FEED YOUR CHILD.

Please tick the box which best corresponds to your answer:

	Never	Rarely	Some-times	Often	Always
Do you encourage your child to look forward to his/her meal?	☐	☐	☐	☐	☐
Do you praise your child if he/she eats what you give him/her?	☐	☐	☐	☐	☐
Do you encourage your child to eat a wide variety of food?	☐	☐	☐	☐	☐

	Never	Rarely	Some-times	Often	Always
Do you present food in an attractive way to your child?	☐	☐	☐	☐	☐
Do you encourage your child to taste each of the foods you serve at mealtimes?	☐	☐	☐	☐	☐
Do you encourage your child to try foods he/she hasn't tasted before?	☐	☐	☐	☐	☐
Do you encourage your child to enjoy his/her food?	☐	☐	☐	☐	☐
Do you praise your child if he/she eats a new food?	☐	☐	☐	☐	☐

	Never	Rarely	Some-times	Mostly	Always
Do you make your child eat all the food on his/her plate?	☐	☐	☐	☐	☐
Does your child have to stay at the table until he/she has eaten a certain amount?	☐	☐	☐	☐	☐
Do you make your child finish all of his/her dinner before he/she can have a dessert?	☐	☐	☐	☐	☐
Do you offer your child a dessert after a meal to get him/her to eat foods that were good for him/her?	☐	☐	☐	☐	☐
Do you use foods that your child likes as a way to get him/her to eat 'healthy' foods s/he doesn't like?	☐	☐	☐	☐	☐
Do you use puddings as a reward to get your child to eat his/her main course?	☐	☐	☐	☐	☐
Do you withhold your child's favourite food if he/she misbehaves?	☐	☐	☐	☐	☐
Do you promise your child something to eat in order to get him/her to behave?	☐	☐	☐	☐	☐
Do you reward your child with something to eat when he/she is well behaved?	☐	☐	☐	☐	☐

	Never	Rarely	Some-times	Often	Always
Do you give your child something to eat to make him/her feel better when he/she is feeling upset?	☐	☐	☐	☐	☐
Do you give your child something to eat to make him/her feel better when he/she has been hurt?	☐	☐	☐	☐	☐
Do you give your child something to eat if he/she is feeling bored?	☐	☐	☐	☐	☐
Do you give your child something to eat to make him/her feel better when he/she is feeling worried?	☐	☐	☐	☐	☐
Do you give your child something to eat to make him/her feel better when he/she is feeling angry?	☐	☐	☐	☐	☐

THIS SECTION IS ABOUT HOW MUCH YOUR CHILD INFLUENCES THE WAY YOU FEED HIM/HER.	Never	Rarely	Some-times	Mostly	Always
Do you let your child decide when he/she wants to eat his/her meal (eg lunch/dinner)?	☐	☐	☐	☐	☐
Do you let your child decide when to have a snack?	☐	☐	☐	☐	☐
Do you let your child decide when he/she has had enough of his/her meal?	☐	☐	☐	☐	☐
Do you let your child decide how much snack food (eg crisps, cheesy crackers) to eat?	☐	☐	☐	☐	☐
Do you let your child decide how many healthy snacks (eg fruit) to eat?	☐	☐	☐	☐	☐
If your child does not like a new food, do you stop giving it to him/her?	☐	☐	☐	☐	☐
If your child does not like what is being served, do you offer him/her something else?	☐	☐	☐	☐	☐
Do you let your child decide what you buy him/her to eat?	☐	☐	☐	☐	☐
Do you let your child choose which foods to have for his/her meal (eg lunch/dinner)?	☐	☐	☐	☐	☐
At your child's main meal, do you let him/her choose the foods he/she wants to eat from what is on his/her plate?	☐	☐	☐	☐	☐
Do you decide what your child eats between meals?	☐	☐	☐	☐	☐

NOW WE ARE INTERESTED IN THE GENERAL CHARACTERISTICS OF YOUR CHILD.	Disagree	Slightly disagree	Neut-ral	Slightly agree	Agree
My child tends to be shy.	☐	☐	☐	☐	☐
My child cries easily.	☐	☐	☐	☐	☐
My child likes to be with people.	☐	☐	☐	☐	☐
My child is always on the go.	☐	☐	☐	☐	☐
My child prefers playing with others rather than alone.	☐	☐	☐	☐	☐
My child tends to be somewhat emotional.	☐	☐	☐	☐	☐
When my child moves about, he/she usually moves slowly.	☐	☐	☐	☐	☐
My child makes friends easily.	☐	☐	☐	☐	☐
My child is off and running as soon as he/she wakes up in the morning.	☐	☐	☐	☐	☐
My child finds people more stimulating than anything else.	☐	☐	☐	☐	☐
My child often fusses and cries.	☐	☐	☐	☐	☐

	Disagree	Slightly disagree	Neut-ral	Slightly agree	Agree
My child is very sociable.	☐	☐	☐	☐	☐
My child is very energetic.	☐	☐	☐	☐	☐
My child takes a long time to warm up to strangers.	☐	☐	☐	☐	☐
My child gets upset easily.	☐	☐	☐	☐	☐
My child is something of a loner.	☐	☐	☐	☐	☐
My child prefers quiet, inactive games to more active ones.	☐	☐	☐	☐	☐
My child doesn't like to be alone.	☐	☐	☐	☐	☐
My child reacts intensely when upset.	☐	☐	☐	☐	☐
My child is very friendly with strangers.	☐	☐	☐	☐	☐

NOW WE ARE INTERESTED IN HOW GENERAL PARENTING STYLE RELATES TO THE WAY YOU FEED YOUR CHILD.
THIS SECTION IS A STANDARD PARENTING QUESTIONNAIRE.

	Disagree strongly	Disagree somewhat	Agree somewhat	Agree strongly
I believe that my child should be able to question the authority of his/her parents.	☐	☐	☐	☐
Too much emphasis is placed on personal freedom nowadays for young children.	☐	☐	☐	☐
A child who defies authority is not very likable.	☐	☐	☐	☐
Other parents probably see me as rather firm with my child.	☐	☐	☐	☐
I believe children would be better behaved if parents listened more to what their children had to say.	☐	☐	☐	☐
A child who always does as he/she is told is not very interesting.	☐	☐	☐	☐
I care that my child obeys me more than most parents would.	☐	☐	☐	☐
It is good to see my child hold his/her own in an argument with an adult.	☐	☐	☐	☐
I try to take my child's opinions seriously.	☐	☐	☐	☐
I do not like my child to question my decisions.	☐	☐	☐	☐
It is all right with me if my child argues with me about my decisions.	☐	☐	☐	☐
I don't particularly like my child to argue with me.	☐	☐	☐	☐
With respect to my child, I would characterise my discipline as quite firm.	☐	☐	☐	☐

NOW WE WOULD LIKE TO ASK YOU A FEW QUESTIONS ABOUT YOURSELF.

Are you male or female? ☐ Male ☐ Female

How old are you? ☐ years

What is your marital status?

☐ Single ☐ Married ☐ Living as married
☐ Separated ☐ Divorced ☐ Widowed

How would you describe your ethnic origin?

☐ White British ☐ Pakistani ☐ Black African
☐ White European ☐ Bangladeshi ☐ Black Caribbean
☐ Indian ☐ Chinese ☐ Other *Please state* ____________

Please give your height: ☐ feet ☐ inches OR ☐ cms

Please give your weight: ☐ stones ☐ pounds OR ☐ kilos

At what age did you leave full-time education? ☐ years

What educational qualifications have you obtained?

☐ No qualifications ☐ National diploma (HND, ONC)
☐ GCSE, O level, School certificate ☐ University degree (BA, BSc)
☐ NVQ, GNVQ ☐ Higher degree (MA, MSc, PhD)
☐ A level ☐ Other *Please state* ____________

Are you currently:

☐ Employed full-time ☐ Employed part-time ☐ Full-time homemaker
☐ Unemployed ☐ Disabled / too ill to work ☐ Retired
☐ Student ☐ Other *Please state* ____________

If employed, please give the full title of your main job:

____

Please tick the box which best describes your living arrangement:

☐ Rent from local authority ☐ Rent from agent / private landlord ☐ Own / buying home ☐ Live with parents / family

Does your household have a car or van?

☐ No ☐ Yes, one ☐ Yes, more than one

Optional question:- **Which category best describes your total annual household income? (including your own and your partner's salary and any benefits)**

☐ Less than £9,999 ☐ £10,000-19,999 ☐ £20,000-20,999 ☐ £30,000-30,999
☐ £40,000-40,999 ☐ £50,000-50,999 ☐ £60,000-60,999 ☐ More than £70,000

PLEASE TURN OVER . . .

YOUR COMMENTS

We are interested in all your thoughts about your child's eating and how you feed your child. We are also interested in how easy you found the questionnaire to complete. Please write any comments you have below.

Please feel free to add extra paper if necessary...

THAT'S IT - THANK YOU VERY MUCH FOR YOUR HELP!

In the future we may want to contact you again about our ongoing research into children's eating. If you would like to be contacted, please give your details below:

Name

Address

Postcode

Telephone numbers: Home

Work

Mobile

Email

Appendix VII: Correlations (Pearson's r) between parental feeding scales, perceptions / concerns about child weight, child eating behaviour and child BMI centile (Study 4)

	Pressure to eat	Food to reward food	Prompting to eat	Emotional feeding	Monitoring	General restriction	Meal-time rules	Food to reward behaviour	Perceived child weight	Concern re overweight	Concern re underweight	Satiety responsiveness	Food responsiveness	Enjoyment of food	Child BMI centile
Parental feeding scales															
Pressure to eat	-														
Food to reward food	.38 p=.000	-													
Prompting to eat	.05 p=.265	.12 p=.005	-												
Emotional feeding	.20 p=.000	.28 p=.000	-.03 p=.452	-											
Monitoring	-.14 p=.001	-.03 p=.574	.33 p=.000	-.18 p=.000	-										
General restriction	.07 p=.104	.21 p=.000	.10 p=.030	.12 p=.004	.28 p=.000	-									
Meal-time rules	.35 p=.000	.43 p=.000	.16 p=.000	.25 p=.000	.03 p=.536	.17 p=.000	-								
Food to reward behaviour	.24 p=.000	.43 p=.000	.03 p=.497	.48 p=.000	-.08 p=.057	.29 p=.000	.30 p=.000	-							
Perceptions / concerns about child weight															
Perceived child weight	-.16 p=.000	-.09 p=.036	-.03 p=.491	-.10 p=.017	.09 p=.033	.03 p=.440	-.10 p=.031	-.08 p=.083	-						
Concern re overweight	.05 p=.277	.05 p=.218	.06 p=.187	.12 p=.008	.08 p=.076	.22 p=.000	.15 p=.001	.14 p=.001	.11 p=.016	-					
Concern re underweight	.38 p=.000	.20 p=.000	.10 p=.031	.16 p=.000	.01 p=.870	.07 p=.099	.23 p=.000	.15 p=.000	-.15 p=.000	.62 p=.000	-				
Child eating behaviour															
Satiety responsiveness	.41 p=.000	.24 p=.000	.08 p=.057	.01 p=.752	-.02 p=.735	.00 p=.934	.04 p=.321	.07 p=.119	-.25 p=.000	-.12 p=.006	.21 p=.000	-			
Food responsiveness	-.15 p=.001	.03 p=.485	.09 p=.050	.22 p=.000	.03 p=.507	.23 p=.000	.13 p=.003	.20 p=.000	.06 p=.203	.10 p=.020	-.09 p=.051	-.31 p=.000	-		
Enjoyment of food	-.39 p=.000	-.20 p=.000	.11 p=.012	-.02 p=.712	.20 p=.000	.08 p=.055	-.01 p=.892	.00 p=.945	.22 p=.000	.13 p=.003	-.16 p=.000	-.62 p=.000	.45 p=.000	-	
Child BMI centile	-.18 p=.000	-.16 p=.001	-.08 p=.095	-.04 p=.374	.01 p=.842	.02 p=.675	-.10 p=.030	-.01 p=.889	.30 p=.000	.13 p=.007	-.10 p=.039	-.24 p=.000	.10 p=.035	.14 p=.003	-

Appendix VIII: Results of multiple regressions predicting feeding behaviours (Study 4)

Results for predictors of 'Prompting to eat' in multiple regression model (n=423)

	B	SE (B)	Beta	t	Sig	R^2	Adj r^2
Model 1							
SES	.045	.060	.036	0.75	.455		
Perceived parent weight	-.057	.053	-.052	-1.07	.288	.004	-.001
Model 2							
SES	.042	.059	.035	0.71	.476		
Perceived parent weight	-.050	.053	-.046	-0.95	.345		
Child BMI centile	-.002	.001	-.076	-1.57	.118	.010	.002
Model 3							
SES	.070	.061	.057	1.15	.250		
Perceived parent weight	-.056	.053	-.052	-1.06	.291		
Child BMI centile	-.002	.001	-.071	-1.41	.160		
Concern about overweight	.016	.036	.028	0.44	.660		
Concern about underweight	.040	.031	.083	1.29	.198	.020	.008
Model 4							
SES	.080	.060	.066	1.32	.186		
Perceived parent weight	-.071	.053	-.065	-1.34	.182		
Child BMI centile	-.001	.001	-.060	-1.19	.236		
Concern about overweight	.020	.037	.035	0.53	.597		
Concern about underweight	.034	.033	.071	1.05	.294		
Food responsiveness	.113	.043	.133	2.60	.010		
Satiety responsiveness	.100	.052	.104	1.90	.058	.039	.023

Results for predictors of 'Emotional feeding' in multiple regression model (n=423)

	B	SE (B)	Beta	t	Sig	R^2	Adj r^2
Model 1							
SES	-.187	.078	-.117	-2.41	.017		
Perceived parent weight	-.064	.069	-.045	-0.92	.358	.016	.012
Model 2							
SES	-.189	.078	-.118	-2.43	.016		
Perceived parent weight	-.059	.070	-.041	-0.85	.394		
Child BMI centile	-.001	.001	-.042	-0.86	.391	.018	.011
Model 3							
SES	-.138	.079	-.086	-1.74	.083		
Perceived parent weight	-.070	.069	-.049	-1.01	.311		
Child BMI centile	-.001	.001	-.033	-0.67	.505		
Concern about overweight	.027	.047	.036	0.57	.567		
Concern about underweight	.076	.041	.120	1.88	.061	.038	.027
Model 4							
SES	-.110	.077	-.069	-1.43	.155		
Perceived parent weight	-.089	.068	-.062	-1.31	.190		
Child BMI centile	-.001	.001	-.036	-0.73	.463		
Concern about overweight	-.003	.048	-.004	-.060	.952		
Concern about underweight	.101	.042	.159	2.42	.016		
Food responsiveness	.285	.055	.256	5.16	.000		
Satiety responsiveness	.066	.066	.053	1.00	.321	.096	.081

Results for predictors of 'Monitoring' in multiple regression model (n=423)

	B	SE (B)	Beta	t	Sig	R^2	Adj r^2
Model 1							
SES	.264	.083	.152	3.16	.002		
Perceived parent weight	.105	.074	.068	1.41	.158	.029	.025
Model 2							
SES	.264	.084	.152	3.16	.002		
Perceived parent weight	.104	.075	.068	1.40	.163		
Child BMI centile	.000	.002	.007	0.15	.882	.029	.023
Model 3							
SES	.283	.086	.163	3.31	.001		
Perceived parent weight	.090	.075	.058	1.21	.228		
Child BMI centile	.000	.002	-.011	-0.21	.832		
Concern about overweight	.095	.051	.119	1.87	.062		
Concern about underweight	-.023	.044	-.033	-0.52	.606	.039	.028
Model 4							
SES	.285	.086	.165	3.32	.001		
Perceived parent weight	.088	.075	.057	1.16	.246		
Child BMI centile	-.000	.002	-.010	-0.20	.846		
Concern about overweight	.094	.053	.117	1.75	.080		
Concern about underweight	-.022	.047	-.032	-0.47	.641		
Food responsiveness	.029	.061	.024	0.48	.635		
Satiety responsiveness	.015	.074	.011	0.20	.840	.040	.024

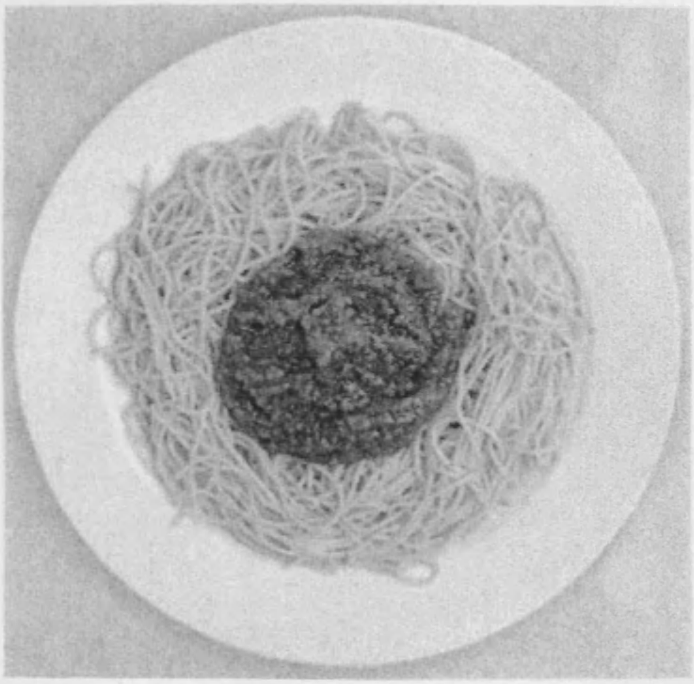
Results for predictors of 'General restriction' in multiple regression model (n=423)

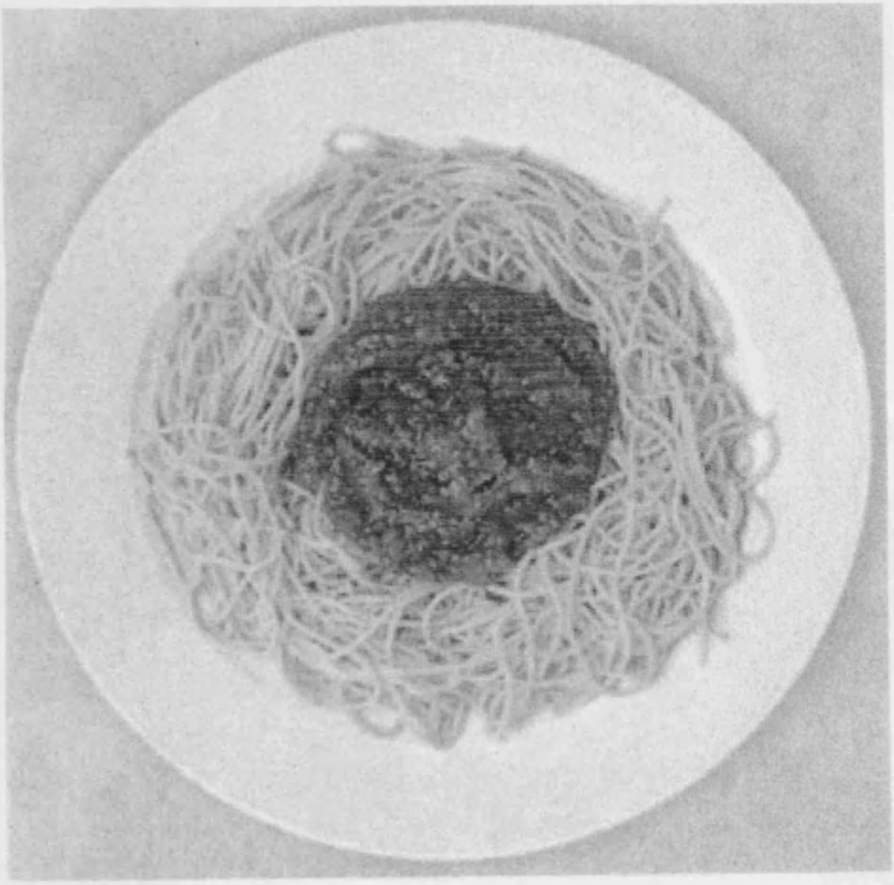
	B	SE (B)	Beta	t	Sig	R^2	Adj r^2
Model 1							
SES	.054	.094	.028	0.58	.565		
Perceived parent weight	.122	.084	.071	1.46	.145	.006	.001
Model 2							
SES	.055	.094	.028	0.58	.561		
Perceived parent weight	.120	.084	.070	1.43	.154		
Child BMI centile	.001	.002	.015	0.32	.752	.006	-.001
Model 3							
SES	.098	.094	.051	1.04	.299		
Perceived parent weight	.083	.082	.048	1.01	.313		
Child BMI centile	-.001	.002	-.031	-0.63	.531		
Concern about overweight	.262	.055	.295	4.72	.000		
Concern about underweight	-.079	.048	-.103	-1.64	.101	.063	.052
Model 4							
SES	.126	.092	.065	1.37	.171		
Perceived parent weight	.051	.081	.030	0.63	.529		
Child BMI centile	-.001	.002	-.021	-.434	.665		
Concern about overweight	.255	.057	.287	4.48	.000		
Concern about underweight	-.077	.050	-101	-1.54	.124		
Food responsiveness	.307	.066	.229	4.67	.000		
Satiety responsiveness	.187	.079	.125	2.37	.018	.113	.098

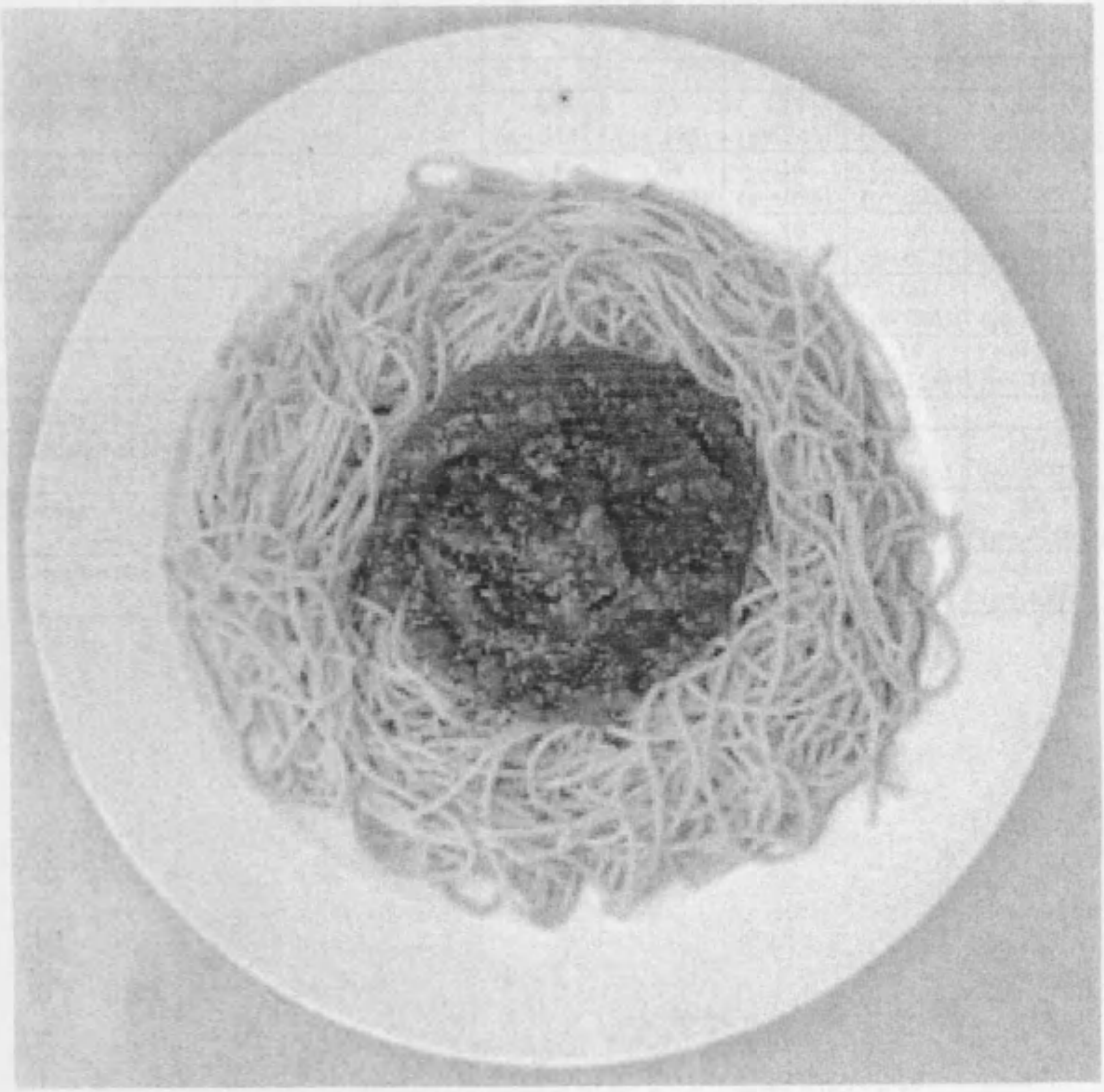
Results for predictors of 'Food to reward behaviour' in multiple regression model (n=423)

	B	SE (B)	Beta	t	Sig	R^2	Adj r^2
Model 1							
SES	-.252	.102	-.120	-2.47	.014		
Perceived parent weight	.052	.091	.028	0.57	.569	.015	.010
Model 2							
SES	-.252	.102	-.120	-2.47	.014		
Perceived parent weight	.053	.091	.028	0.58	.559		
Child BMI centile	-.000	.002	-.011	-0.22	.824	.015	.008
Model 3							
SES	-.188	.104	-.090	-1.81	.071		
Perceived parent weight	.035	.091	.019	0.39	.698		
Child BMI centile	-.000	.002	-.010	-0.21	.836		
Concern about overweight	.071	.061	.073	1.15	.249		
Concern about underweight	.073	.053	.087	1.37	.173	.035	.023
Model 4							
SES	-.157	.102	-.075	-1.54	.123		
Perceived parent weight	-.001	.089	.000	-0.04	.997		
Child BMI centile	-.000	.002	.000	-0.01	.996		
Concern about overweight	.064	.063	.066	1.01	.311		
Concern about underweight	.075	.055	.090	1.35	.177		
Food responsiveness	.339	.073	.232	4.66	.000		
Satiety responsiveness	.209	.087	.127	2.39	.017	.086	.070

Appendix VIIII: Materials for hunger tests used in Study 6 / 7







Appendix X: Correlations (Pearson's r) between child eating outcomes and potential confounding variables (Study 7)

	EWH intake	Eating rate	Lunch intake	Fruit & vegetable intake	Bread intake	Snack food intake	Protein food intake
Child factors							
Child age	.11 (p=.255)	-.01 (p=.886)	-.06 (p=.514)	.13 (p=.195)	-.11 (p=.248)	-.11 (p=.291)	.04 (p=.700)
Shyness	-.21 (p=.039)	-.22 (p=.023)	-.21 (p=.027)	-.04 (p=.717)	-.16 (p=.096)	-.10 (p=.327)	-.17 (p=.092)
Emotionality	-.03 (p=.748)	-.11 (p=.256)	-.23 (p=.020)	-.06 (p=.568)	-.10 (p=.290)	-.18 (p=.072)	-.08 (p=.445)
Sociability	.18 (p=.069)	.01 (p=.962)	.03 (p=.781)	.01 (p=.905)	.05 (p=.626)	-.00 (p=.986)	-.01 (p=.934)
Activity	.28 (p=.006)	.32 (p=.001)	.20 (p=.036)	-.02 (p=.867)	.06 (p=.532)	.14 (p=.158)	.15 (p=.142)
Family SES							
Educational level	-.03 (p=.742)	.08 (p=.436)	.03 (p=.786)	.02 (p=.877)	.04 (p=.661)	.02 (p=.856)	-.01 (p=.893)
Income	-.11 (p=.367)	.01 (p=.958)	.01 (p=.955)	-.22 (p=.065)	.03 (p=.801)	-.07 (p=.572)	.10 (p=.410)
Home ownership	.11 (p=.295)	-.03 (p=.753)	-.06 (p=.519)	-.10 (p=.331)	.01 (p=.961)	-.02 (p=.807)	-.08 (p=.410)