Development of the Parental Modelling of Eating Behaviours Scale (PARM): Links with food intake among children and their mothers

Running head: Parental modelling of eating

Abstract

This study aimed to develop a self-report questionnaire to explore parental modelling of eating behaviours and then to use the newly developed measure to investigate associations between parental modelling with healthy and unhealthy food intake in both mothers and their children. Mothers (N=484) with a child aged between 18 months and 8 years completed the Parental Modelling of Eating Behaviours Scale (PARM), a new, self-report measure of modelling, as well as a food frequency questionnaire. Principal component analysis of the PARM identified 15 items grouped into three subscales: Verbal modelling (modelling through verbal communication); Unintentional Modelling (children adopting eating behaviours that parents hadn't actively modelled); and Behavioural Consequences (children's eating behaviours directly associated with parental modelling). The PARM subscales were found to be differentially related to food intake. Maternally perceived consequences of behavioural modelling were related to increased fruit and vegetable intake in both mothers and children. Unintentional modelling was related to higher levels of savoury snack intake in both mothers and their children. This study has highlighted three distinct aspects of parental modelling of eating behaviours. The findings suggest that mothers may intentionally model healthy food intake while unintentionally acting as role models for their children's less healthy, snack food intake.

Keywords: Eating Behaviours; Food preferences; Measurement; Child; Maternal; Modelling; Parental feeding strategies; Questionnaire; PARM; Fruit and vegetables.

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Parental influences on their children's eating behaviours during infancy and early childhood are well established (e.g., Birch & Fisher, 2000; Carper et al., 2000; Faith et al., 2004; Hughes et al., 2008). The first five years of life are deemed to be critical in the development of eating behaviours (Birch & Fisher, 1998). During this time, parents actively make food choices for their family, provide the mealtime environment, and use feeding practices to reinforce the development of those eating patterns they prefer (e.g., Baranowski et al., 2007; Birch et al., 2007).

Within the family, eating behaviours and food preferences are often transferred across generations (Kemm, 1987; Wardle, 1995), along with obesity (Garn & Clark, 1976) and patterns of disordered eating (Cutting et al., 1999). One potential form of influence is parental role modelling; whereby behaviours, preferences and attitudes relating to food and eating are modelled by parents (e.g., Cutting et al., 1999; Cullen et al., 2000; Hall & Brown, 1982; Harper & Sanders, 1975; Jansen & Tenney, 2001; Rossow & Rise, 1994; Tibbs et al., 2001). Modelling is a process of observational learning which relies on the parent to encourage and facilitate behaviour within the child, with the consequence of the behaviour becoming habitual (Bandura, 1971). A limited amount of research suggests that there are several aspects of this multidimensional construct which remain ambiguous. Specifically, no distinction has been drawn between intentional and unintentional modelling or between behavioural and verbal modelling.

It is plausible that parents use modelling as a feeding strategy by intentionally demonstrating preferred eating practices in front of their child (for example, eating vegetables with the intended outcome of increasing their child's vegetable consumption; e.g., Reinaerts et al., 2007; van der Horst et al., 2007). In keeping with this notion, studies have found strong similarities between the food intake and preferences of parents and their children (e.g., Brown & Ogden, 2004; Gibson et al., 1998). Similarly, experimental studies have found that children are more likely to eat new foods if their parents also eat the same item during a shared mealtime (Addessi et al., 2005; Harper & Sanders, 1975). In support of this is research using facial expression cues, which found that showing pictures of individuals displaying pleasure in eating a food which was disliked by the participant increases the participant's desire to eat the previously disliked food (Barthommeuf et al., 2009). In addition to the conscious modelling of desired behaviours, parents are a continuous role model for their child (e.g., Rhee, 2008; Sallis & Nader, 1988) and therefore may also unintentionally model eating behaviours. This distinction between intentional and unintentional modelling of eating behaviours has been overlooked in previous research, but is nevertheless likely to be important.

Another potentially important distinction is between behavioural and verbal modelling. Parents may directly model their eating behaviours through physical means (e.g., eating certain foods in front of their child), or through verbal means (e.g., stating their food preferences). Some previous research has touched on behavioural modelling (e.g., Reinaerts et al., 2007; Tibbs et al., 2001), whereas verbal modelling has not been explored as a separate facet of modelling, although the use of verbal communication in modelling has been alluded to in some assessments of modelling, for example: "I tell my child that healthy food tastes good" (Musher-Eizenman & Holub, 2007). The use and effectiveness of both behavioural and verbal modelling on the development of children's eating behaviours requires further exploration.

Although research assessing the impact of parental modelling on children's eating behaviours is limited, a number of positive health outcomes have been found. For instance, Gregory et al. (2010) found parental modelling of healthy eating predicts lower levels of food fussiness and higher interest in food among preschool-aged children. Other studies have focused on the relationship between reported outcomes of parental modelling and child food intake, especially fruit and vegetable consumption, with research finding both strong (Reinaerts et al., 2007; Tibbs et al, 2001: Young et al., 2004) and weak (Cullen et al., 2001) positive associations between parent and child intake. Less positive eating activities have also been associated with parental modelling (e.g., intake of high fat and sugar snacks and sweetened beverages; Brown & Ogden, 2004; Hendy et al., 2008; Woodward et al., 1996). This initial research has focussed on the perceived consequences of behavioural modelling, using questions such as: “When I show my child I enjoy eating fruits/vegetables, he/she tries them” (Tibbs et al., 2001). Such questions provide a route into examining modelling through parents’ perception of their child’s response to their modelling behaviours.

An important facilitating factor in the modelling process is the opportunity for children to observe their parents’ eating behaviours. Experimental research has found that young children were more likely to accept a new food if their parent ate the same food with them, than if the children were simply presented with the food (Addessi et al., 2005; Harper & Sanders, 1975). This suggests that it is not merely the presence of the parent at a mealtime which influences a child’s intake, as shown by Klesges et al. (1991), but also the parental behaviour that the child observes. Furthermore, parents report a strong belief in the importance of eating with their young children in order to model eating behaviours (Campbell et al., 2007), highlighting the importance of parents and children sharing mealtimes.

Parental feeding practices (including parental modelling), have tended to be measured via self-report questionnaires. However, most existing measures have concentrated on controlling feeding practices, such as restriction and pressure to eat (e.g., the Child

Feeding Questionnaire; Birch et al., 2001). Those that have included modelling have a number of limitations. These include having only a few items (Musher-Eizenman & Holub, 2007; Tibbs et al., 2001) or a limited focus – for example, exploring only certain modelled behaviours, such as healthy eating (Cullen et al., 2001; Hubbs-Tait et al., 2008; Musher-Eizenman & Holub, 2007; Young et al., 2004) or snacking behaviours (Hendy et al., 2008). In addition, some measures lack clarity and face validity, for example, including items which relate more to food restriction than parental modelling (e.g., "I limit my child's high-fat snacks") as part of a measure aiming to assess modelling (Tibbs et al., 2001). Existing measures have also not considered unintentional modelling or the perceived outcomes of such behaviour. Thus, currently available measures fail to fully assess the multidimensional nature of modelling within the context of eating.

In summary, the fairly limited research on modelling to date appears to suggest that parental modelling of eating or food intake can be linked to both healthy and unhealthy eating behaviours in children, yet specific details about the types of modelling behaviours that parents are displaying are lacking, mainly due to the paucity of appropriate measurement tools. Therefore, the current study had two aims. First, to develop and test the validity of a new measure to more fully assess parents' modelling of eating behaviours to their children. Second, to explore the links between different modelling behaviours with healthy and unhealthy food intake among parents and children. It was hypothesised that higher levels of maternal modelling would be positively related to healthy food intake in children.

Method

Parental Modelling of Eating Behaviours Scale (PARM): Initial item development

Potential items were generated from an extensive review of the parental feeding practices and eating behaviour literature, a critical review of existing measures, theoretical reasoning, and discussions with clinicians and academics in the field. Eighteen items assessing modelling in the broadest sense were generated and collated into a questionnaire format. Respondents were required to respond to each item on a 7-point Likert scale, anchored with strongly disagree (1) to strongly agree (7).

Participants

Four hundred and ninety seven parents of children aged between 18 months and 8 years responded and returned/submitted completed questionnaires. As only 13 (2.6%) of these respondents were fathers they were subsequently excluded, leaving 484 mothers who were included in the analyses. Mothers within this sample ranged in age from 20 to 59 years (mean age 34.6 years, SD = 5.74) and were predominantly White/British (87.4% of sample), with only Asian (4.9%) and White/European (2.1%) scoring above 1% of sample. The mothers had a mean Body Mass Index (BMI) score of 24.9 (SD = 5.08) and reported working between 0 and 68 hours per week (mean 18.53 hours, SD = 15.83); the largest group (25.4%) were non-working mothers. Mothers had an average of 4.2 years of education after the age of 16 (responses ranged from 0 to 12 years, SD = 2.67).

The children ranged in age from 18 to 107 months and had a mean age of 51.7 months (SD = 22.95). Child gender was evenly spread (boys n = 239, 50.6%; girls n = 233, 49.4%) but 14 participants failed to provide the gender of their children so these data were coded as missing. The children were predominantly White/British (84.8% of the sample), the next largest ethnicity group was Asian/Asian British (5.6% of sample) and only White/European and Mixed Ethnicity scored above 1% (1.9% and 2.1%, respectively). The mean age and gender adjusted child BMI z-score was 0.15 (SD = 2.41) (Child Growth Foundation, 1996).

Measures and Procedure

Following Institutional Review Board ethical approval and parental informed consent, data collection proceeded via two methods. First, participants were recruited through primary and junior schools, pre-schools and nurseries in the midlands region of England. Fifteen hundred questionnaires packs were distributed to mothers/primary caregivers of children aged between 18 months and 8 years and 313 were returned (a response rate of 21%). Second, the study recruited a further 184 participants through an online version of the questionnaire pack which was advertised on a number of parent forums and via two University email lists. Mandatory consent was required before the online questionnaire could be completed. Once completed and submitted, the data were only accessible via the researcher's online account. Whether the online or paper format of the questionnaire was completed, mothers/caregivers provided background information for themselves and their child, including nationality, ethnicity, age, self-reported height, weight and gender. After this, each participant completed the items generated as part of the newly developed PARM questionnaire and recorded the number of meals eaten in the past seven days with their child (out of a possible 21 meals), along with completing the following pre-established questionnaires:

<u>Comprehensive Feeding Practices Questionnaire (CFPQ: Musher-Eizenman & Holub, 2007).</u>

The CFPQ was developed to explore a range of feeding practices. It consists of 14 subscales which each explore different parental feeding practices. However, for the purpose of this study, only the modelling subscale was used, which consists of four questions that assess modelling in relation to healthy eating: "I model healthy eating for my child by eating healthy foods myself"; "I try to show enthusiasm about eating healthy foods"; "I try to eat healthy foods in front of my child, even if they are not my favourite"; and, "I show my child how much I enjoy eating healthy foods". Responses are measured using a 5-point scale (1 = Strongly Disagree to 5 = Strongly Agree). Findings by Musher-Eizenman and Holub (2007) suggest considerable support for the validity of this measure using American and French samples of parents. The CFPQ has also been successfully used with British parents (e.g., Blissett, Haycraft & Farrow, 2010) and the modelling subscale attained good reliability in the current sample (Cronbach's α .77).

Food Frequency Questionnaire (FFQ: Cooke et al., 2003)

The FFQ, developed by Cooke et al. (2003), is a parental self-report measure which assesses both the parent's and child's consumption of a range of foods by asking *"How often do you eat the following items?"* and *"How often does your child eat the following items?"* during a typical week. These questions are then followed by a list of six food types but for this study only four items were administrated: (1) Fruit (fresh or tinned); (2) Vegetables (not including potatoes); (3) Cakes, biscuits, sweets or chocolate; (4) Rice, potatoes or pasta. Parents report their intake separately for themselves and for their child and possible responses ranged from 'Never/Rarely' (1) to 'Four or more times a day' (8). For the purpose of the current study, three more food items were added. One of the additions, "Savoury snacks (e.g., crisps)", was added to enable an examination of consumption of snack foods (Brown & Ogden, 2004) which did not fall under the category of sweets and chocolates already covered by the original FFQ. The second addition to the measure was "salad items", which were split from vegetables due to findings suggesting that these items should be considered separately to vegetables (Cullen et al., 2000). The third addition was "fresh fruit juice" which has been previously linked to healthier diets in children (Baranowski et al., 2008) and to parental modelling (Woodward et al., 1996). The original FFQ has been successfully used in previous studies exploring how often items such as fruit and vegetables are consumed weekly by mothers and their child, and how these related to each other and to the nationally recommended daily intake (e.g., Cooke et al., 2003; Wardle et al., 2005).

Data analysis

Principal Components Analysis (PCA) was conducted on the 18 initial items of the modelling measure in order to establish coherent subscales. Spearman's rho correlations were then used to examine correlations between the newly developed subscales with a previously established modelling subscale (CFPQ), in order to assess the new measure's validity.

Kolmogorov-Smirnov tests established the dataset to be predominantly non-normally distributed and so non-parametric statistics were used when possible to test the study's hypothesis. Preliminary Spearman's rho correlations were conducted between the three modelling subscales identified in the PCA and maternal and child food intake with child age, child BMI z scores, maternal age and maternal BMI. Child BMI z scores, maternal age and maternal BMI did not significantly correlate with any of the food intake variables or modelling subscales. However, child age significantly correlated with child intake of cakes, biscuits, sweets or chocolate and fresh fruit juice, with maternal intake of vegetables, salad items, and rice, potatoes and pasta, with verbal modelling, and with the number of shared parent-child mealtimes (data not shown). Therefore, two-tailed partial correlations (due to a non-parametric version of this statistical test being unavailable), controlling for the age of the child, were used to test the hypotheses that modelling would be positively related to child and maternal food intake. An alpha level of 0.01 was adopted to decrease the chance of type II errors, given the reasonable sample size.

Results

Factor analysis: Preliminary analyses

Initial analyses and screening were conducted to establish the factorability of the data. Missing data were replaced by the mean for the individual, not for the sample, where three items or more had been completed, in order to avoid a reduction in the sample size and the sample variance (Hill & Lewicki, 2005). The sample of 484 participants provided a good size for factor analysis (Comrey & Lee, 1992), easily satisfying Nunnally's (1978) and Gurson's (2008) recommendations of no fewer than ten participants/cases per item. A preliminary Principal Components Analysis was conducted separately for male and female children within this sample. Results confirmed that there were no gender differences in the number of factors retained and therefore all subsequent analyses were conducted using the entire sample.

Initial factor analysis and item elimination

To explore the relationship between the initial 18 items, data from the 484 participants were subjected to a Principal Components Analysis (PCA) with varimax rotation (orthogonal rotations criterion). Initially, using Kasier (1961) criterion (i.e. Eigenvalues greater than 1), the PCA suggested the retention of 4 factors which explained 58.6% of the variance. However, the Scree plot analysis (Cattell, 1966) suggested support for either a 3 or a 4 factor solution, and parallel analysis (Horn, 1965) supported the retention of only 3 factors, so a 3 factor solution was retained. The resultant 3 factor 18-item rotated matrix from the initial PCA was further examined to reduce overlap and exclude poor items. Two items were eliminated due to their lack of conceptual (face) validity, thereby ensuring that all retained items were valid indicators of the construct being measured. Therefore, in total, 16 of the initial 18 items were retained.

Analysis of remaining 16 items

The remaining 16 items were then subjected to a second PCA with varimax rotation. All items loaded distinctly onto one factor with a factor loading of 0.55 or greater with the exception of one item. This item did not load at the inclusion value of >0.50 onto any of the factors and therefore did not contribute to the final model. This left a total of 15 items to form the new modelling measure (see Table 1).

---TABLE 1 ABOUT HERE---

Factors

This PCA suggested the retention of three factors explaining 56.94% of the variance (Factor 1, Eigenvalue = 5.14, Variance = 34.26; Factor 2, Eigenvalue = 1.44, Variance = 9.63; Factor 3, Eigenvalue = 1.97, Variance = 13.05). The three factor extraction was supported by the Scree plot analysis (Cattell, 1966) and parallel analysis (Horn, 1965). The first factor (6 items) contained items related to parental modelling through verbal communication (e.g., verbally stating own food preferences to influence child) and was labelled “Verbal modelling”. Factor two (3 items) reflected reported outcomes in children of indirect parental modelling (e.g., children adopting eating behaviours that the parents do themselves but that the parents hadn’t actively tried to promote) and so was named “Unintentional modelling”. Factor three (6 items) reflected parents’ perceived consequences of their modelling behaviours on their children’s eating behaviours and was therefore labelled “Behavioural consequences” (e.g., parents consider their child to be more inclined to eat a food item if the child observes a parent eating it). Each subscale represented the mean score of that factor (i.e., sum of items divided by the number of items). The items and factor loadings of the final questionnaire are presented in Table 1.

Internal consistency

Cronbach’s alpha for the overall scale was good (α 0.86), with alpha coefficients for each of the subscales (see Table 1) ranging from acceptable to high (Nunnally, 1978). There was a mean item-total correlation of 0.49 and all other item-total correlations were greater than 0.34.

Subscale intercorrelation

Significant relationships were found between: Verbal modelling and Behavioural consequences (r = .45, p<0.001); Verbal modelling and Unintentional modelling (r = .30, p<0.001); and, Unintentional modelling and Behavioural consequences (r = .36, p<0.001). Although there were significant correlations between the PARM subscales none of the correlations exceeded a correlation of 0.80 and consequently no multicolinearity was present (Field, 2005).

Validity

To test the convergent and concurrent validity of the PARM, a series of correlations (Spearman's r) were conducted between the three subscales of the PARM and the Modelling subscale of the previously validated Comprehensive Feeding Practices Questionnaire (Musher-Eizenman & Holub, 2007). Two of the three PARM subscales were found to be positively correlated with the CFPQ's modelling subscale (Verbal modelling, r = .45, p <0.001; Behavioural consequences, r = .31, p <0.001), lending support to the convergent and concurrent validity of the new measure.

Factor analysis summary

The results from the PCA supported a three factor model leading to the creation of three distinct subscales. These subscales reflect Verbal modelling (VM; modelling by talking with their child about eating/foods), Unintentional modelling (UM; children picking up eating behaviours exhibited by their parents which are not intentionally modelled by parents) and the final subscale denotes Behavioural consequences (BC; perceived parental outcomes to modelling, which is intended to alter their child's eating behaviours). The PARM displayed good reliability and validity and these initial findings suggest that it is therefore suitable to further explore the construct of parental modelling in relation to other factors, as presented below.

Descriptive Statistics

Information about mother and child weekly food intake (FFQ) is provided in Table 2.

---TABLE 2 ABOUT HERE---

Mothers' reports of their own and their child's food intake were all significantly and positively related (rs .48 - .70, $p < .000$), with mothers who reported eating more of a food also reporting higher intake of that food in their child too. In line with previous research (e.g., Cooke et al., 2003), mothers and children within this sample reported similar but generally low amounts of fruit and vegetable intake. The mean fruit and vegetable intake scores were around 5 for parents and children, which indicates that these foods were being eaten on average once per day. This is much lower than recommended guidelines for fruit and vegetable intake (Department of Health, 2007; Joint Health Surveys Unit, 2009; NHS Information Centre, 2009). Intake of savoury and sweet snack foods was similar for mothers and their children, also supporting previous research (Brown & Ogden, 2004).

Mothers reported eating meals with their children approximately 14 out of a possible 21 times per week (SD = 4.62). In general, mothers reported eating dinners (evening meals) with their children 5 times per week (SD = 2.11), lunches 4 times per week (SD = 3.51) and breakfasts 5 times per week (SD = 2.50). Mothers who reported eating more breakfasts with their child during the past week scored higher on PARM VM ($r = .14$, $p=0.004$) and BM ($r = .11$, $p=0.01$) subscales, but there were no significant relationships between breakfasts and the UM subscale ($r = .05$, $p=0.32$). The number of lunches that mothers and children ate together did not significantly correlate with any of the PARM subscales. Mothers who reported eating more dinners during a week with their child had higher scores on the BC ($r = .13$, $p=0.004$) and UM ($r = .16$, $p= .001$) subscales of the PARM. Mothers who reported eating more meals with their child within a week, scored higher on PARM VM (r = .12, p=0.01) and PARM BC (r = .13, p=0.006) subscales but, again, there was no significant relationship between mealtimes and the UM subscale (r = .08, p=0.06).

Testing the hypothesis that higher levels of maternal modelling would be positively related to healthy food intake in children within this sample yielded some significant associations (see Table 3).

---TABLE 3 ABOUT HERE---

The PARM BC subscale was significantly and positively associated with children's fruit, vegetable, and salad intake. PARM UM was positively associated with children's savoury snack intake, but was not significantly related to any other foods. PARM VM was not significantly related to child food intake. Children's intake of cakes, biscuits, sweets or chocolate, rice, potatoes and pasta, and fresh fruit juice were not related to any maternal modelling subscales.

Significant associations were also found between PARM scores and mothers' food intake (see table 3). Increased VM was correlated with greater maternal fresh fruit juice intake. As with the reports of children's food intake, PARM BC was positively associated with mothers' fruit intake, with a trend approaching significance between PARM BC and mothers' vegetable intake (r = .11, p=.017). PARM UM was positively associated with mothers' savoury snack intake. Maternal intake of vegetables, sweet snack foods (e.g., cakes and chocolates), rice, potatoes and, pasta, and salad intake were not significantly related to any of the three modelling subscales.

Discussion

The first aim of this research was to develop and validate a comprehensive parent report measure of parental modelling of eating behaviours. The Principal Component Analysis suggested that 15 retained items formed three distinct, coherent scales and initial examination of the validity and internal consistency of the Parental Modelling of Eating Behaviours Scale (PARM) yielded positive results. Whereas previous modelling measures have been limited in their size and scope, the three distinct sub-types of modelling identified by the PARM subscales provide researchers with a more in-depth measure of this complex behaviour.

The second aim was to use the PARM to explore relationships between maternal modelling and reported healthy and unhealthy food intake in children and their mothers. A number of interesting relationships were found. First, there was an association between mothers who perceive there to be consequences of their modelling behaviours and reports of greater fruit intake in both mothers and children, as well as higher vegetable and salad intake in children. Similar relationships have previously been found between parental modelling and child intake of fruit, vegetable and salad items (Cullen et al., 2001; Tibbs et al., 2001) but the current results extend previous findings to suggest that mothers who are aware of the outcomes of certain modelling behaviours, or who model with the specific intention of promoting certain food intake in their children, report that their children eat higher levels of healthier food items, such as fruit, vegetables and salad. It therefore follows that mothers who use modelling as a feeding strategy tend to have higher levels of healthier food intake themselves, given that one important element of modelling is for the child to see the parent eating the food that the parent is trying to encourage the child to eat (Campbell et al., 2007), and the positive association between reports of maternal and child intake of foods lends further support to this notion.

Mothers in this study who modelled verbally reported having higher levels of fresh fruit juice intake, and there was a trend approaching significance between verbal modelling and children's fruit juice intake too. Fruit juice consumption is considered a healthy option as it counts as one of the daily intake of five fruits and vegetables, which are recommended for adults and children in the UK (Department of Health, 2007; Joint Health Surveys Unit, 2009; NHS Information Centre, 2009). Thus, mothers who verbally model more, and who talk to their child more about foods and use this strategy to draw attention to their consumption of items they consider to be healthier options, choose to model healthier drink choices. However, verbal modelling was not significantly associated with maternal or child intake of any other foods. The reasons for this are unknown and there could be a number of possible explanations, for example mothers may be less aware of their use of this modelling strategy or may not consider it to be influential on the food intake of children. Additional work is required with other samples to explore this further.

The results also indicated that mothers who scored higher on unintentional modelling (behaviours which are not intentionally modelled) reported higher intake of savoury snacks both in their children and themselves. This supports previous work by Brown and Ogden (2004) who also reported a relationship between children's snacking behaviours and parental modelling, and expands on their findings by identifying unintentional modelling as the specific aspect of modelling that is linked with children's increased intake of these less healthy snack foods. Taken together, the results of the current study may therefore suggest that while parents intentionally promote their children's intake of healthy foods, such as fruit and vegetables, the modelling of less healthy snack food intake may be unintended. However, unlike Brown and Ogden's research, the present study did not find supporting evidence of a relationship between parental modelling and higher intake of sweet snack foods, such as chocolate. This could be due to these sweet foods being eaten as desserts and savoury snack foods being seen more as treats and so considered less healthy choices, thus attracting the attention of mothers. Future research would benefit from making a distinction between sweet snack foods and items eaten as puddings.

An important factor in relation to modelling is the opportunity for parental behaviours to be observed by their child. Mothers who ate more meals with their children reported higher levels of modelling (specifically, verbal and behavioural consequences). In addition, shared breakfasts and dinner times both seem to be important in producing the opportunity for modelling to occur. Mothers who reported eating more breakfasts with their child also reported higher levels of verbal and behavioural consequences modelling. The link between verbal modelling and eating breakfast together may also be a factor in the findings relating verbal modelling to higher levels of fresh fruit juice intake, which is commonly consumed at this meal. Mothers who ate more evening meals with their child reported higher levels of unintentional and behavioural consequences modelling. This could be due to parents having more time during this meal, meaning that there is a greater opportunity for them to notice the consequences of their modelled eating behaviours (both intentional and unintentional). This study did not find any relationships between shared lunchtimes and modelling, which is probably due to the age range of the children in this sample resulting in a high percentage being in school or childcare for lunch. This would mean lunchtimes would provide the less opportunity for modelling. These findings highlight the importance of shared mealtimes in the process of modelling and, potentially, in maternal awareness of the effects of acting as a role model for their children.

This study has made an important contribution to our ability to measure parental modelling of eating behaviours by identifying three distinct aspects of modelling behaviour. However, there were a number of limitations. Although the goal was to create a measure of modelling that would be as comprehensive as possible, there may remain some aspects of parental modelling that have not been included in the PARM, such as modelling outside of the home environment, negative behaviours which may be modelled, or an absence of parental modelling of eating behaviours. It is also noted that other family members (e.g., siblings) may be important role models for children's intake of foods but that unfortunately this cannot be assessed with the PARM. In addition, although the current study provided support for the validity of the PARM, the internal consistency (Cronbach's alpha) value for the unintentional modelling subscale was slightly lower than for the other two PARM subscales. This may be due to the UM subscale only consisting of three items and the fact that it is a difficult construct of modelling to assess, due to parents having to think about the possible effects on their children's eating behaviours of instances where they might unintentionally act as a role model. Furthermore, a study of test–retest reliability and further validation of the PARM with observations of family mealtimes would increase researchers' confidence in the measure. In addition, the measures were self-report measures so relied on the accuracy of mothers' reports and were not supported by an objective measure. The assessment of diet is known to be challenging and while the FFQ used in this study has been successfully employed in previous research (e.g., Cooke et al., 2003; Wardle et al., 2005), the measure only used a select number of items and these items referred to groups of food rather than individual items. Despite adding additional food groups for this study, using a more detailed measure of food intake or using food diaries or 24 hour recall could prove useful in future research. Moreover, the sample was predominantly white and generally well educated, which means that generalisation to the wider population is limited. There was also a modest response rate (21%) for parents who completed a paper version of the questionnaire and the whole sample were self-selected mothers, who may differ from other parents who chose not to take part in this study. Finally, the cross-sectional nature of our data limits the implications that can be drawn.

The PARM was created for use with parents of children within a broad age range but, given the significant association between child age and maternal reports of verbal modelling and the changes that occur in children's eating behaviours as they grow and develop, further work should consider child age as an important factor which may influence the opportunities for, and the methods of, parental modelling of eating behaviours.

In conclusion, the findings from this study support and extend previous research and highlight the possible role of maternal modelling in the development of the diets and food intake of young children. The key finding that increased parental awareness of behavioural consequences of modelling is related to greater reported healthy food intake in children is especially significant as it suggests that using modelling as a feeding strategy could provide an effective means for parents to positively influence the development of their children's diets. The results also show that mothers can be aware of the potential impact (consequences) of their modelling behaviours which therefore suggests that targeting specific modelling behaviours could prove useful in future work aiming to improve children's diets. Interventions aimed at promoting children's healthy food intake may benefit from targeting mothers' modelling behaviours, specifically the modelling strategies which are intended to alter the child's behaviour. Finally, the results also support previous research which has found modelling to be linked to less healthy food intake by elucidating Unintentional Modelling as a key factor linked to less healthy food intake. Further research into this area is required.

Conflict of interest and sources of support

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Table 1: Factor loadings and corrected item-total correlations (r^{it}) of the final Parental Modelling of Eating Behaviours Scale (PARM) items (N = 484)

Factors, items numbers, and item text		Factor Loading F1	F2	F3	r^{it}
Factor 1: Verbal Modelling	1. I make comments on my eating behaviours / food choices when I am with my child (e.g., "I'll be healthy and have vegetables").	**0.69**			.41
	7. I try to influence my child's food preferences by verbally stating my own (e.g., "I love carrots, they're one of my favourites").	**0.72**			.56
	9. I verbally encourage my child to copy my eating behaviours.	**0.61**			.48
	13. I tend to talk more often about foods I would like my child to eat.	**0.65**			.43
	14. I try to talk more often about foods I would like my child to eat.	**0.75**			.54
	15. I explain my food choices verbally to my child (e.g., "I think I'm going to have some fruit for my pudding as I like it and it's good for me)".	**0.75**			49
Factor 2: Unintentional Modelling	5. My child has picked up eating behaviours from me which I have not intentionally encouraged him/her to adopt (e.g., having tomato sauce with most meals, or eating vegetables first).		**0.63**		.38
	10. My child has picked up eating behaviours from me which I had tried to hide from him/her (e.g., avoiding certain foods).		**0.81**		.34
	11. My child has adopted eating behaviours from me which I did not previously realise I did (e.g., eating certain foods first).		**0.75**		.38
Factor 3: Behavioural Consequences	2. If I intentionally emphasise certain eating behaviours/food preferences my child is more likely to copy them.			**0.55**	.58
	3. When I show my child I enjoy fruits or vegetables, he/she tries them.			**0.84**	.56
	4. The eating behaviours of other family members influence what my child eats.			**0.67**	.54
	6. My child is more likely to try or eat new foods if I eat the new foods with him/her.			**0.85**	.61
	8. My child is more likely to try new foods he/she has seen me eating.			**0.85**	.68
	12. My child asks to try foods from my plate which he/she sees me eating.			**0.55**	.42
Eigenvalues		5.14	1.44	1.96	
Variance explained (%)		34.26	9.63	13.05	
Cronbach's alpha		0.81	0.63	0.85	
Mean (SD)		4.81 (1.13)	3.48 (1.21)	5.00 (1.25)	

Table 2: Descriptive statistics for mother and child food intake per week (FFQ[1]).

	Mother (n=480)		Child (n=478)	
	MEAN	(SD)	MEAN	(SD)
Fruit	4.98	1.79	5.64	(1.66)
Vegetables	5.09	(1.48)	4.99	(1.54)
Salad	3.74	(1.70)	2.90	(1.60)
Rice, potatoes pasta	4.42	(1.15)	4.45	(1.21)
Cake, biscuits, sweets or chocolate	3.68	(1.59)	4.00	(1.46)
Savoury snacks	2.69	(4.64)	2.59	(1.28)
Fresh fruit juice	3.20	(1.79)	3.50	(1.93)

[1]Possible response options on the FFQ range from (1) ‘Never/Rarely’ to (8) ‘Four or more times a day’.

Table 3: Two-tailed partial correlations, controlling for child age, between maternal modelling with child and maternal food intake.

	PARM subscales		
FFQ Items	**Verbal Modelling**	**Unintentional Modelling**	**Behavioural Consequences**
Child food intake			
Fruit	-.056	.056	**.233*** **
Vegetables	-.043	.082	**.267*** **
Cake, biscuits, sweets or chocolate	-.077	.005	-.108
Rice, potatoes and pasta	-.075	-.014	.108
Savoury snacks	.014	**.156** **	-.031
Salads	-.015	.004	**.238*** **
Fresh Fruit juice	.107	.004	.040
Maternal food intake			
Fruit	.061	.001	**.146** **
Vegetables	.026	.041	.110
Cake, biscuits, sweets or chocolate	-.048	.009	-.032
Rice, potatoes and pasta	.004	.007	.086
Savoury snacks	.018	**.137** **	.052
Salads	.071	-.068	.078
Fresh fruit juice	**.152** **	.027	.096

**p≤.01; ***p≤.001; FFQ = Food Frequency Questionnaire; PARM = Parental Modelling of Eating Behaviours Scale.