Department of Social Research
University of Helsinki
Finland

DIETARY HABITS AND OBESITY: THE ROLE OF EMOTIONAL AND COGNITIVE FACTORS

Hanna Konttinen

ACADEMIC DISSERTATION

To be presented, with the permission of the Faculty of Social Sciences of
the University of Helsinki, for public examination in Small Hall,
University main building, on February 17th 2012, at 12 noon.

Helsinki 2012

ABSTRACT

In post-industrialised societies, food is more plentiful, accessible and palatable than ever before and technological development has reduced the need for physical activity. Consequently, the prevalence of obesity is increasing, which is problematic as obesity is related to a number of diseases. Various psychological and social factors have an important influence on dietary habits and the development of obesity in the current food-rich and sedentary environments. The present study concentrates on the associations of emotional and cognitive factors with dietary intake and obesity as well as on the role these factors play in socioeconomic disparities in diet. Many people cognitively restrict their food intake to prevent weight gain or to lose weight, but research on whether restrained eating is a useful weight control strategy has produced conflicting findings. With respect to emotional factors, the evidence is accumulating that depressive symptoms are related to less healthy dietary intake and obesity, but the mechanisms explaining these associations remain unclear. Furthermore, it is not fully understood why socioeconomically disadvantaged individuals tend to have unhealthier dietary habits and the motives underlying food choices (e.g., price and health) could be relevant in this respect.

The specific aims of the study were to examine 1) whether obesity status and dieting history moderate the associations of restrained eating with overeating tendencies, self-control and obesity indicators; 2) whether the associations of depressive symptoms with unhealthier dietary intake and obesity are attributable to a tendency for emotional eating and a low level of physical activity self-efficacy; and 3) whether the absolute or relative importance of food choice motives (health, pleasure, convenience, price, familiarity and ethicality) contribute to the socioeconomic disparities in dietary habits.

The study was based on a large population-based sample of Finnish adults: the participants were men (N=2325) and women (N=2699) aged 25-74 who took part in the DILGOM (Dietary, Lifestyle and Genetic Determinants of Obesity and Metabolic Syndrome) sub-study of the National FINRISK Study 2007. The participants' weight, height, waist circumference and body fat percentage were measured in a health examination. Psychological eating styles (the Three-Factor Eating Questionnaire-R18), food choice motives (a shortened version of the Food Choice Questionnaire), depressive symptoms (the Center for Epidemiological Studies–Depression Scale) and self-control (the Brief Self-Control Scale) were measured with pre-existing questionnaires. A validated food frequency questionnaire was used to assess the average consumption of sweet and non-sweet energy-dense foods and vegetables/fruit. Self-reported total years of education and gross household income were used as indicators of socioeconomic position.

The results indicated that 1) restrained eating was related to a lower body mass index, waist circumference, emotional eating and uncontrolled eating, and to a higher self-control in obese participants and current/past dieters. In contrast, the associations were the opposite in normal weight individuals and those who had never dieted. Thus, restrained eating may be related to better weight control among obese individuals and those with dieting experiences, while among others it may function as an indicator of problems with eating and an attempt to solve them. 2) Emotional eating and depressive symptoms were both related to less healthy dietary intake, and the greater consumption of energy-dense sweet foods among participants with elevated depressive symptoms was attributable to the susceptibility for emotional eating. In addition, emotional eating and physical activity self-efficacy were both important in explaining the positive association between depressive symptoms and obesity. 3) The lower vegetable/fruit intake and higher energy-dense food intake among individuals with a low socioeconomic position were partly explained by the higher priority they placed on price and familiarity and the lower priority they gave to health motives in their daily food choices.

In conclusion, although policy interventions to change the obesogenic nature of the current environment are definitely needed, knowledge of the factors that hinder or facilitate people's ability to cope with the food-rich environment is also necessary. This study implies that more emphasis should be placed on various psychological and social factors in weight control programmes and interventions.

TIIVISTELMÄ

Nykyisissä länsimaisissa yhteiskunnissa ruokaa on lähes rajattomasti saatavilla ja teknologinen kehitys on vähentänyt fyysisen aktiivisuuden tarvetta. Tämä on johtanut ylipainon ja lihavuuden yleistymiseen, mikä on ongelmallista, koska niiden tiedetään altistavan monille sairauksille. Tämä tutkimus keskittyi tarkastelemaan tunteiden ja kognitiivisten tekijöiden yhteyksiä ruokatottumuksiin ja lihavuuteen sekä näiden psykologisten tekijöiden roolia sosioekonomisten ryhmien välisten erojen selittäjinä. Monet ihmiset rajoittavat tietoisesti syömistään estääkseen painon nousemisen tai pudottaakseen painoaan, mutta syömisen rajoittamisen hyödyllisyys painonhallinta keinona on myös kyseenalaistettu. Masennusoireet on yhdistetty epäterveellisempiin ruokatottumuksiin ja ylipainoon, mutta on epäselvää, mistä nämä yhteydet johtuvat. Myös sosioekonominen asema on tärkeä syömistottumuksiin vaikuttava tekijä ja ruokavalintojen taustalla olevat motiivit (esim. ruoan hinnan tai terveellisyyden tärkeys) voivat olla yksi syy sille, että epäterveelliset ruokatottumukset ovat yleisempiä alemmissa sosioekonomisissa ryhmissä.

Tutkimuksen tarkoituksena oli selvittää: 1) Vaihtelevatko syömisen rajoittamisen ja painoindeksin, vyötärön ympäryksen, tunnesyömisen, kontrolloimattoman syömisen ja itsekontrollin väliset yhteydet painoryhmän ja laihdutushistorian mukaan? 2) Selittyvätkö masennusoireiden yhteydet epäterveellisempiin ruokatottumuksiin ja ylipainoon tunnesyömisen ja liikuntaan liittyvän pystyvyyden tunteen kautta? 3) Johtuvatko sosioekonomisten ryhmien väliset erot ruokatottumuksissa eri ruokavalintamotiivien erilaisesta tärkeydestä näissä ryhmissä?

Tutkimus on osa laajaa suomalaista väestötutkimusta (DILGOM-tutkimus), jossa selvitetään ravitsemuksen, elämäntapojen ja perintötekijöiden yhteyttä lihavuuteen ja metaboliseen oireyhtymään. DILGOM-tutkimus toteutettiin osana Kansallista FINRISKI -tutkimusta 2007 ja siihen osallistui 2325 miestä ja 2699 naista, jotka olivat iältään 25–74-vuotiaita. Tutkittavien pituus, paino, vyötärön ympärys ja rasvaprosentti mitattiin terveystarkastuksen yhteydessä. Syömistapoja (syömisen rajoittaminen, kontrolloimaton syöminen ja tunnesyöminen), ruokavalintamotiiveja (terveys, mielihyvä, eettisyys, kätevyys, hinta ja tuttuus), masennusoireita ja itsekontrollia kartoitettiin olemassa olevilla kyselylomakkeilla. Frekvenssityyppistä ruoankäyttökyselyä käytettiin kartoittamaan makeiden ja suolaisten energiapitoisten ruokien sekä kasvisten ja hedelmien kulutusta. Sosioekonomista asemaa mitattiin koulutusvuosien ja ruokakunnan kokonaistulojen avulla.

Tulokset osoittivat, että 1) syömisen rajoittaminen oli yhteydessä pienempään painoindeksiin ja vyötärön ympärykseen sekä vähäisempiin syömisen hallinnan ongelmiin ja vahvempaan itsekontrolliin ylipainoisilla

sekä entisillä ja nykyisillä laihduttajilla. Sen sijaan normaalipainoisilla ja niillä, jotka eivät olleet koskaan laihduttaneet, yhteydet olivat päinvastaisia. Syömisen tietoinen rajoittaminen näyttäisi siis olevan toimiva ratkaisu ylipainoisten painonhallinnassa, kun taas normaalipainoisilla huomion kiinnittäminen syömisen rajoittamiseen saattaa ilmentää ongelmia painonhallinnassa ja toisaalta olla myös vastaus niihin. 2) Tunnesyöminen ja masennusoireet olivat molemmat yhteydessä epäterveellisempiin syömistottumuksiin, ja masentuneiden suurempi makeiden energiapitoisten ruokien kulutus selittyi taipumuksella tunnesyömiseen. Tunnesyöminen ja heikompi usko omaan kykyyn ylläpitää liikuntaharrastuksia selittivät, miksi osa masennusoireista kärsivistä oli ylipainoisia. 3) Matalasti koulutetut ja pieni tuloiset pitivät ruoan edullisuutta ja tuttuutta tärkeämpinä päivittäisiin ruokavalintoihin vaikuttavina tekijöinä kuin korkeammassa asemassa olevat. Suurituloisilla korostuivat puolestaan terveyteen ja painonhallintaan liittyvät motiivit. Nämä erot selittivät myös osittain matalammassa sosioekonomisessa asemassa olevien vähäisempää kasvisten ja hedelmien kulutusta sekä suurempaa energiapitoisten ruokien käyttöä.

Nykyinen ruoka- ja liikuntaympäristö edistää painonnousua ja toimet tämän ympäristön muuttamiseksi ovat tärkeitä. Lisäksi tarvitaan kuitenkin tietoa tekijöistä, jotka helpottavat tai vaikeuttavat painonhallintaa nykyisessä elinympäristössä. Tutkimuksen tulokset korostavat sitä, että painonhallinta ohjauksessa ja interventioissa pitäisi kiinnittää enemmän huomiota ruokavalintoihin ja liikuntaan vaikuttaviin psykologisiin ja sosiaalisiin tekijöihin.

ACKNOWLEDGEMENTS

CONTENTS

LIST OF ORIGINAL PUBLICATIONS

This thesis is based on the following publications:

I   Konttinen, H., Haukkala, A., Sarlio-Lähteenkorva, S., Silventoinen, K., & Jousilahti, P. (2009). Eating styles, self-control and obesity indicators. The moderating role of obesity status and dieting history on restrained eating. *Appetite, 53*(1), 131-134.

II   Konttinen, H., Männistö, S., Sarlio-Lähteenkorva, S., Silventoinen, K., & Haukkala, A. (2010). Emotional eating, depressive symptoms and self-reported food consumption. A population-based study. *Appetite, 54*(3), 473-479.

III   Konttinen, H., Silventoinen, K., Sarlio-Lähteenkorva, S., Männisto, S., & Haukkala, A. (2010). Emotional eating and physical activity self-efficacy as pathways in the association between depressive symptoms and adiposity indicators. *American Journal of Clinical Nutrition, 92*(5), *1031-1039.*

IV   Konttinen, H., Sarlio-Lähteenkorva, S., Silventoinen, K., Männisto, S., & Haukkala, A. Socioeconomic disparities in the consumption of vegetables, fruit and energy-dense foods: the role of motive priorities. Submitted.

The publications are referred to in the text by their roman numerals.

The original articles are reprinted here with the kind permission of the copyright holders.

ABBREVIATIONS

BMI	Body mass index
CES-D	Center for Epidemiological Studies-Depression Scale
CFI	Comparative Fit Index
CI	Confidence interval
DEBQ	Dutch Eating Behavior Questionnaire
DF	Degrees of freedom
DILGOM	Dietary, Lifestyle and Genetic Determinants of Obesity and Metabolic Syndrome Study
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders-IV
FCQ	Food Choice Questionnaire
FINRISK	The National Cardiovascular Risk Factor Survey
MLR	Maximum Likelihood Robust
OR	Odds ratio
RMSEA	Root Mean Square Error of Approximation
RS	Restraint Scale
SEP	Socioeconomic position
SRMR	Standardised Root Mean Square Residual
SD	Standard deviation
TFEQ	Three-Factor Eating Questionnaire
TFEQ-R18	Three-Factor Eating Questionnaire-R18
TLI	Tucker-Lewis Index
WC	Waist circumference

1 INTRODUCTION

Food and eating are pleasurable and essential to life. However, the abundance of palatable food items in post-industrialised societies has created problems both at the individual and societal levels. The rapidly increasing prevalence of obesity worldwide is a major public health problem, and many people are struggling to prevent weight gain or are trying to lose weight. In 2007, 66% of men and 53% of women in Finland were overweight, i.e. had a body mass index (BMI) of 25 kg/m² or higher, and 21% were obese (BMI ≥ 30 kg/m²) (Vartiainen et al., 2010). Among Finnish adolescents, a remarkable threefold increase in the prevalence of overweight has been observed from 1979 to 2005 (Kautiainen et al., 2009). Obesity, i.e. excess body weight and fat, is closely related to a number of serious health consequences, including hypertension (Hu et al., 2004), type 2 diabetes (Vazquez, Duval, Jacobs, & Silventoinen, 2007), cardiovascular diseases (Emerging Risk Factors Collaboration et al., 2011), musculoskeletal disorders (Rissanen et al., 1990) and some types of cancer (Pischon, Nothlings, & Boeing, 2008), and it also lowers physical and social functioning and quality of life (Griffiths, Parsons, & Hill, 2010). Even though not investigated in the present study, it is important to note that stigma and discrimination toward obese people are pervasive in post-industrialised societies and psychological and physical health problems associated with obesity can be partly attributed to them (Puhl & Heuer, 2010).

The current obesogenic environment has been considered to be a causal factor underlying the obesity epidemic: technological development has reduced the need for physical activity, and food is more plentiful, accessible and palatable than ever before. Together, these two factors cause excess energy intake compared to energy expenditure, leading to weight gain. However, not all individuals gain weight, and this variability between individuals has generated a vast amount of research from perspectives ranging from genetic and biological to social and cultural. Body weight is highly heritable, and from 60% to 80% of within population variation in weight has been estimated to be due to genetic differences between individuals (Schousboe et al., 2003). The strong influence of genes on body weight does not mean that other factors are unimportant, as one mechanism through which genes exert their effects on weight is in interactions with health-related behaviours, particularly dietary habits and physical activity (Li et al., 2010). In the present food-rich and sedentary environments, various psychological and social factors have an increasingly important influence on behaviours related to diet and physical activity, and consequently on obesity. Thus, although the obesogenic environment is a central contributor to the increasing prevalence of obesity, psychosocial factors are relevant as they determine how individuals respond to this environment (Faith, Fontaine,

Baskin, & Allison, 2007). Furthermore, psychosocial factors may be more amenable to change, at least in the short term, than environmental factors.

This doctoral dissertation consists of four studies and aims to increase understanding of eating-specific and more general psychosocial factors related to emotions and self-control, and their associations with dietary habits and obesity. At least some level of cognitive control of eating may be necessary for successful weight management in a food-rich environment, but cognitive restriction of food intake has also been postulated to have negative consequences (Polivy & Herman, 1985). Moreover, emotional states, especially negative ones, have long been considered to be linked with food intake (Macht, 2008) and can either facilitate or hinder an individual's ability to control him- or herself (Baumeister, Tice, & Zell, 2007). The eating-specific psychosocial factors of interest in this study are psychological eating styles (the cognitive restraint of eating, emotional eating and uncontrolled eating) and the motives underlying food selection (health, pleasure, convenience, price, familiarity and ethicality), while the more general psychosocial factors of depressive symptoms and self-control are also investigated. With respect to dietary habits, the consumption of specific foods and food groups are examined, as the actual food choices take place on this level. The study is based on a large population-based sample of 25–74-year-old men and women, which provides the opportunity to explore psychosocial factors and their associations in the context of sociodemographic factors (age, gender and socioeconomic position, i.e. SEP). Before describing the aims of the doctoral dissertation in detail, the theoretical and conceptual framework of the study (Chapter 2) and relevant previous empirical evidence are presented (Chapter 3).

2 THE THEORETICAL AND CONCEPTUAL FRAMEWORK OF THE STUDY

2.1 PSYCHOSOCIAL AND SOCIODEMOGRAPHIC FACTORS INFLUENCING EATING AND OBESITY

Understanding why we eat what we eat is important from the perspective of the current obesity epidemic and has received much research interest. In the contemporary food-rich environment, an increasing proportion of eating is motivated by pleasure, not just by the body's energy-deficits (Lowe & Butryn, 2007). Thus, food choice is a complex process influenced by the interplay of multiple factors, including genetic, physiological, psychological, situational, social and cultural factors. An individual's experience with foods is largely determined by cultural traditions, and culture and food availability have long been recognized as the most important determinants of food choice (see, e.g., Rozin, 2006). However, within a culture, various factors, such as food preferences, psychological attributes, mood, social factors and economic resources, explain the differences between individuals in the selection of food. Furthermore, research has estimated that most people make over 200 food decisions per day (Wansink & Sobal, 2007), highlighting that food choice entails both conscious decisions and automatic and habitual responses.

The emphasis in this study is on the psychological and social factors affecting food choices and, consequently, weight changes. Psychological eating styles and food choice motives can be considered to be proximal psychological attributes influencing eating, while depressive symptoms and self-control are more distal ones. Sociodemographic factors (age, gender and SEP) characterise the individual within his or her surrounding social structure: age and gender reflect the effects of biological as well as non-biological factors, including the expectations placed on individuals on the basis of these attributes. SEP refers to the social and economic resources of the individual that influence what position(s) he or she holds within the structure of society (Lynch & Kaplan, 2000). Sociodemographic factors place psychosocial factors in a wider context, and one mechanism through which sociodemographic factors can exert their effects on food intake is their influence on psychosocial factors.

Two sets of theories concerning the factors influencing eating and food choices are relevant in the context of the present dissertation: one set of theories (e.g., psychosomatic theory, externality theory and restraint theory, which are described in Section 2.1.1) has been developed to explain the psychological processes that lead to overeating, and consequently obesity, while another set of theories has been constructed to better understand the complex process of food choice (e.g., the food choice process model described

in Section 2.1.2). The latter theories incorporate a wide range of factors that affect the selection of food, whereas the former ones are concerned with cognitive and behavioural tendencies related to eating, i.e. psychological eating styles.

2.1.1 PSYCHOLOGICAL EATING STYLES

Several psychological theories were developed to explain overeating and the development of obesity in the second half of the 20th century, and psychosomatic (Kaplan & Kaplan, 1957; Bruch, 1973), externality (Schachter & Rodin, 1974) and restraint theories (Herman & Polivy, 1984) have been the most influential. These theories introduced the concepts of emotional eating, external eating and restrained eating, respectively. Restrained eating refers to the tendency to cognitively restrict food intake in order to lose weight or prevent weight gain, while emotional eating can be defined as a tendency to eat in response to negative emotional states, and external eating as a susceptibility to eat in response to external food cues.

Overeating tendencies: emotional and external eating

Psychosomatic theory postulated that emotional eating has a relevant role in the etiology of obesity (Kaplan & Kaplan, 1957; Bruch, 1973). Obesity was proposed to be a consequence of the inability to distinguish hunger from other aversive internal states or of using food to reduce emotional distress, possibly because of early learning experiences. Numerous laboratory studies were conducted to compare normal weight and obese participants' eating in response to experimentally induced feelings of anxiety or stress. Consistent with psychosomatic theory, obese participants were found to overeat in the presence of negative emotions, at least in studies where the food offered was palatable, the salience of the food stimuli was high, and the source of the anxiety was diffuse and uncontrollable (for a review, see Ouwens, 2005; Stroebe, 2008). Moreover, early interview and questionnaire studies conducted among obese individuals in weight loss programmes and those not seeking treatment supported the hypothesis that emotional eating is frequent among the obese (Ganley, 1989). However, the development of the concept of restrained eating surpassed the scientific interest in emotional eating for several decades, and only recently has the number of studies concentrating on emotional eating started to increase again. A few more recent experimental studies have found that participants scoring high on self-report emotional eating scales increase their eating in response to negative emotions (Oliver, Wardle, & Gibson, 2000; Fay & Finlayson, 2011), but negative findings have also been reported (Evers, de Ridder, & Adriaanse, 2009; Adriaanse, de Ridder, & Evers, 2011).

    On the contrary, externality theory suggested that overeating, and consequently obesity, is caused by being more reactive to external food cues such as the sight, smell and taste of food and less responsive to internal cues

related to hunger and satiety (Schachter & Rodin, 1974). A series of innovative experimental studies provided evidence for the assumption of externality theory that external food cues have a greater impact on the food intake of overweight/obese people than on the food intake of normal weight people (for a review, see Stroebe, 2008). However, a shortcoming of externality theory was that it did not offer an explanation for the origin of individual differences in the sensitivity to external and internal food-related cues. An interpretation for external eating was offered by set-point theory (Nisbett, 1972), which postulated that obese people's biologically determined weight is above a culturally acceptable level, leading many of them to diet chronically in an attempt to suppress their weight below this "set-point". Thus, according to set-point theory, an over-responsiveness to external food cues and obesity was caused by a chronic state of food deprivation.

Cognitive control of eating: restrained eating

Herman and Polivy (1975) extended the set-point theory and argued that all people, irrespective of their weight status, are vulnerable to the adverse effects of chronic dieting. They also offered a more cognitive explanation for overeating in the form of restraint theory, which later developed into the boundary model of eating (Herman & Polivy, 1984). Herman and Mack (1975) developed the Restraint Scale (RS) to identify chronic dieters, and the results from early experiments using a preload/taste-test paradigm led to the development of restraint theory. Participants of normal weight were preloaded with 0, 1 or 2 milkshakes before they had to rate a series of different foods for a variety of qualities such as saltiness, preference and sweetness. In these experiments, participants with low scores on the RS ate in inverse proportion to the preload size, while those with high scores ate more after the 1- or 2-milkshake preload than after no preload at all. This eating pattern shown by restrained eaters has been referred to as "counterregulatory eating" and "the disinbition effect". Herman and Polivy (1984) hypothesised that bringing one's food intake under cognitive control is counterproductive as it causes an insensitivity to biological hunger and satiety signals. Restrained eaters were assumed to be vulnerable to episodes of overeating when their motivation or ability to control their eating was impaired by certain events, such as palatable foods or negative emotions. Thus, Polivy and Herman (1985) considered restrained eating to be dysfunctional and a risk factor for disordered eating and weight gain. Subsequently, numerous experimental studies have observed various factors to trigger counterregulatory eating among restrained eaters, including emotional distress, actual or perceived dietary violations and alcohol consumption (for a review, see Ouwens, 2005; Stroebe, 2008).

Measures of restrained eating and overeating tendencies

Although the concept of restrained eating has influenced the research on the psychology of eating and obesity for several decades, it has also been subject

to a large amount of criticism on both theoretical and empirical grounds. Restraint theory's hypotheses about the psychological and physiological process involved in counterregulatory eating have been criticised by many researchers (see, e.g., Heatherton & Baumeister, 1991; Lowe, 1993; Boon, Stroebe, Schut, & Ijntema, 2002; Stroebe, 2008, p. 136-139). Furthermore, the construct validity of the measurement scale for restrained eating (the RS) developed by Herman and Mack (1975) has been seriously questioned, as its structure has been found to be multifactorial, one factor reflecting a concern for dieting and the other weight fluctuations (Stunkard & Messick, 1985; van Strien, Frijters, Bergers, & Defares, 1986; Wardle, 1986). As a response to this criticism, Heatherton, Herman, Polivy, King and McGree (1988) argued that restrained eating refers to a multifaceted behavioural tendency that includes both the tendency to restrict food intake as well as a propensity to overeat. According to them, the average dieter fluctuates between periods of restraining eating and losing control over eating. The basic principle of scale development is one-dimensionality, however, and the problems related to the RS motivated researchers to develop truly one-dimensional measures of restrained eating. These new questionnaires included several sub-scales to measure other theoretically interesting aspects of psychological eating behaviour as well.

The Three Factor Eating Questionnaire (TFEQ) developed by Stunkard and Messick (1985) assesses the disinhibition of eating control (referring to both externally and emotionally triggered eating) and the susceptibility to hunger in addition to the cognitive restraint of eating. Furthermore, van Strien et al. (1986) constructed the Dutch Eating Behavior Questionnaire (DEBQ), which has scales for restrained, external and emotional eating. The restraint scales of the TFEQ and DEBQ both assess a cognitive tendency and behavioural strategies to restrict food intake. These two scales have been considered to differ from the RS in that they identify successful dieters, whereas the RS identifies unsuccessful ones, i.e. those who alternate between restricting their eating and overeating (Heatherton et al., 1988). Accordingly, experimental studies using the restraint scales of the TFEQ and DEBQ have not usually found the disinhibition effect among restrained eaters (for a review, see Ouwens, 2005; Stroebe, 2008). A few experimental studies combining scores from the restraint scale of the DEBQ or TFEQ and the overeating scales of the DEBQ or TFEQ have also provided support for the contention that restrained eaters consist of two subpopulations. These studies have found that only those scoring high on both restraint and overeating scales (i.e. disinhibition, external eating and emotional eating) increase their eating in response to a forced preload (Westenhoefer, Broeckmann, Münch, & Pudel, 1994) and stress (Haynes, Lee, & Yeomans, 2003). Hence, it has been argued that only some restrained eaters are vulnerable to problems in regulating eating, namely those with a simultaneous tendency toward overeating (van Strien, Cleven, & Schippers, 2000).

The factor structure of the original TFEQ has also raised some concerns: factor analytic studies have provided support for the restraint scale, but the structures of the disinhibition and hunger scales have emerged as more unstable (Ganley, 1988; Hyland, Irvine, Thacker, Dann, & Dennis, 1989). Karlsson, Persson, Sjöstrom and Sullivan (2000) investigated the structure of the TFEQ in a large sample of obese individuals and subsequently developed a shortened and revised 18-item Three-Factor Eating Questionnaire (TFEQ-R18). The TFEQ-R18 includes separate scales for restrained, uncontrolled and emotional eating. Uncontrolled eating refers to general problems in the regulation of eating, and the scale consists of a mixture of items on extreme appetite and eating in response to external food cues. Hence, the results from the study of Karlsson et al. (2000) supported the construct validity of emotional eating, while external eating did not appear to be independent from feelings of extreme hunger. Psychological eating styles were assessed with the TFEQ-R18 in the present study, and consequently, restrained eating, emotional eating and uncontrolled eating were the specific eating styles investigated. With respect to two overeating tendencies, i.e. emotional and uncontrolled eating, more emphasis is placed on emotional eating because it is a more homogenous concept.

2.1.2   FOOD CHOICE MOTIVES

Several models have been put forward to describe the various factors that affect food choices. Shepherd (1985) divided the factors influencing food intake into those related to the food (physical properties and nutrient content), to the individual making the choice (the perception of sensory attributes, physiological effects and psychological factors) and to the external economic and social environment in which the choice is made. Shepherd (1989) also considered that many of these factors are reflected in attitudes towards foods. These attitudes (i.e. global negative or positive evaluations) may concern the sensory properties, the health value or other characteristics of the food. A more recent and broader framework depicting the complex processes involved in choosing foods is food choice process model, which was developed on the basis of in-depth qualitative interviews among adults (Falk, Bisogni, & Sobal, 1996; Furst, Connors, Bisogni, Sobal, & Falk, 1996; Connors, Bisogni, Sobal, & Devine, 2001). It distinguishes between three major interacting determinants of food choices: 1) one's life course together with past experiences; 2) various influences including ideals, personal factors, resources, social factors and contexts; and 3) one's personal food system, which refers to developing food choice values, classifying foods and situations according to these values, negotiating values in food choice settings, balancing competing values, and constructing strategies for food selection and eating for recurring events. Hence, food choice values or motives (these two terms are used interchangeably in the literature on food choice motives, but only the latter one is used in the present study) are part

of the personal food system in the food choice process model and represent a set of considerations important in the selection of food (Sobal, Bisogni, Devine, & Jastran, 2006). Motives for food selection can vary across situations and change over time as a consequence of life changes or experiences. Previous research in Europe and the United States has revealed that the most important food choice motives among adults are taste, health, cost and convenience of purchasing and preparation (Steptoe, Pollard, & Wardle, 1995; Glanz, Basil, Maibach, Goldberg, & Snyder, 1998; Connors et al., 2001).

The qualitative interviews conducted in developing the food choice process model gave insight into the nature of these motives (Sobal et al., 2006). Taste refers to considerations related to the sensory properties of foods and beverages that affect food likes and dislikes, such as appearance, odour, flavour and texture. Health is a multidimensional motive, which consists of considerations related to physical well-being. Both the immediate and longer-term effects of foods on well-being are important, including digestibility, allergic reactions, weight control, and disease management and prevention. The meanings attached to healthy eating can vary considerably across people. Convenience relates to the time and effort needed to acquire, prepare and consume a particular food or meal. As most of the food in post-industrialised societies is purchased, the price of food in grocery shops and restaurants has an important influence on food choices. Individuals evaluate the price of the food in relation to their financial resources. The cost motive also includes the concept of worth: people with a high income can choose not to buy an expensive product if they feel that it is not "worth it", and those with a low income can buy a product with a relatively high price if they believe that it is essential for their well-being. Several other motives can also be relevant in making food choice decisions, such as managing relationships, mood control, ethicality, familiarity, quality and naturalness, but the importance of these may vary considerably between individuals.

It should be noted that food choice motives and psychological eating styles are interrelated, although the relationships between them are not investigated in the context of this study. Motives can be considered to underlie eating styles: restrained eating is a consequence of considering health or weight control as important in daily food choices, and emotional eating may be a result of using food to control mood. Indeed, restrained eating and emotional eating have been observed to correlate positively with the motives of weight control and mood control, respectively (Steptoe et al., 1995). However, while food choice motives reflect conscious considerations related to food selection, overeating tendencies describe more automatic food-related behaviours. Restrained eating by definition is conscious, but it refers to actual cognitive and behavioural strategies of restricting food intake.

One questionnaire that is widely used to assess food choice motives is the Food Choice Questionnaire (FCQ) developed by using a demographically heterogeneous sample from the United Kingdom (Steptoe et al., 1995). It was

constructed to measure health-related and non-health-related motives in a systematic manner, as there was a scarcity of such questionnaires. The FCQ intends to assess nine different motives, i.e. health, mood control, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern. However, the nine-factor structure of the FCQ has not been replicated in all samples from other post-industrialised countries (Eertmans, Victoir, Notelaers, Vansant, & van den Bergh, 2006; Fotopoulos, Krystallis, Vassallo, & Pagiaslis, 2009). This is presumably at least partly related to the influence of culture and time period on the importance and meaning of various food choice motives (Prescott, Young, O'Neill, Yau, & Stevens, 2002; Eertmans et al., 2006).

Since people generally consider several food choice motives as personally relevant, conflicts between motives are common in specific food choice situations, making it necessary for individuals to prioritise them (Sobal et al., 2006; Sobal & Bisogni, 2009). Price, taste or convenience can be a barrier to buying healthy food items, for example (Lappalainen et al., 1997). In a related area of research, i.e. research on personal values, the interest has long been on individual's value priorities (analysed by dividing respondent's score on a single value by his/her mean rating of all values) rather than on absolute importance of single values because values influence behaviour through trade-offs among multiple values that are simultaneously relevant to action (Schwartz, 1992). A similar approach could be adopted to investigate individual priorities in food choice motives, but I am not aware of any study that has done this.

2.1.3   DEPRESSIVE SYMPTOMS AND SELF-CONTROL

Depressive symptoms and self-control can be considered to be more distal psychosocial factors influencing dietary behaviours and obesity than the eating-specific factors described in the previous sections. Furthermore, one mechanism through which depressive symptoms and self-control may exert their effects on food intake is their influence on eating-specific factors. The interest in depressive symptoms and self-control is twofold in this study: on one hand, to examine their associations with psychological eating styles and, on the other hand, to explore their relations with dietary habits and obesity, albeit depressive symptoms receive more attention in this latter respect.

Depressive symptoms
The concept of depression is ambiguous, and the term has been used to refer to various phenomena: a mood state, a symptom, a syndrome consisting of a constellation of symptoms, a mood disorder or a disease with biochemical or structural abnormalities. Thus, on the one hand, depression can be viewed as a mood state that is an inevitable and necessary part of everyday life and which fluctuates over time. On the other hand, depression can be viewed as a disorder (e.g., a major depressive disorder) that severely limits the

functioning of an individual. In general, the concept of depression is used to refer to a group of symptoms that the scientific community has collectively decided to label "depression" (Ingram & Siegle, 2002). The central psychological symptoms in depression are sad mood, loss of interest in previously enjoyable things, the inability to experience pleasure (anhedonia) and reduced energy leading to increased fatigue. Other symptoms are, for example, guilty affect, low self-esteem, self-destructive thoughts and the inability to make decisions. Several somatic symptoms can also be part of depression such as increased appetite accompanied with weight gain or decreased appetite accompanied with weight loss.

In research settings, depression is usually assessed either with structured psychiatric interviews or with self-report questionnaires. Structured clinical interviews are used to identify subjects who meet the criteria for different categories of depression according to classification systems such as the DSM-IV (Diagnostic and Statistical Manual of Mental Disorders-IV) (American Psychiatric Association, 2000), while self-report inventories assess the number and intensity of depressive symptoms on a continuous scale. People who meet the interview criteria for depression usually score high on questionnaires; however, many who are not depressed according to the interviews may also score high on self-report questionnaires (Tennen, Hall, & Affleck, 1995). There is an ongoing discussion in the literature whether depression is a continuous or a categorical phenomenon in which major depressive disorder reflects a state that is qualitatively different from a negative mood state (e.g., Coyne, 1994; Flett, Vredenburg, & Crames, 1997; Haslam, 2007). Although no consensus has been reached on this issue, there is tentative evidence that subthreshold depressive symptoms and major depressive disorder resemble each other along many important dimensions (e.g., in terms of functional impairment and psychiatric and physical comorbidities) (Solomon, Haaga, & Arnow, 2001). This indicates that the results concerning self-reported depressive symptoms and clinically diagnosed depression are comparable, at least to some extent. In this study, the term "depressive symptoms" is used to refer to a constellation of various symptoms that do not inevitably limit the functionality of a person.

Several theories have been constructed to explain the psychological processes underlying the development of depression, and cognitive factors have received a central role in these theories. The two most well-known theories are perhaps cognitive theory of depression, developed by Aaron Beck (1967; 1987), and hopelessness theory, proposed by Abramson, Metalsky and Alloy (1989). Both of these theories are vulnerability-stress theories: depression is argued to be caused by the interaction between cognitive vulnerability and negative stressful experiences, i.e. cognitive vulnerability leads to depression only in the presence of stress. According to cognitive theory of depression, dysfunctional attitudes involving themes of loss, inadequacy, failure and worthlessness constitute cognitive vulnerability for depression. In contrast, hopelessness theory proposes that individuals who

habitually attribute negative events to stable and global causes, infer negative consequences, and/or infer negative characteristics about the self are vulnerable to depression.

Self-control

Human beings are able to exert control over their inner thoughts, feelings, desires and actions (Baumeister, Heatherton, & Tice, 1994). The terms "self-regulation" and "self-control" are often used interchangeably in the scientific literature, but some authors consider the former term to be broader than the latter one (see, e.g., de Ridder & de Wit, 2006; Carver & Scheier, 2011). Self-regulation can be conceptualised broadly as a dynamic motivational system of setting goals, developing and enacting strategies to achieve those goals, appraising the progress, and revising the goals and strategies accordingly (de Ridder & de Wit, 2006). In contrast, the term self-control is generally used to refer to the capacity to override immediate and automatic tendencies, desires or behaviours in order to achieve longer-term goals (Bauer & Baumeister, 2011). There are stable individual differences in personal levels of self-control, and a high level of dispositional self-control is associated with positive outcomes in a broad range of life domains (Tangney, Baumeister, & Boone, 2004). The failure of self-control has been postulated to have various negative personal and societal consequences. For instance, experimental studies have linked breakdowns in self-control with depression (Wenzlaff, Wegner, & Roper, 1988), and cognitive theory of depression (Beck, 1987) proposes that *automatic thoughts* (i.e. repetitive, unintended and not easily controllable) reflecting negative views of the self, the world and the future are characteristic of depressed individuals. Baumeister and colleagues (Muraven & Baumeister, 2000; Baumeister, Gailliot, DeWall, & Oaten, 2006) have proposed, based on numerous experimental studies, that although stable individual differences can be considered to exist in the ability to control one's behaviours and impulses, self-control consumes a limited resource that resembles a muscle or strength: self-control appears to be fatigued temporarily as a result of use and to be strengthened by exercise.

The relationships of depressive symptoms and self-control with psychological eating styles

Self-control can be considered to be an important psychological factor underlying restrained eating and overeating tendencies. Restrained eating by definition consists of the ability to exert self-control with respect to eating in order to achieve a longer-term goal of weight loss or maintenance. Moreover, restraint theory (Herman & Polivy, 1984) and the strength model of self-control described above are consistent in a sense that individuals' self-control resources are perceived to be limited in both of these theories. In contrast, overeating tendencies reflect more automatic food-related behaviours and problems in the regulation of eating. Depressive symptoms and emotional eating are closely related: the construct of emotional eating specifically

suggests that negative emotional states trigger eating. Depressive symptoms may also underlie other overeating tendencies, as one possible symptom of depression is increased appetite. The relationships between restrained eating and depressive symptoms are more complex, however: caloric restriction has been shown to result in lowered mood (Keys, Brozek, Henschel, Mickelsen, & Taylor, 1950), but it is unclear whether restrained eaters actually are in a state of energy deprivation (van Strien, Engels, van Staveren, & Herman, 2006). Furthermore, there is evidence that successful weight loss is related to improved mood (French & Jeffery, 1994). Weight cycling, i.e. weight regain after weight loss, could have the opposite effect, but studies have not generally provided support for this assumption (Foster, Sarwer, & Wadden, 1997).

In accordance with the above considerations, various overeating tendencies (i.e. emotional eating, external eating, disinhibited eating and susceptibility to hunger) have been found to be positively associated with personality traits reflecting poor self-control abilities (e.g., high impulsivity and low conscientiousness) and a tendency to experience negative emotions (e.g., high neuroticism) (Heaven, Mulligan, Merrilees, Woods, & Fairooz, 2001; Lyke & Spinella, 2004; Yeomans, Leitch, & Mobini, 2008; Elfhag & Morey, 2008; Provencher et al., 2008). In a recent study, emotional eating was associated with elevated levels of depressive symptoms, while this was not the case for external eating (Ouwens, van strien, & van Leeuwe, 2009). In contrast, findings concerning restrained eating have been incompatible: Yeomans et al. (2008) and Lyke and Spinella (2004) observed restrained eating to be unrelated to impulsivity measured with behavioural test and self-report questionnaires, while in other studies higher restraint has been linked with persistence and impulse control (i.e. high conscientiousness) (Provencher et al., 2008; Elfhag & Morey, 2008) and rigidity and reflectiveness (i.e. low novelty seeking) (van den Bree, Przybeck, & Cloninger, 2006). Similarly, negative (Elfhag & Morey, 2008) and positive (Heaven et al., 2001; Provencher et al., 2008) correlations have been observed between neuroticism and restrained eating. However, a limitation of the previous studies is that they have often been based on small and selected samples, for example, only female university students or obese women.

2.1.4   AGE, GENDER AND SOCIOECONOMIC POSITION

Various sociodemographic factors affect dietary habits and obesity. Age, gender and SEP, defined by education and income, are the main factors of interest in the present study, and thus, the following discussion concentrates on these.

Age
In Finland, the elderly (65–74 years old) report consuming porridge and sweet buns more often, and yoghurt, hard cheeses and sweets less often than

working-age adults (25–64 years old) (Paturi, Tapanainen, Reinivuo, & Pietinen, 2008). Besides affecting the specific foods chosen, older age is also related to a general decline in food intake, which has been termed the physiological anorexia of ageing (Morley, 2001). Body weight and body fat increase through approximately the age of 55–65 years in both genders, but beyond the age of 65–75 years, they typically decrease, even in healthy individuals in post-industrialised societies (Hays & Roberts, 2006). Several lines of evidence suggest that the anorexia of ageing is caused by both physiological and non-physiological factors: ageing is related to the physiological impairment of food intake regulation (e.g., declined taste and smell sensations and diminished sensory-specific satiety), social and psychological changes (e.g., poverty, isolation, depression, dementia), chronic diseases and the use of medication, which may all contribute to reduced energy intake and weight loss in older individuals (Hays & Roberts, 2006). Since the age range of the present study sample is wide (25–74 years old), the influence of age on the associations of psychosocial factors with dietary intake and obesity is of interest.

Gender

Gender is an important aspect in the domain of food, eating and obesity as women in general have the main responsibility for shopping and cooking for the household, and norms concerning appropriate body shape and weight are more restrictive towards women (Rolls, Fedoroff, & Guthrie, 1991; Beardsworth & Keil, 1997, p. 173-192). Accordingly, gender differences in dietary behaviours have consistently been observed, with women consuming a diet that is in line with dietary recommendations more often than men (Westenhoefer, 2005). In Finland, women eat more vegetables, fruit, berries and dairy products and less red meat compared to men (Paturi et al., 2008). Further, women's diets are higher in protein, dietary fibre and sucrose, while men have a higher fat and alcohol intake (Pietinen, Paturi, Reinivuo, Tapanainen, & Valsta, 2010). There is evidence that women's healthier dietary habits are partly explained by their greater involvement in weight control and their stronger beliefs in healthy eating (Wardle et al., 2004).

The ideal female body in post-industrialised societies is characterised by slimness, leanness and low body weight (Beardsworth & Keil, 1997, p. 173-192), and studies conducted in Europe and the United States have documented that women are less satisfied with their body weight and shape (McElhone, Kearney, Giachetti, Zunft, & Martinez, 1999; Keski-Rahkonen et al., 2005), diet to lose weight more often (Serdula et al., 1999; Wardle & Johnson, 2002) and have a remarkably higher prevalence of eating disorders (Treasure, Claudino, & Zucker, 2010) than men. Moreover, restrained eating and overeating tendencies are more common among women (Lluch, Herbeth, Mejean, & Siest, 2000; de Lauzon et al., 2004; Bellisle et al., 2004), and women place more importance on most of the food choice motives, especially those related to health and weight control (Steptoe et al., 1995;

Glanz et al., 1998). However, it is not well-known whether the various psychological factors related to eating have similar associations with dietary behaviours and indicators of obesity in both genders because the majority of studies concerning the psychological aspects of eating have included only females.

Socioeconomic position

Numerous studies have shown that low SEP is related to a higher prevalence of obesity and unhealthier dietary habits in post-industrialised societies (McLaren, 2007; Darmon & Drewnowski, 2008; Giskes, Avendano, Brug, & Kunst, 2010). SEP is an aggregate concept and, according to Lynch and Kaplan (2000, p. 14), can be defined as "the social and economic factors that influence what position(s) individuals and groups hold within the structure of society, i.e. what social and economic factors are the best indicators of location in the social structure that may have influences on health". SEP is usually measured in terms of education, income and occupation, each of which reflects a somewhat different dimension of SEP. These are causally ordered in a way that education is likely to lead to certain occupations, which have specific incomes.

Lynch and Kaplan (2000) and Krieger, Williams and Moss (1997) provide excellent descriptions of various indicators of SEP, and the following is based on their discussion. Educational attainment is perhaps the most widely used SEP indicator due to its ease of measurement, applicability to persons outside the active labour force and relative stability over adulthood. Education influences future occupational and income opportunities and provides cognitive and social resources. However, a major problem with respect to education as an indicator of SEP is that it does not have universal meaning: the economic and social consequences of education are related to age, birth cohort and gender, for instance. In Finland, for example, the population's overall level of education has increased rapidly in recent decades (Official Statistics of Finland, 2011). Occupations are usually classified according to their social prestige and psychosocial risks and physical hazards. However, occupational classifications are limited since they exclude individuals outside the formal workforce (e.g., the unemployed, students and homemakers). Income reflects an individual's economic resources in a given period of time, but is a more unstable indicator of SEP than education or occupation.

There is a long tradition of examining the health differences between SEP groups, and a vast amount of evidence exists that socioeconomically advantaged individuals have better health (e.g., Adler, 1994). Consequently, considerable research efforts are being devoted to better understand the processes that link SEP to health. The most basic principle has been argued to be that indicators of SEP reflect particular structural positions in society and that these positions are powerful determinants of the likelihood of health-damaging exposures and of possessing health-enhancing resources

(Lynch & Kaplan, 2000). Several specific factors have been proposed to play a role in producing SEP differences in dietary intake, and these are discussed in Section 3.3.

2.2 EMOTIONS, COGNITIVE CONTROL, EATING AND OBESITY

The influence of cognitive control and emotions on food intake and obesity has been subject to considerable scientific interest, which is also evident in the early research on psychological eating styles (Section 2.1.1). In this section, the effects of emotions on eating and the theoretical models developed to explain the psychological processes involved are discussed. These theories vary in the emphasis that they place on the role of cognitive control.

Emotions arise as a response to personally relevant events and are multifaceted phenomena that involve changes in the domains of subjective experience, behaviour and physiology (Gross & Thompson, 2007). Various terms have been used to refer to emotional processes in the literature, such as affect, emotion, stress and mood. While both stress and emotion involve whole-body responses to significant events, stress usually refers to negative affective responses and emotion to both negative and positive affective states (Lazarus, 1993). Compared to emotions, moods often last longer and may appear in the absence of obvious stimuli (Gross & Thompson, 2007). Eating and emotions interact with each other in multiple ways: emotional states influence the quantity and quality of foods eaten, and food intake has affective consequences that may influence subsequent food choices (Gibson, 2006). Both physiological and psychological processes are involved in the influence of emotions on eating and weight changes, but this study concentrates on the latter processes.

It has become clear that there is a large variability in the effects of emotions on eating. Surveys on perceived changes in eating under stress have demonstrated that most individuals report either an increase or decrease (on average, 30% and 48%, respectively) in appetite or food intake in response to emotional stress (Macht, 2008). In particular, high fat and sweet foods are preferred during stressful encounters (Oliver & Wardle, 1999). Most of the previous research has concentrated on identifying individuals vulnerable to stress-induced eating, and numerous experimental studies have shown that restrained eaters are one such vulnerable group (Greeno & Wing, 1994). However, as discussed in Section 2.2.1, the stress-induced eating shown by restrained eaters in earlier studies may be explained by the inclusion of items on vulnerability to overeating, weight fluctuation and weight history in the RS. Recently, Macht (2008) has emphasised that there is variability across *individuals* and *emotions* in the effects of emotions on food intake. High intensity or high arousal emotions (e.g., fear, tension) suppress eating as they

are related to physiological and behavioural responses that reduce appetite and interfere with eating. In contrast, emotions with more moderate levels of arousal or intensity affect eating depending on the motivations to eat (e.g., restrained and emotional eating) or the cognitive and motivational features of the emotions (e.g., differences between negative and positive emotions). However, little is currently known about the influences of positive emotions on eating (Macht, 2008).

The underlying psychological processes through which negative emotions lead to increased food intake among some individuals are also far from clear. Theories related to restrained eating propose that emotional stimuli may impair restrained eaters' ability to control their eating cognitively, as processing emotions requires attention. According to restraint theory (Herman & Polivy, 1984), negative emotions lead to overeating among restrained eaters because coping with them is more urgent than even dieting. An alternative "cognitive investment hypothesis" (Boon et al., 2002) emphasises that cognitive capacity is limited, and since restrained eaters invest more cognitive resources in regulating their eating than unrestrained eaters do, any experience (be it emotional or not) that requires cognitive resources leads to increased eating among restrained eaters.

Another set of theories share the assumption that emotional eating is a consequence of attempting to cope with these emotions. According to psychosomatic theory (Kaplan & Kaplan, 1957), some people are motivated to eat when experiencing negative emotions because they have learned that eating improves their mood. The masking hypothesis states that restrained eaters use overeating to misattribute their distress in other areas of life to eating, because problems related to eating may after all seem more controllable than those related to other aspects of themselves or their lives (Polivy & Herman, 1999). Finally, Heatherton and Baumeister (1991) have proposed that overeating in response to negative events relevant to the self occurs as a consequence of escaping from aversive self-awareness: shifting attention away from the self to the immediate environment provides a means of escape from an aversive internal state, but at the same time interferes with the effective self-regulation of eating.

Nevertheless, these theories do not explain why sweet and high fat foods are preferred during negative emotional states. Nutrient-dependent physiological changes have often been proposed to explain the mood-elevating effects of eating. The serotonin hypothesis (Wurtman & Wurtman, 1989) is perhaps the most well known of these proposals, postulating that carbohydrate-rich meals lead to an improvement in mood through increased serotonin levels. Nevertheless, the ecological validity of the hypothesis can be questioned, as relatively small proportions of protein in a meal may deteriorate these effects (Benton, 2002). Further, physiological changes after eating can occur only with delay, while experimental studies have demonstrated that a negative mood is improved immediately and selectively after eating food rated palatable by the participants (Macht & Mueller, 2007).

This has led to suggestions that the palatability of the food is the most likely mechanism accounting for the elevation of mood after eating, not its nutritional content (Benton & Donohoe, 1999; Macht, 2008). It should be pointed out that this still leaves the question of how people learn to like and prefer certain foods (see, e.g., Birch, 1999), but unfortunately this issue is out of the scope of this study.

3 REVIEW OF THE RESULTS FROM PREVIOUS OBSERVATIONAL STUDIES

3.1 DIETARY HABITS AND OBESITY: THE ROLE OF PSYCHOLOGICAL EATING STYLES

Numerous experimental studies have examined psychological eating styles in relation to actual food intake, as described in Section 2.1.1. Experimental studies can shed light on the possible causal relations between the constructs, since they allow for controlling for the context and sequence of events. However, a limitation is that the results are based on individuals' behaviour in a laboratory context for a short period of time. Further, most of the experimental studies related to psychological eating styles have involved female university or college students. Thus, observational studies are needed in addition to experimental ones to examine the relevance of the phenomenon found in a laboratory context to the general population. Results from previous non-experimental studies among adults exploring the associations of restrained and emotional eating (assessed by means of the TFEQ or DEBQ) with dietary habits and obesity are reviewed next. These are mainly cross-sectional studies, but a few prospective studies also exist. Restrained eating has again gained the most research attention, while specific overeating tendencies, such as emotional eating, have received less interest.

Restrained eating has consistently been related to healthier dietary habits: for example, individuals with a higher level of restrained eating reported consuming fish, dairy products, fat-reduced foods and vegetables more often and sugar and French fries less frequently in a community-based cohort of French adults (de Lauzon et al., 2004). With respect to energy and macronutrient intake, restraint has been related to lower total energy and fat intake, and to higher protein intake (Lindroos et al., 1997; Lluch et al., 2000; Provencher, Drapeau, Tremblay, Despres, & Lemieux, 2003; de Lauzon et al., 2004).

However, there is also evidence that restrained eating is associated with higher levels of misreporting on self-reported dietary assessment methods (Maurer et al., 2006), and it is likely that the associations found with restrained eating are at least partly attributable to the under-reporting of unhealthy foods and the over-reporting of healthy foods. Stice and colleagues (Stice, Fisher, & Lowe, 2004; Stice, Cooper, Schoeller, Tappe, & Lowe, 2007; Stice, Sysko, Roberto, & Allison, 2010) conducted a series of studies with various restraint scales and objectively measured caloric intake, including single eating episodes in the laboratory, doubly labelled water estimates of caloric intake over a two-week period and observationally measured caloric intake during lunch meals consumed at work cafeterias over three months.

They observed that restraint scales were generally unrelated to these objective measures of caloric intake and concluded that the scales are not valid measures of dietary restriction. Nevertheless, van Strien et al. (2006) have argued that assessing the validity of the restraint scales in relation to the actual caloric intake is problematic as restrained eaters are eating less than they desire, which implies that they are not necessarily in a state of negative energy balance or may not be eating less than unrestrained eaters.

Findings from previous studies on restrained eating and obesity are inconsistent. Positive (e.g., Lluch et al., 2000), negative (e.g., Williamson et al., 1995; Foster et al., 1998) or non-significant associations (e.g., Carmody, Brunner, & St Jeor, 1995; Dykes, Brunner, Martikainen, & Wardle, 2004) between restrained eating and indicators of obesity such as BMI have been observed in cross-sectional studies. Similarly, the evidence from the few prospective studies conducted among adults is contradictory: Savage, Hoffman and Birch (2009) found using growth-curve modelling that within-person increases in restraint over time were associated with concurrent decreases in weight over a 6-year follow-up period, while in another study participants with a high initial restraint score were more likely to gain weight and develop obesity six years later (Chaput et al., 2009). De Lauzon-Guillain et al. (2006) observed in a community-based cohort of French adults that higher baseline BMI predicted an increase in restraint scores after two years but not vice versa. With respect to weight loss maintenance, data from the National Weight Control Registry in the United States have shown that the inability to maintain large weight losses over the long term is associated with decreases in dietary restraint (McGuire, Wing, Klem, Lang, & Hill, 1999; Wing & Hill, 2001).

Results from a few studies suggest that obesity status may be one factor that contributes to these contradictory results (Provencher, Drapeau, Tremblay, Despres, & Lemieux, 2003; de Lauzon-Guillain et al., 2006): restrained eating correlated positively with obesity indicators among normal weight individuals, while the correlations were negative or non-significant among the overweight or obese. Bellisle et al. (2004) and Lindroos et al. (1997) also observed that higher restraint scores were related to higher disinhibition and hunger scores in normal weight participants, but to lower scores in those areas in obese participants. Nevertheless, it is unclear why the associations of restrained eating vary as a function of body weight level. Weight loss attempts are less common among normal weight individuals (Provencher et al., 2004), setting dieting status and history as possible explanatory factors. When developing the TFEQ, Stunkard and Messick (1985) noticed that the restraint scale correlated negatively with the disinhibition scale among dieters, whereas there was no association among non-dieters. Further, Lowe (1993) has criticised the restraint theory for not distinguishing between chronic and current dieting. According to his three-factor model of dieting behaviour, current dieting should be separated from a general tendency to cognitively control eating as the former refers to resisting

the temptation to eat *what is needed* while the latter refers to resisting the temptation to eat *more than is needed*. Nevertheless, no previous study has simultaneously investigated the effects of obesity status and dieting history on the associations between restrained eating, overeating tendencies and obesity indicators.

Relatively few studies have examined the associations of emotional eating with habitual dietary intake and obesity. Obese individuals report higher levels of emotional eating than those with normal weight (de Lauzon-Guillain et al., 2006; Keskitalo et al., 2008; van Strien, Herman, & Verheijden, 2009), but the associations between emotional eating and dietary intake have been inconsistent. In the studies of Lluch et al. (2000) and Anschutz, van Strien, van de Ven and Engels (2009), emotional eating was unrelated to total energy and macronutrient intake, whereas de Lauzon et al. (2004) and Elfhag, Tholin and Rasmussen (2008) found that emotional eaters consumed more energy-dense sweet snacks. Emotional eating has been proposed to increase the intake of sweet and high fat foods in particular (Macht, 2008), and the measurement level of dietary intake is one factor that may explain the previous contradictory findings. The studies (Lluch et al., 2000; Anschutz et al., 2009) finding no association assessed energy and macronutrient intake, while specific foods (i.e. energy-dense snacks) were examined in the studies with positive findings (de Lauzon et al., 2004; Elfhag et al., 2008). Furthermore, a recent study investigated daily diary reports of stressors experienced and the intake of high fat and sugar snacks, and found that stressors were related to an increased consumption of snacks, especially among emotional eaters (O'Connor, Jones, Conner, McMillan, & Ferguson, 2008).

3.2 DIETARY HABITS AND OBESITY: THE ROLE OF DEPRESSIVE SYMPTOMS

The relationships between depressive symptoms, dietary habits and obesity are complex: one possible symptom of major depression is appetite change, which may take the form of increased or decreased appetite, and depressive symptoms have been found to predict both weight gain and loss in the general population (Haukkala, Uutela, & Salomaa, 2001). Moreover, excess body weight can lead to negative psychological consequences, as obesity is stigmatised in post-industrialised societies and obese people encounter discrimination in many areas of life (Puhl & Heuer, 2009). These complexities in the depression-obesity association are perhaps one reason for the considerable research interest that it has received.

Recent systematic reviews and meta-analyses (Atlantis & Baker, 2008; Blaine, 2008; Rooke & Thorsteinsson, 2008; Luppino et al., 2010) provide increasing evidence that clinically diagnosed depression and self-reported depressive symptoms are positively related to obesity. However, various

sociodemographic factors have been observed to moderate the association, with women (e.g., Heo, Pietrobelli, Fontaine, Sirey, & Faith, 2006; Scott, McGee, Wells, & Oakley Browne, 2008), more educated people (e.g., Ross, 1994) and younger individuals (e.g., Heo et al., 2006) having a stronger positive association, although not in all studies (e.g., Ross, 1994; Haukkala & Uutela, 2000; Dong, Sanchez, & Price, 2004; Scott et al., 2008; Simon et al., 2008). Most of the studies investigating the depression-obesity association are cross-sectional, but a few prospective studies have been carried out which suggest that the relationship is bidirectional: obesity predicts the later development of depression, and depression predicts the later development of obesity (Rooke & Thorsteinsson, 2008; Luppino et al., 2010). Nevertheless, the mechanisms explaining the association between depressive symptoms and later weight gain remain unclear. Both direct physiological mechanisms, such as hypothalamic-pituitary-adrenal axis dysregulation (Vogelzangs et al., 2007; Muhtz, Zyriax, Klahn, Windler, & Otte, 2009), and indirect behavioural and psychosocial pathways may be involved. With regard to the latter pathways, dietary and physical activity behaviours and the psychological factors related to them have been suggested to be causal links between depressive symptoms and weight gain (Faith, Matz, & Jorge, 2002; Stunkard, Faith, & Allison, 2003; Markowitz, Friedman, & Rutgers, 2008), but there is a lack of empirical evidence for this.

The results from a few community surveys provide scattered evidence that depressive symptoms are related to unhealthier food choices, especially among women: females with elevated symptoms consume vegetables/fruit (Allgöwer, Wardle, & Steptoe, 2001; Cohen, Kristal, Neumark-Sztainaer, Rock, & Neuhouser, 2002; Sarlio-Lähteenkorva, Lahelma, & Roos, 2004; Mikolajczyk, Ansari, & Maxwell, 2009), fish (Tanskanen et al., 2001), low-fat dairy products (Sarlio-Lähteenkorva et al., 2004), energy-dense nonsweet foods and low-energy foods less frequently and energy-dense sweet foods more often than those without the symptoms (Jeffery et al., 2009). Among men, significant associations have been infrequent, although in a British sample including mainly male participants, depressive symptoms were positively related to the consumption of processed foods (sweetened desserts, fried food, processed meat, refined grains and high fat dairy products) and negatively to the consumption of unprocessed foods (vegetables, fruit and fish) (Akbaraly et al., 2009). Furthermore, a Finnish study found that men with affective mental health symptoms were less likely to eat fresh fruit and berries on a daily basis (Sarlio-Lähteenkorva et al., 2004). However, possible factors explaining why depressive symptoms may lead to unhealthier food choices have not been examined, and tendency for emotional eating could be one such factor. Emotional eating could also play a role in explaining the positive depression-obesity association in the general population. In accordance with these hypotheses, emotional eating has recently been associated with elevated levels of depressive symptoms (Ouwens et al., 2009), the higher consumption of energy-dense snack foods (de Lauzon et

al., 2004; Elfhag et al., 2008) and higher body weight (de Lauzon-Guillain et al., 2006; Keskitalo et al., 2008; van Strien et al., 2009).

Evidence concerning the associations between depressive symptoms, physical activity and the psychosocial determinants of physical activity suggests that physical activity self-efficacy, defined as a person's confidence in his or her ability to be physically active on a regular basis (Bandura, 1997), has a role in explaining the depression-obesity association. Physical activity self-efficacy has emerged as the most consistent psychosocial correlate of engaging in physical activity (Trost, Owen, Bauman, Sallis, & Brown, 2002), and it predicts success in weight control (Teixeira, Going, Sardinha, & Lohman, 2005). Numerous studies have also shown that elevated levels of depressive symptoms prospectively predict a decline in physical activity (Roshanaei-Moghaddam, Katon, & Russo, 2009). Finally, consistent with the general negative cognitive style inherent in a depressive mood, depressive symptoms have been linked to lower physical activity self-efficacy (Milligan et al., 1997; Craft, Perna, Freund, & Culpepper, 2008; Azar, Ball, Salmon, & Cleland, 2010). These associations have been observed in separate studies, however, and no previous study has explored simultaneously whether emotional eating and physical activity self-efficacy explain the positive association between depressive symptoms and obesity.

3.3 SOCIOECONOMIC DISPARITIES IN DIETARY HABITS AND FOOD CHOICE MOTIVES

There is evidence from numerous studies that socioeconomically disadvantaged individuals have less healthy dietary habits. A higher SEP (defined by education, income or occupational status) has been linked with a greater consumption of vegetables and fruit in Europe (especially in the Western and Northern Europe), the United States, Canada and in Australia (Irala-Estevez et al., 2000; Darmon & Drewnowski, 2008; Giskes et al., 2010), although, in Finland, education and household income differences in daily vegetable consumption have slightly narrowed during 1998-2002 (Roos et al., 2008). Individuals with a lower SEP tend to consume energy-dense foods such as fatty meats and fried and fast foods more frequently (Darmon & Drewnowski, 2008; Pereira et al., 2005; Miura, Giskes, & Turrell, 2011; Thornton, Bentley, & Kavanagh, 2011). Intakes of fiber and some essential vitamins and minerals also vary according to the SEP: those with a higher position have higher fiber, vitamin C, folates, β-carotene, calcium and iron intakes. In contrast, findings concerning the SEP differences in total energy intake or the macronutrient composition of diets have been contradictory (Darmon & Drewnowski, 2008).

Several individual, social and environmental factors may contribute to the SEP gradient in dietary intake, as food choice is a complex process. Recently, differences in food access, availability and affordability between

socioeconomically advantaged and disadvantaged areas have attracted much research interest. In the United States, poorer access to healthy foods has been observed in socioeconomically deprived areas, but the evidence is unequivocal for other high-income countries, including the United Kingdom, Canada and Australia (Beaulac, Kristjansson, & Cummins, 2009). A few studies have suggested that perceptions of food availability, accessibility and affordability could be more relevant than the objective situation (Inglis, Ball, & Crawford, 2008; Giskes, van Lenthe, Brug, Mackenbach, & Turrell, 2007) in explaining the SEP variations in diet. Other factors that have been proposed to play a role in the SEP gradient include attitudes and beliefs related to foods, nutrition knowledge, food preferences, cooking skills and the motives underlying food selection, but evidence for these is scarce or inconsistent (see, e.g., Lawrence & Barker, 2009; Darmon & Drewnowski, 2008). In the present study, the interest is on the role of various food choice motives.

As discussed in Section 2.1.2, previous research conducted in Europe and the United States has shown that the most important food choice motives among adults are taste, health, cost and convenience of purchasing and preparation (Steptoe et al., 1995; Glanz et al., 1998; Connors et al., 2001). Food choice motives have also been linked with self-reported dietary intake. In particular, higher importance attached to health, weight control, natural content and ethicality in daily food selection is associated with healthier food choices (Pollard, Steptoe, & Wardle, 1998; Roininen et al., 2001). There is evidence that individuals with lower levels of income and education place more importance on price, whereas those with a higher education emphasise health aspects more (Lennernas et al., 1997; Hupkens, Knibbe, & Drop, 2000; Bowman, 2006). Higher education can improve the ability to process nutrition-related information and may socialise individuals to adopt healthy dietary habits (Yen & Moss, 1999). On the contrary, it can be more difficult for individuals with fewer financial resources to take health aspects into account in their food purchasing decisions, since the cost of food has been shown to be related to its nutritional quality, with lower priced products being nutritionally poor and energy dense (Drewnowski, 2010). Nevertheless, it has rarely been explored whether food choice motives contribute to the SEP disparities in dietary intake (Steptoe & Wardle, 1999; Hupkens et al., 2000; Ball, Crawford, & Mishra, 2006). To my knowledge, only one study (Steptoe & Wardle, 1999) thus far has examined several health- and non-health-related motives simultaneously in this context. This study showed that the higher importance placed by participants with less education on the familiarity and sensory appeal of the food contributed to the educational gradient in fiber intake.

Previous studies have focused only on the absolute importance of food choice motives. However, it could be relevant to analyse the relative importance of each motive, since conflicts between motives are common in particular food choice situations, making it necessary for individuals to

prioritise them (Sobal et al., 2006; Sobal & Bisogni, 2009). Beydoun and Wang (2008) took a step forward in this respect and investigated the ratio of the importance of price relative to healthiness. They found that low SEP individuals considered both price and healthiness as equally important, whereas those with a high SEP put more emphasis on healthiness. The ratio also partly explained the SEP disparities in energy, fat, sodium and sugar intake. The conflict between price and health considerations is not the only one that can arise in relation to food choice, however, and thus it would be pertinent to examine all motives in relation to each other.

4 AIMS OF THE STUDY

The literature reviewed in the previous chapters reveals several lines of mixed evidence and gaps in the knowledge. Most of the studies on psychological eating styles have been based on selected and often small samples. The participants of experimental studies have frequently been female university students of normal weight. Although observational studies have been conducted among more diverse range of subjects (e.g., obese individuals in weight loss programmes, university students and individuals from the general population), large population-based samples are rare (however, for exceptions, see Provencher et al., 2003; de Lauzon et al., 2004; van den Bree et al., 2006; van Strien et al., 2009; Cappelleri et al., 2009). The heterogeneity of the study populations might be one factor that explains the contradictory findings on how restrained eating is related to overeating tendencies, personality dispositions related to self-control and obesity. The present population-based sample of men and women enables the simultaneous comparison of the relationships of restrained eating between various sub-groups.

Specific overeating tendencies, such as emotional eating, have received considerable less research attention than restrained eating. While a few observational studies have found that obese individuals report higher levels of emotional eating than those of normal weight, the associations with food intake have been contradictory in both experimental and observational studies. Furthermore, the observational studies have rarely incorporated any measure of negative emotions, even though the concept of emotional eating specifically suggests that emotional distress triggers eating. The accumulating evidence on depressive symptoms and obesity implies that they are positively related, but the association seems to be complex, and the mechanisms explaining it are not well known. Several researchers have proposed that dietary and physical activity behaviours and the psychological factors related to them might be causal links between depressive symptoms and weight gain, but empirical evidence for this plausible hypothesis is scarce.

Finally, it is well established that individuals with a low SEP tend to have less healthy dietary habits than their more advantaged counterparts. Even though research efforts have been devoted to disentangle the mechanisms contributing to the SEP gradient in diet, they remain poorly understood. Scattered evidence suggests that the SEP groups differ in the importance placed on certain food choice motives (e.g., health and price), but only one earlier study (Steptoe & Wardle, 1999) has simultaneously examined the roles of a range of motives in explaining the SEP gradient in diet. Furthermore, to the best of my knowledge, it has never been explored

whether the importance of food choice motives should be analysed on an absolute or a relative level.

The relationships between socioeconomic factors, eating-specific and general psychosocial factors, dietary habits and obesity that were investigated in the four studies comprising the doctoral dissertation are shown in Figure 1. In addition, the effects of gender and age on the associations were examined in all studies. The specific aims related to the four studies were as follows: ***The first aim*** was to examine how psychological eating styles, depressive symptoms and self-control are related to each other and to indicators of obesity (Studies I and II). ***Secondly,*** it was explored whether obesity status and dieting history moderate the associations of restrained eating with overeating tendencies, self-control and indicators of obesity (Study I). ***Thirdly,*** it was investigated whether emotional eating and depressive symptoms are associated with the consumption of energy-dense sweet and non-sweet foods and vegetables/fruit (Study II). More specifically, it was examined whether emotional eating explains the possible relations between depressive symptoms and energy-dense food intake and whether individuals with both a vulnerability to emotional eating and elevated levels of depressive symptoms have the highest intake of these foods. ***The fourth aim*** was to examine whether the positive association between depressive symptoms and obesity is attributable to a tendency for emotional eating and a low level of physical activity self-efficacy (Study III). ***The final aim*** was to increase the understanding of the reasons for the well-established SEP disparities in dietary intake (Study IV). More specifically, the role of the absolute and relative importance of various food choice motives (health, pleasure, convenience, price, familiarity and ethicality) was explored.
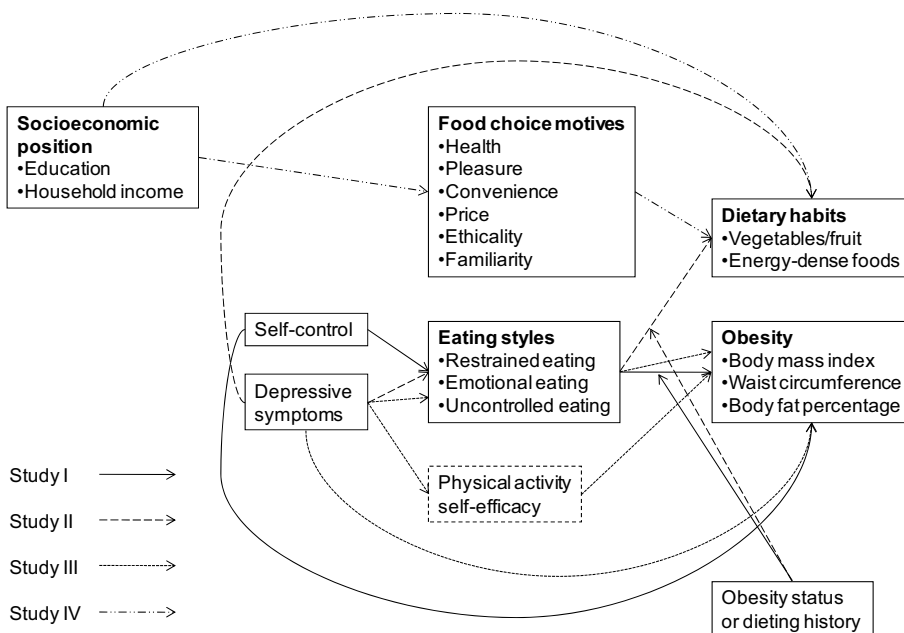
Figure 1. The relationships between socioeconomic factors, eating-specific and general psychosocial factors, dietary habits and obesity investigated in the context of the present study.

5   METHODS

5.1 PARTICIPANTS

The present study is part of the National Cardiovascular Risk Factor Survey conducted in 2007 (the FINRISK Study 2007) (Vartiainen et al., 2010). FINRISK is a large population survey of the risk factors of chronic diseases carried out by the National Public Health Institute. The survey is conducted every five years using independent, random and representative population samples from different geographic regions of Finland.

The participants took part in two phases of the FINRISK Study 2007. The ethical committee of the National Institute for Health and Welfare and the hospital districts gave their approval of the study protocols, and all the participants gave their informed consent. A random sample of 10 000 people aged 25-74 years was drawn from the Finnish population register in five areas: 1) the province of North Karelia, 2) the province of North Savo, 3) the province of Oulu, 4) the areas of Turku and Loimaa, and 5) the cities of Helsinki and Vantaa in the metropolitan area (Figure 2). The sample was stratified by gender, 10-year age group and area so that there were 200 men and 200 women in each 10-year age group in all study areas. The participants received, by mail, an invitation to participate in a health examination and a self-administered health questionnaire that included questions about sociodemographic factors, health behaviour and medical and disease history. They completed the health questionnaire at home and returned it when they came to the municipal health centre for the health examination. This first study phase took place from January to March 2007 and involved a total of 6258 subjects (a response rate of 63%).

All the subjects who participated in the first study phase (N=6258) were invited to continue in the second phase, conducted from April to June 2007, the aim of which was to investigate the dietary, lifestyle and genetic determinants of obesity and metabolic syndrome (the DILGOM sub-study). The response rate for this phase was 84% (2325 men and 2699 women). The second phase also included a health examination at a municipal health centre in which research nurses measured the height, weight, waist circumference, body fat percentage and blood pressure of the participants, and took a 2-hour glucose tolerance test and fasting blood and saliva samples from them. In the course of the health examination, the subjects completed three questionnaires: a 132-item Food Frequency Questionnaire (FFQ) and questionnaires concerning lifestyle factors (dieting and weight history, physical activity and sleeping) and psychosocial factors (psychological eating styles, food choice motives, depressive symptoms, self-control and physical activity self-efficacy).

In Studies I-IV, information on sociodemographic factors (marital status, number of children in the household, education years and household income) and the prevalence of chronic diseases was derived from the first study phase, while information related to all the other variables was based on the second phase. Participants aged 25-74 years were included in Studies I and III, which concentrated on obesity. The oldest age group (aged 65-74) was excluded from Studies II and IV, which examined dietary intake as an outcome variable, because the focus was on the dietary habits of a working-age population.
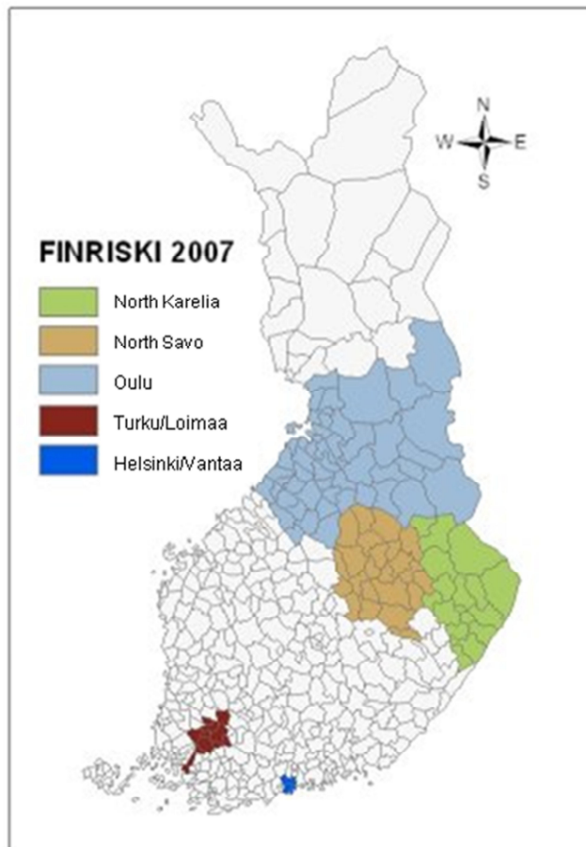
Figure 2. The five study areas of the National Cardiovascular Risk Factor Survey conducted in 2007.

5.2 MEASURES

5.2.1 PSYCHOLOGICAL EATING STYLES

The shortened and revised 18-item Three Factor Eating Questionnaire (TFEQ-R18) (Karlsson et al., 2000) was used to assess restrained, uncontrolled and emotional eating in Studies I, II and III. The TFEQ-R18 was developed on the basis of a factor analysis of the original 51-item TFEQ in a large sample of Swedish obese subjects (Karlsson et al., 2000), and it has been found to be valid in the general population in France (de Lauzon et al., 2004) and in the United States (Cappelleri et al., 2009), and in adolescent girls and young women in Finland (Angle et al., 2009). The cognitive restraint scale includes six items (e.g., "I consciously hold back at meals in order not to gain weight"), the uncontrolled eating scale consists of nine items (e.g., "Sometimes when I start eating, I just can't seem to stop"), and the emotional eating scale three items (e.g., "When I feel blue, I often overeat"). Most of the items are rated on a four-point scale, from 1, the statement does not describe me at all, to 4, the statement describes me exactly.

The factor structure of the TFEQ-R18 was examined with a confirmatory factor analysis in the present sample. The original structure provided a reasonable fit with the data (χ^2=2226.53, df=132, p<0.001; CFI=0.92; TLI=0.91; RMSEA=0.06; SRMR=0.08), although the fit was less than optimal according to the cut-off points suggested by Hu and Bentler (1999). One cognitive restraint item ("How likely are you to consciously eat less than you want?") loaded weakly on the restrained eating factor (standardised loading = 0.15), but all the other items had adequate loadings on their respective factors (standardised loadings ≥ 0.35). Exclusion of the item improved the fit of the model (χ^2=1593.07, df=116, p<0.001; CFI=0.94; TLI=0.94; RMSEA=0.05; SRMR=0.06), but the item was retained in the following analyses to maintain comparability with other studies.

The mean scores for the cognitive restraint, uncontrolled eating and emotional eating scales were calculated if the respondent had answered at least half of the items, and these raw scores were transformed to a 0-100 scale (Karlsson et al., 2000). The Cronbach's alphas for these scales were 0.72, 0.87 and 0.87, respectively, indicating reasonable internal consistency. In the structural equation modelling analyses of Study III, emotional eating was modelled as a latent factor with the three emotional eating items as indicators.

5.2.2 FOOD CHOICE MOTIVES

Food choice motives were measured with a shortened version of the Food Choice Questionnaire (FCQ) (Steptoe et al., 1995) in study IV. The original FCQ includes 36 items and is intended to measure nine different

motivational dimensions underlying the selection of food (health, mood, convenience, sensory appeal, natural content, price, weight control, familiarity and ethical concern). The respondents are asked to rate the statement "It is important to me that the food I eat on a typical day…" for each item on a four-point scale (from 1, not at all important, to 4, very important). However, the factor structure of the FCQ has not been well replicated in all studies (Eertmans et al., 2006; Fotopoulos et al., 2009), and Fotopoulos et al. (2009) have proposed that the number of motivational dimensions could be reduced and that fewer items could be used to measure each dimension. In the present study, 13 items whose content overlapped with other items were excluded to reduce the answering burden of the respondents. More specifically, one health item (#10 of the original FCQ), three mood items (#13, 26 and 34), two convenience items (# 11 and 15), one sensory appeal item (#18), one natural content item (#5), two price items (#6 and 12), two familiarity items (#8 and 21), and one ethical concern item (#32) were excluded. With respect to the ethical or political aspects of food purchases, three items ("is domestically produced", "carries the Fairtrade mark" and "is organically grown") were added that are currently relevant in the Finnish context (Piiroinen & Järvelä, 2006). Taken together, although the original FCQ was shortened considerably, each of the nine dimensions was assessed by at least one item.

A confirmatory factor analysis was conducted first to test whether the nine-factor structure of the original FQC described the structure of the shortened FCQ in the present sample. However, the model had a poor fit with the data (χ^2=3781.08, df=265, p<0.001; CFI=0.89; TLI=0.87; RMSEA=0.06; SRMR=0.06), and several factors had strong correlations with each other, reflecting poor discriminant validity (the strongest correlations were between sensory appeal and mood control, r=0.84; between ethical concern and natural content, r=0.79; and between weight control and health, r=0.75). An exploratory factor analysis (Maximum Likelihood extraction method with Oblimin with Kaiser Normalisation oblique rotation) was performed next, and factor solutions with four, five, six, seven, eight and nine factors were examined separately. A scree plot (Cattell, 1966) clearly supported the four-factor structure, implying that adding a fifth factor or more did not remarkably increase the total variance explained in the items (the total variance explained by the four-, five- and six-factor solutions were 45.1%, 47.5% and 49.8%, respectively). These four factors were interpreted as health, pleasure, convenience and ethicality (Appendix 1). Three items did not clearly load on any of the factors (all loadings < 0.35). One of them ("is high in protein") was excluded from the present analyses, but the other two were analysed as separate variables because they were the only items measuring the dimensions of familiarity ("is what I usually eat") and price ("is cheap").

The absolute importance of health, pleasure, convenience and ethicality was derived by calculating the mean score of the items belonging to the

respective factors, whereas the participant's rating of price and familiarity items reflected the absolute importance of these two motives. The relative importance of each motive was computed by dividing the participant's absolute rating of it by his/her mean score on all 25 motive items. The same method has been used to calculate individuals' value priorities in studies on personal values (Verkasalo, Tuomivaara, & Lindeman, 1996; Schwartz & Rubel, 2005).

5.2.3 PHYSICAL ACTIVITY SELF-EFFICACY

Physical activity self-efficacy was included in Study III and was assessed as the individual's confidence in his/her ability to overcome different emotional and other barriers to maintain physical activity behaviours (Schwarzer & Renner, 2000). The scale was framed with the following explanation: Most people have various plans for exercising and ways to do it. However, it is sometimes difficult to follow these intentions. How certain are you that you could overcome the following barriers? The five barriers included in the scale were: I can manage to carry out my exercise intentions even when I have/am... 1) problems and worries, 2) busy, 3) depressed, 4) tired, and 5) tense. These items were rated on a four-point scale (from 1, very uncertain, to 4, very certain). Physical activity self-efficacy was modelled as a latent factor with the five items as indicators in structural equation modelling analyses, and in other analyses, a mean score of the items (with an allowance of up to one missing item per respondent) was used (Cronbach's alpha=0.87).

5.2.4 DEPRESSIVE SYMPTOMS

Depressive symptoms were measured with the 20-item Center for Epidemiological Studies–Depression Scale (CES-D) (Radloff, 1977) in Studies II and III. The scale is designed to measure depressive symptomatology in the general population, and it has also been found to be adequately related to clinical ratings of depression (Beekman et al., 1997). For each item the respondents are asked to indicate how often they have felt in the described way during the past week on a four-point scale (from 0, rarely or none of the time, to 3, almost all of the time). The structure of the CES-D scale has been widely studied, and a recent meta-analysis of 28 studies (Shafer, 2006) concluded that the four-factor structure (negative affect; somatic and retarded activity; lack of positive affect; and interpersonal difficulties) proposed by Radloff (1977) best described the CES-D scale. This four-factor structure (with a second-order depressive symptom factor) was also supported in the present data.

   In the structural equation modelling analyses of Study III, depressive symptoms were modelled as a latent factor with four indicators, each of which were the sum of the items belonging to the respective original factor. For the other analyses, the mean ratings of the 20 items were calculated,

allowing up to two missing items per respondent, and these scores were then multiplied by 20 in order to normalise them to the original scale (Cronbach's alpa=0.89). In Study II, which examined the associations between depressive symptoms and dietary intake, an item concerning loss of appetite was excluded from the analyses in order to avoid criterion confounding.

5.2.5   SELF-CONTROL

Self-control was included in Study I and measured with the Brief Self-Control Scale developed by Tangney et al. (2004). It consists of 13 items such as "I am good at resisting temptation", and the participants are asked to rate themselves on a five-point scale, from 1, not at all like me, to 5, very much like me. The total self-control score was calculated as a mean of the ratings for the 13 items (with an allowance of up to two missing items per respondent). The Cronbach's alpha for the scale was 0.77.

5.2.6   DIETARY HABITS

A validated Food Frequency Questionnaire (FFQ) was used to assess habitual dietary intake (Männistö, Virtanen, Mikkonen, & Pietinen, 1996; Paalanen et al., 2006) in Studies II and IV. It inquires into the average use frequencies of 132 food items common in the current Finnish diet during the previous 12 months. The portion size is fixed for each item and, if possible, is specified in natural units (e.g., glass, slice). There are nine possible frequency categories for all of the items, ranging from never or seldom to more than six times a day.

   In the present study, the interest was on the consumption of specific foods and food groups rather than on macro- and micronutrients, as actual food choices take place on this level. Food groups were formed with the aid of the principal component analysis (orthogonal varimax rotation): initially all the vegetable, fruit, berry and energy-dense food items from the FFQ were selected, but finally six items (sugar-sweetened beverages, blue cheese, pancakes, oleaginous fruit, nuts/seeds and ice cream) were excluded because they did not clearly load on any of the factors or differed from the other items loading on the factor. For Study II, three food groups were formed: sweet energy-dense foods (buns, biscuits, other sweet baked items, chocolate and sweets), non-sweet energy-dense foods (savoury pasties, pizza, hamburgers, French fries, sausages, mayonnaise salads and chips/popcorn) and vegetables/fruit (fresh vegetables, fruit and berries). Responses to these food items were transferred to a use frequency/week scale before adding up them. In Study IV, the consumption of vegetables/fruit (g/day) and non-sweet energy-dense foods (g/day) was analysed, and these food variables were the same as in Study II, except that berries were excluded from the former and chips/popcorn from the latter. The food variables were divided into quartiles according to gender and age (ages 25–44 and 45–64) in Study II, whereas

they were modelled as continuous variables (and square-root transformed to improve the normality of the distributions) in Study IV. The Finnish national food composition database (Fineli) of the National Institute for Health and Welfare was used to calculate total energy intake (KJ/day) and the average daily consumption of vegetables (g), fruit (g) and energy-dense foods (g) from the FFQ (Reinivuo, Hirvonen, Ovaskainen, Korhonen, & Valsta, 2010).

5.2.7 OBESITY INDICATORS AND DIETING HISTORY

Body mass index (BMI) was calculated as the weight in kilograms (measured to the nearest 100 grams in light clothing without shoes) divided by the squared height in meters (measured to the nearest 0.5 centimetres). The participants with a BMI between 18.5 and 24.9 kg/m² were defined as having normal weight and those with a BMI between 25.0 and 29.9 kg/m² as being overweight. The participants who were classified as obese had a BMI of more than or equal to 30.0 kg/m² (World Health Organization, 2004). Six males and 25 females were classified as underweight (BMI < 18.5 kg/m²), and they were excluded from the analyses in Studies I, II and III, which concentrated on psychological eating styles, to avoid including participants with possible eating disorders. Waist circumference (WC) was measured to the nearest 0.5 cm, and central obesity was defined as WC ≥ 102 cm for men and WC ≥ 88 cm for women (Lean, Han, & Morrison, 1995). A TANITA TBF-300MA body composition analyser (Tanita Corporation, Tokyo, Japan) was used to estimate the subjects' body fat percentage. The participants were also classified according to their dieting history: current dieters were those who indicated that they were currently dieting to lose weight. The participants who had dieted at least once in the past, but were not currently dieting, were defined as past dieters, and those with no experience of dieting were never dieters.

5.2.8 SOCIOECONOMIC POSITION AND BACKGROUND VARIABLES

Self-reported total years of education and gross household income were used as SEP indicators. Education years were analysed on a continuous scale as well as divided into tertiles according to birth year. Participants were asked to report their previous year's gross household income on a nine-point scale ranging from less than €10 000 to more than €80 000. Household income was subsequently divided by the weighted sum of the number of household adult and child members (a weight of 1.0 was given for the first adult of the household, 0.7 for all other adults, and 0.5 for children under the age of 17), as recommended by the OECD (Organisation for Economic Co-operation and Development, 1982).

Other sociodemographic variables included in the current study were age, marital status and the presence of children in the household. Age was used both as a continuous and categorical variable (ages 25-44, 45-64 and 65-74).

Marital status was dichotomised into married/cohabiting vs. single, while households were divided into those with children under the age of 17 and those without children.

The level of physical activity and the prevalence of chronic diseases were controlled for in some of the analyses. Two questions derived from the validated short form of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003) were used to assess the number of days during the previous week on which the participants engaged in vigorous (e.g., running or lifting heavy weights) or moderate (e.g., light jogging) physical activity for at least 10 minutes. The participants were classified as having a chronic disease if they reported one or more of the following diseases diagnosed by a physician: myocardial infarction, stroke, diabetes, elevated blood pressure, heart failure, angina pectoris, cancer, asthma, emphysema/bronchitis, cholelithiasis, back pain, chronic urinary tract infection/nephritis, or rheumatoid arthritis or other joint disease.

5.3 STATISTICAL METHODS

All the analyses were adjusted for age due to the wide age range of the study participants. In addition, interactions between age and eating-specific and general psychosocial factors in relation to food variables and BMI were tested separately for men and women, but only few significant interactions emerged (of the 74 interactions tested, 3 were significant at the $p<0.05$ level). Analyses were stratified by gender because many previous studies on psychological factors related to eating have included only women. Group differences (gender and BMI groups) in the mean level of variables were examined with analyses of variance. Age-adjusted Pearson's partial correlation coefficients were used to investigate bivariate associations between the variables. Interactions between various study variables were tested in linear or logistic regression models (Study II) by adding an interaction term between the variables of interest after the main effects and age (and after restrained eating in Study II). Mplus statistical software (versions 5.21 and 6.0) (Muthen & Muthen, 1998-2009) was used for structural equation modelling in Studies III and IV, but all the other analyses in Studies I-IV were done with SPSS statistical software (version 15.0; SPSS Inc, Chicago, IL).

In Study I, the correlations between psychological eating styles, self-control, BMI and WC were examined separately according to obesity status and dieting history. Interaction terms between restraint and BMI and between restraint and dieting history were calculated to test whether the associations of restraint with overeating tendencies, self-control and obesity indicators were significantly different among obesity and dieting groups (with respect to the obesity indicators, testing was possible only with the term restraint*dieting history).

In Study II, the relationships of emotional eating and depressive symptoms with the consumption of sweet and non-sweet energy-dense foods and vegetables/fruit were examined using multivariate logistic regression analyses. The food variables were divided into quartiles according to gender and age (ages 25–44 and 45–64-year), and the risk of belonging to the highest quartile was predicted. In order to detect possible nonlinear relationships, emotional eating and depressive symptoms were divided into quartiles separately for men and women. The first model in the logistic regression analyses was adjusted for age, education years, BMI, physical activity, restrained eating and total energy intake with respect to vegetables/fruit. The analyses for sweet and non-sweet energy-dense foods were not adjusted for energy intake in order to avoid over-adjustment as these food variables have a high energy content by definition. The second model was further adjusted for emotional eating or depressive symptoms. The interactions between emotional eating and depressive symptoms in relation to energy-dense foods were tested with continuous scales in order to increase the power to detect possible interaction effects.

In Study III, structural equation modelling was used to test the hypothesised mediation model between depressive symptoms, emotional eating, physical activity self-efficacy and obesity. The model was estimated separately for all obesity indicators (BMI, WC and body fat percentage), and depressive symptoms, emotional eating and physical activity self-efficacy were modelled as latent factors (this measurement part of the model was also tested separately and it fit the data adequately, see the original publication of Study III for details). As the distributions of the variables deviated from normality to some extent, Maximum Likelihood Robust (MLR) was used as an estimation method. It produces standard errors (by means of a sandwich estimator) and a chi-square test statistic that are robust for non-normality (Muthen & Muthen, 1998-2009). The model fit was evaluated with several types of fit indexes, including the Standardised Root Mean Square Residual (SRMR), the Tucker-Lewis Index (TLI), the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA). TLI and CFI values ≥ 0.95, SRMR values ≤ 0.08, and RMSEA values ≤ 0.06 were considered to indicate a good fit for the data, as suggested by Hu and Bentler (1999). For the mediation model, the total, direct and indirect effects (through emotional eating and physical activity self-efficacy) of depressive symptoms on obesity indicators and their respective 95% confidence intervals (MacKinnon, Lockwood, & Williams, 2004) were derived from Mplus.

Multi-group analyses were used to examine whether the associations between depressive symptoms, emotional eating, physical activity self-efficacy and BMI were similar between genders, the three age groups (ages 25-44, 45-64 and 65-74) and education tertiles. The fit of the constrained models (all six regression paths were fixed the same between the groups) was compared with the fit of the unconstrained models (all paths were allowed to vary freely between the groups) using chi-square difference tests (taking into

account the scaling correction factor of MLR). If the constrained model had a significantly worse fit than the unconstrained model, then group differences in each regression path were examined separately with a chi-square difference test. An alpha level of $p<0.01$ was used instead of $p<0.05$ due to the sensitivity of the chi-square difference test to sample size, which makes small differences statistically significant in large samples (Cheung & Rensvold, 2002).

Finally, a series of logistic and linear regression analyses predicting obesity (defined by BMI cut-offs), central obesity (defined by WC cut-offs) and body fat percentage (as a continuous outcome) were conducted with adjustments for sociodemographic variables (age, education years, marital status), restrained eating and chronic diseases. In these analyses, the CES-D scores were dichotomised using the cut-off score of 16 proposed by Radloff (1977), but the continuous emotional eating and physical activity self-efficacy scores were used.

In Study IV, the mediation models between SEP indicators (education and income), food choice motives (absolute and relative) and dietary intake (vegetables/fruit and energy-dense foods) were also analysed with structural equation modelling. The models were adjusted for gender, age, marital status, the presence of children in the household, BMI, physical activity and total energy intake. As in Study II, the analyses for energy-dense foods were not adjusted for energy intake in order to avoid over-adjustment. MLR was used as an estimation method, but the model fit was not evaluated in Study IV because the estimated mediation models had zero degrees of freedom and thus, by definition, fit the data perfectly. Multi-group analyses were performed to formally test gender differences in the associations between SEP indicators, food choice motives and dietary intake. Due to the large number of analyses conducted in Study IV, the gender-stratified total, direct and indirect effects are shown only if the multi-group analyses indicated significant differences between the men and women.

6   RESULTS

The descriptive characteristics of the study sample by gender are shown in Appendix 2. The mean age was 53.5 years (SD=13.3) in men and 52.1 years (SD=13.6) in women. On average, men had 12.2 years (SD=4.0) and women 12.9 years (SD=4.0) of education. Among men, 49.0% (N=1132) were classified as overweight (BMI 25.0-29.9 kg/m²) and 19.7% (N=455) as obese (BMI ≥ 30 kg/m²). The respective percentages for women were 33.8% (N=903) and 23.4% (N=625). With respect to dieting history, 21.6% (N=485) of men and 34.5% (N=902) of women were currently dieting to lose weight, 17.7% (N=397) of men and 25.0% (N=655) of women had dieted in the past, and 60.7% (N=1362) of men and 40.5% (N=1059) of women had never dieted.

In both genders, restrained eating was more prevalent than uncontrolled or emotional eating (Appendix 2). Women reported higher levels of restrained eating, uncontrolled eating, emotional eating and depressive symptoms than men, but the mean level of self-control did not differ according to gender. Both men and women rated health and pleasure as the two most important food choice motives, followed by convenience and price, irrespective of whether absolute or relative motives were analysed. Gender differences emerged with respect to all six motives on the absolute level: women considered health, pleasure, ethicality, convenience and price as more relevant in their daily food choices than men, whereas men placed more importance on familiarity than women. In contrast, health and familiarity were the only motives showing significant gender differences on the relative level.

6.1 ASSOCIATIONS BETWEEN PSYCHOLOGICAL EATING STYLES, SELF-CONTROL, DEPRESSIVE SYMPTOMS AND OBESITY INDICATORS (STUDIES I AND II)

The associations between psychological eating styles, self-control and depressive symptoms were initially examined with age-adjusted Pearson's correlation coefficients (Table 1). In both genders, elevated levels of depressive symptoms were associated with higher uncontrolled and emotional eating and lower self-control, while depressive symptoms and restrained eating were unrelated. Self-control had a small positive correlation with restrained eating, but moderate negative correlations with both uncontrolled and emotional eating. Overall, restrained eating had the weakest correlations with the other variables, and the positive association between uncontrolled and emotional eating was the strongest (r=0.61 in men

and r=0.63 in women). However, obesity status and dieting history moderated the associations of restrained eating, and these results are presented in Section 6.2.

Table 1.   *Age-adjusted Pearson's correlation coefficients between psychological eating styles, self-control and depressive symptoms by gender.*

	1	2	3	4	5
1. Restrained eating	1.00	-0.11[a]	0.04[c]	-0.03	0.14[a]
2. Uncontrolled eating	-0.01	1.00	0.62[a]	0.28[a]	-0.47[a]
3. Emotional eating	0.14[a]	0.61[a]	1.00	0.28[a]	-0.35[a]
4. Depressive symptoms	0.00	0.28[a]	0.32[a]	1.00	-0.40[a]
5. Self-control	0.08[a]	-0.38[a]	-0.31[a]	-0.48[a]	1.00

Men (N=2199) are below and women (N=2580) above the diagonal.
[a] $p<0.001$; [c] $p<0.05$.

Figure 3 shows that obese and overweight participants scored higher on restrained eating ($p<0.001$ in both genders, $\eta^2=0.024$ for men and $\eta^2=0.015$ for women), uncontrolled eating ($p<0.001$, $\eta^2=0.088$ and $\eta^2=0.101$, respectively) and emotional eating ($p<0.001$, $\eta^2=0.055$ and $\eta^2=0.090$, respectively) than those with normal weight. Adjustment for restrained eating in the analyses on uncontrolled and emotional eating or adjustment for uncontrolled or emotional eating in the analyses on restrained eating did not change the results. The effects of the BMI group on the level of depressive symptoms and self-control were the opposite: obese individuals had the highest depressive symptom scores ($p<0.001$ in both genders, $\eta^2=0.009$ for men and $\eta^2=0.012$ for women), while normal weight individuals scored the highest on self-control ($p<0.001$, $\eta^2=0.029$ and $\eta^2=0.037$, respectively). The age-adjusted correlations between eating styles, depressive symptoms, self-control and the three obesity indicators included in this study were consistent with the above results from the analyses of variance (Table 2): restrained eating, uncontrolled eating, emotional eating and depressive symptoms correlated positively and self-control negatively with BMI, WC and body fat percentage. The sizes of the correlation coefficients indicated that uncontrolled and emotional eating had the strongest associations with these obesity indicators. BMI, WC and body fat percentage all correlated highly with each other (r=0.88−0.91 in men and 0.88−0.92 in women).
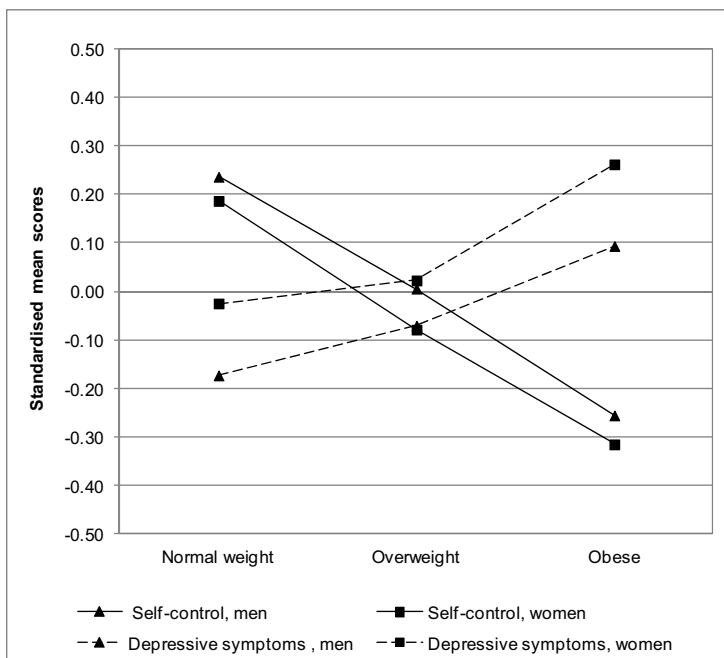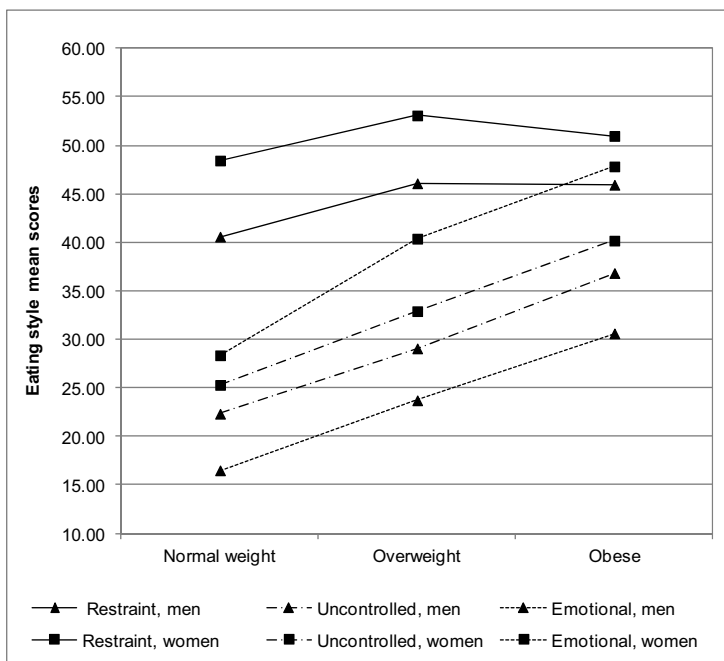
Figure 3. Age-adjusted mean scores of psychological eating styles, depressive symptoms and self-control according to obesity status and gender.

Table 2. *Age-adjusted Pearson's correlations coefficients between psychological eating styles, depressive symptoms, self-control and obesity indicators by gender.*

	Men (N=2172)			Women (N=2537)		
	BMI	WC	Fat %	BMI	WC	Fat %
Restrained eating	0.14[a]	0.10[a]	0.13[a]	0.06[b]	0.04[c]	0.10[a]
Uncontrolled eating	0.31[a]	0.30[a]	0.28[a]	0.33[a]	0.34[a]	0.32[a]
Emotional eating	0.26[a]	0.25[a]	0.23[a]	0.32[a]	0.32[a]	0.30[a]
Depressive sympt.	0.10[a]	0.12[a]	0.11[a]	0.10[a]	0.12[a]	0.08[a]
Self-control	-0.17[a]	-0.19[a]	-0.17[a]	-0.22[a]	-0.24[a]	-0.21[a]

BMI=body mass index (kg/m^2); WC=waist circumference.

[a] $p<0.001$; [b] $p<0.01$; [c] $p<0.05$.

6.2 OBESITY STATUS AND DIETING HISTORY AS MODERATORS IN THE ASSOCIATIONS OF RESTRAINED EATING (STUDY I)

The associations of restrained eating with overeating tendencies, self-control and obesity indicators varied according to the obesity status ($p≤0.01$ for all testable interactions between restraint and BMI) and dieting history ($p≤0.001$ for all interactions between restraint and dieting history). Among normal weight participants, restraint was unrelated to uncontrolled eating and self-control, and positively related to emotional eating (r=0.25 in men and 0.12 in women), BMI (r=0.24 in both genders) and WC (r=0.14 in men and 0.13 in women). In contrast, among obese participants, restraint was associated with lower uncontrolled eating (r=-0.21 for men and -0.32 for women), emotional eating (r=-0.12 for women), BMI (r=-0.15 for women) and WC (r=-0.10 for men and -0.15 for women), and with higher self-control (r=0.22 for men and 0.21 for women). The correlations of restrained eating by dieting history are displayed in Figure 4: current and past dieters with higher restraint scores had lower levels of uncontrolled eating, emotional eating, BMI and WC and a higher level of self-control, whereas never dieters had opposite or non-significant associations. It should be noted that the dieting history and BMI groups overlapped partly: the majority of obese participants (66% of men and 81% of women) were current or past dieters, whereas the majority of normal weight participants (82% of men and 59% of women) had never dieted.

Uncontrolled eating, emotional eating and self-control had consistent correlations with each other and with obesity indicators in all the BMI and dieting history groups. The only exception was that among women, the interactions of dieting history with uncontrolled and emotional eating and self-control were significant in relation to BMI and WC ($p<0.01$). However, uncontrolled (r=0.21–0.36 in women and r=0.22–0.31 in men) and emotional eating (r=0.20–0.30 in women and r=0.11–0.24 in men) were

positively and self-control (r=-0.12– -0.28 in women and r=-0.13– -0.21 in men) negatively related to these obesity indicators in all dieting history groups in both genders.
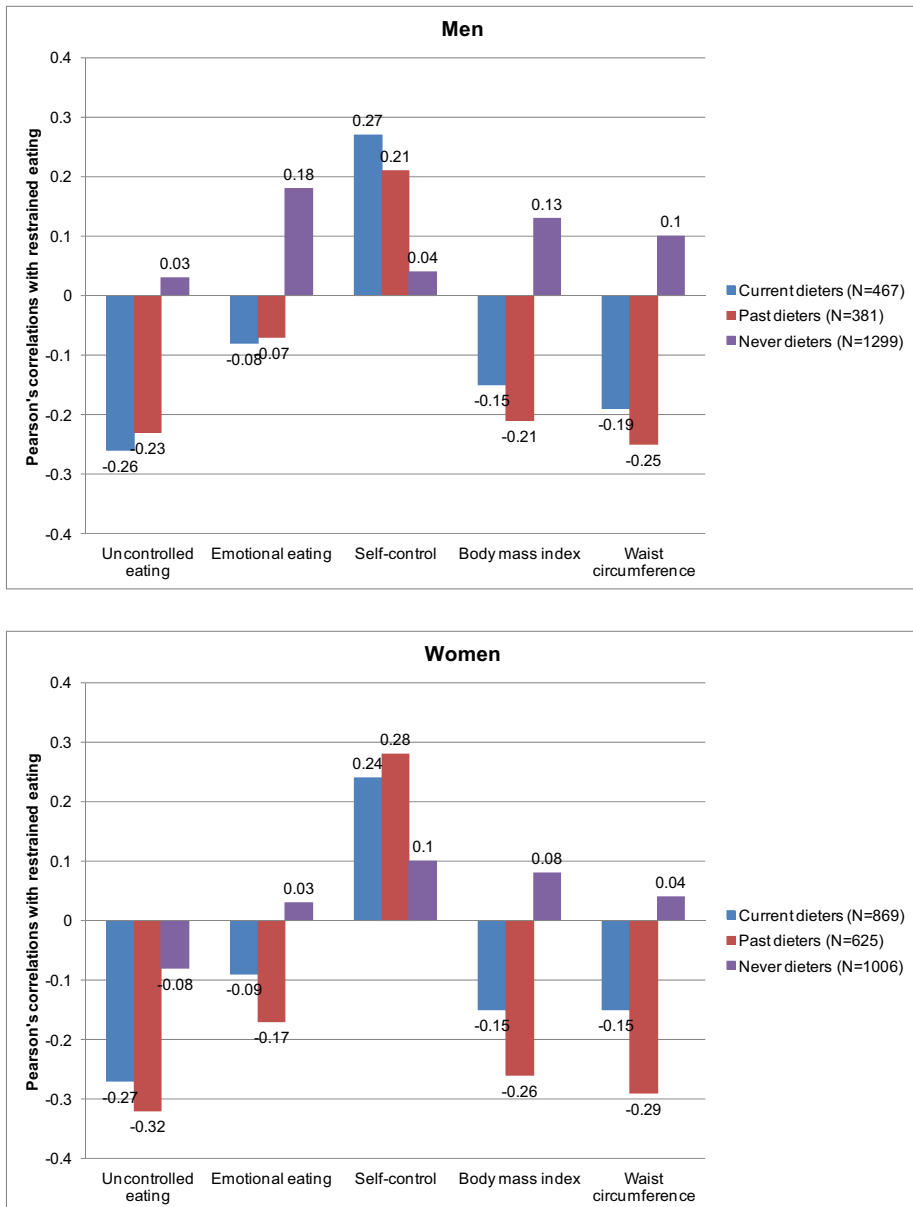
Figure 4. Age-adjusted Pearson's correlation coefficients of restrained eating with overeating tendencies, self-control and obesity indicators according to dieting history and gender. Coefficients with absolute values ≥ 0.10 are significant at the p<0.001 level.

6.3 THE INTERPLAY BETWEEN EMOTIONAL EATING AND DEPRESSIVE SYMPTOMS WITH RESPECT TO DIETARY HABITS (STUDY II)

Logistic regression models were used to analyse the relationships of emotional eating and depressive symptoms with the consumption of sweet and non-sweet energy-dense foods and vegetables/fruit. Model 1 shown in Figures 5 and 6 was adjusted for age, education, BMI, physical activity and restrained eating and, in Model 2, a further adjustment was made for emotional eating/depressive symptoms. Men and women with a higher tendency for emotional eating consumed more sweet energy-dense foods, and these associations remained after an adjustment for depressive symptoms. Emotional eating was related to eating more non-sweet energy-dense foods only among men. There were no associations between emotional eating and the consumption of vegetables/fruit in either gender. Men and women with elevated depressive symptoms ate more sweet and non-sweet foods, but the associations with sweet foods became non-significant when emotional eating was added into the model. Higher depressive symptoms were related to a lower consumption of vegetables/fruit independently of the other study variables in both genders. Restrained eating was consistently related to a healthier diet, i.e. eating fewer energy-dense foods and more vegetables/fruit. The interactions of BMI with depressive symptoms, emotional eating and restrained eating in relation to the consumption of sweet and non-sweet foods and vegetables/fruit were tested, but no significant interactions were detected.

However, a significant interaction emerged between emotional eating and depressive symptoms with respect to non-sweet energy-dense foods (χ^2(df=1, N=1624)=4.83, p=0.028 for men, and χ^2(df=1, N=1975)=7.66, p=0.006 for women). In order to interpret this interaction effect, the association of depressive symptoms with non-sweet foods was analysed at one standard deviation below the mean and one standard deviation above the mean of emotional eating (Hayes & Matthes, 2009): depressive symptoms were related to consuming more non-sweet foods among men (β=0.04, p=0.001) and women (β=0.04, p<0.001) with low emotional eating, whereas there was no such association among those with high emotional eating (β=0.01, p=0.343 for men, and β=0.01, p=0.286 for women). The same applied to emotional eating when its associations were examined at the low and high levels of depressive symptoms. This indicates that the only group with a lower consumption of non-sweet foods was comprised of the participants with low scores on both of the scales.
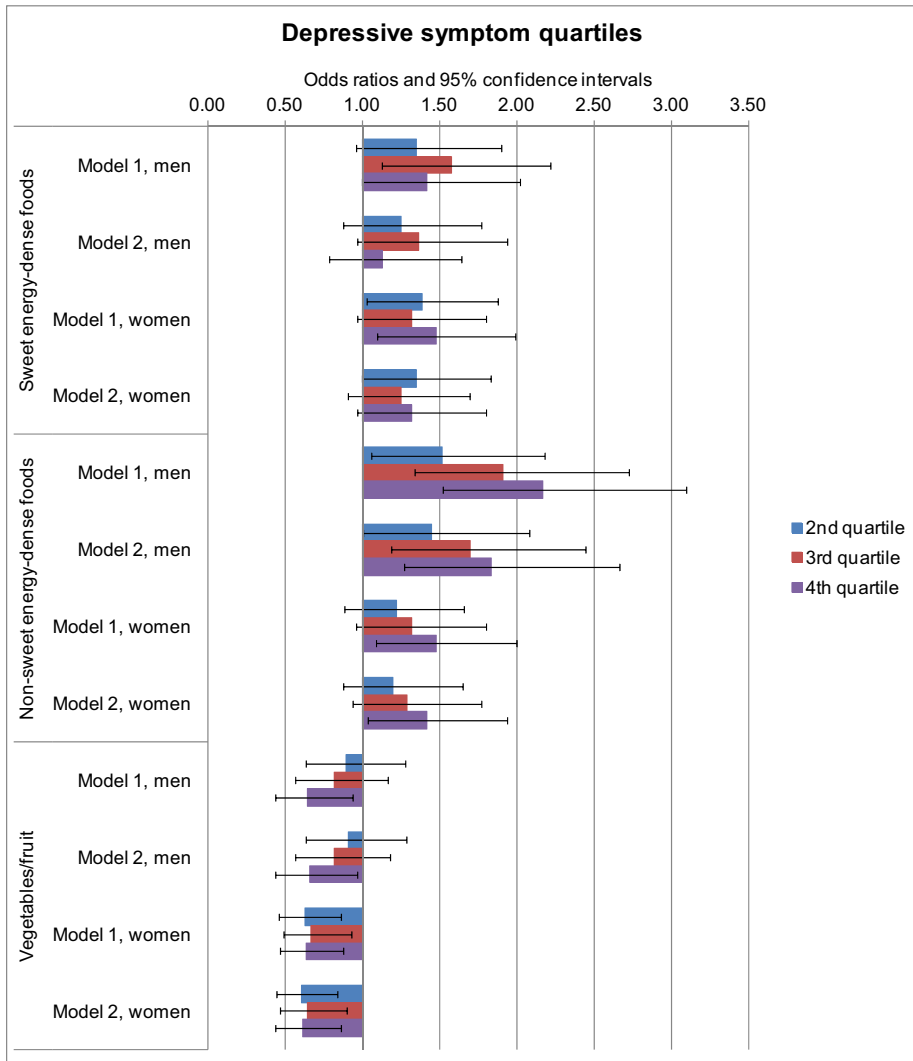
Figure 5. Results from the multivariate logistic regression models: depressive symptom quartiles (the first quartile as a reference group) as predictors of the risk of belonging to the highest quartile of the consumption of sweet energy-dense foods, non-sweet energy-dense foods and vegetables/fruit. Model 1: depressive symptom quartiles, age, education years, body mass index, physical activity and restrained eating (and total energy intake in the models for vegetables/fruit). Model 2: Model 1 + emotional eating quartiles.
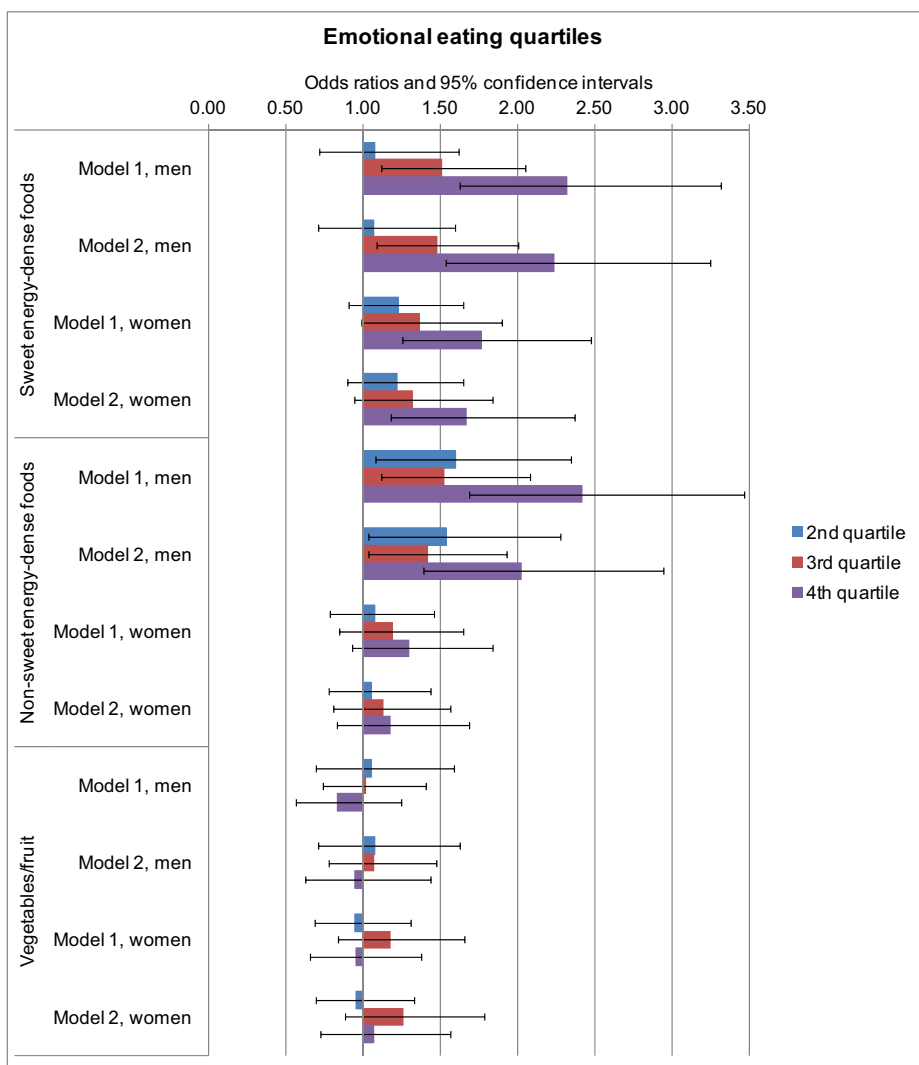
Figure 6. Results from the multivariate logistic regression models: emotional eating quartiles (the first quartile as a reference group) as predictors of the risk of belonging to the highest quartile of the consumption of sweet energy-dense foods, non-sweet energy-dense foods and vegetables/fruit. Model 1: emotional eating quartiles, age, education years, body mass index, physical activity and restrained eating (and total energy intake in the models for vegetables/fruit). Model 2: Model 1 + depressive symptom quartiles.

6.4 EMOTIONAL EATING AND PHYSICAL ACTIVITY SELF-EFFICACY AS MEDIATORS BETWEEN DEPRESSIVE SYMPTOMS AND OBESITY INDICATORS (STUDY III)

Structural equation modelling was used in Study III to explore whether emotional eating and physical activity self-efficacy mediated the positive associations between depressive symptoms and obesity indicators. Figure 7 presents the results from the mediation model, which was estimated separately for BMI, WC and body fat percentage (only the model for BMI is shown, for other models, see the original publication of Study III). The fit indexes indicated that the models fit the data adequately with respect to all obesity indicators and both genders. Elevated depressive symptoms were associated with higher emotional eating (β=0.38 for men and 0.31 for women) and lower physical activity self-efficacy (β=-0.41 for men and -0.31 for women), while emotional eating and self-efficacy were negatively correlated with each other. Emotional eating was related to higher BMI, WC and body fat percentage (β=0.27, 0.23 and 0.20 in men, and β=0.25, 0.23 and 0.20 in women) and physical activity self-efficacy to lower BMI, WC and body fat percentage (β=-0.17, -0.23 and -0.21 in men, and β=-0.24, -0.26 and -0.26 in women) independently of each other. The positive bivariate correlations between depressive symptoms and obesity indicators became non-significant, or even significantly negative, in these mediation models. The effects of depressive symptoms on BMI, WC and body fat percentage were mediated both by emotional eating and physical activity self-efficacy: the indirect effects through emotional eating and physical activity self-efficacy were significant at the $p<0.001$ level, and the standardised regression coefficients for the indirect effects varied between 0.06 and 0.10.

Multi-group analyses indicated that the relationships between depressive symptoms, emotional eating, physical activity self-efficacy and BMI in the mediation model were not significantly different between the three age groups (ages 25-44, 45-64 and 65-74) ($\Delta\chi^2$=5.5, Δdf=12, p=0.941 for men; and $\Delta\chi^2$=12.1, df=12, p=0.435 for women) or education tertiles ($\Delta\chi^2$=8.0, Δdf=12, p=0.782 for men; and $\Delta\chi^2$=3.7, df=12, p=0.988 for women). The associations of physical activity self-efficacy differed significantly between genders: it had a weaker negative association with depressive symptoms ($\Delta\chi^2$=19.5, Δdf=1, p<0.001) and stronger negative associations with emotional eating ($\Delta\chi^2$=9.3, Δdf=1, p=0.002) and BMI ($\Delta\chi^2$=10.8, Δdf=1, p=0.001) among women than men. However, it can be seen from Figure 7 that the actual difference in the size of these coefficients was not large.
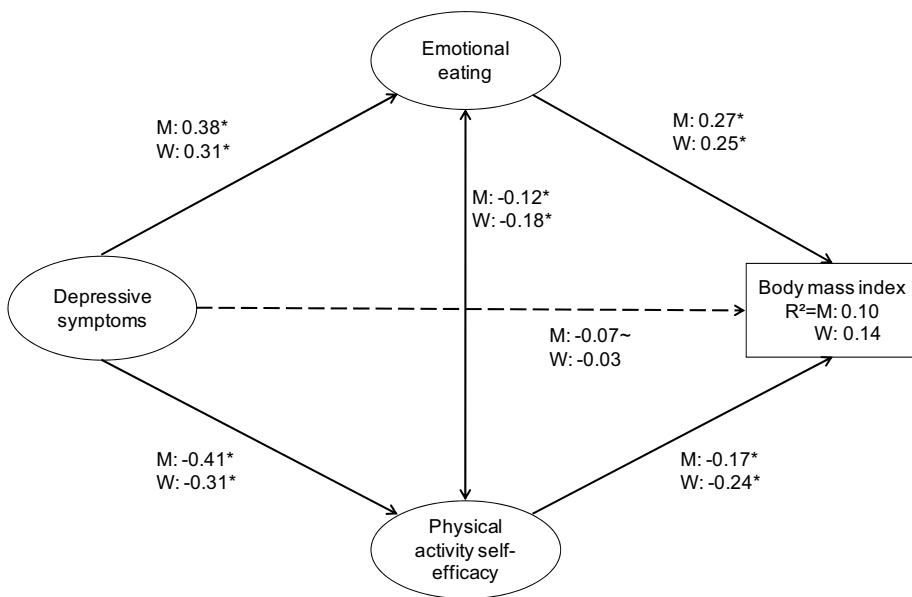
Men: χ²=277.60* (df=60), c=1.12; CFI=0.98; TLI=0.97; RMSEA=0.04; SRMR=0.03
Women: χ²=365.59* (df=60), c=1.10; CFI=0.97; TLI=0.97; RMSEA=0.04; SRMR=0.03

Figure 7. The results from the structural equation modelling: the mediation model with emotional eating and physical activity self-efficacy as pathways between depressive symptoms and body mass index among men (N=2312) and women (N=2674). The ovals represent latent factors (items loading on the latent factors are not shown), and the rectangles measured variables. Standardised regression coefficients are shown by the arrows. The fit statistics and parameter estimates are presented separately for men and women. c=scaling correction factor of Maximum Likelihood Robust estimation method. * p<0.001; ~ p<0.05.

The results from the logistic and linear regression analyses that included age, education years, marital status, chronic diseases and restrained eating as covariates were consistent with those obtained from the structural equation modelling (Table 3). Elevated levels of depressive symptoms were related to a higher risk of being obese, having central obesity and a higher body fat percentage. Although adjustment for the covariates attenuated the associations between depressive symptoms and obesity indicators, the associations became non-significant only when emotional eating and physical activity self-efficacy were added to the models. Older age, lower education, chronic diseases, higher emotional eating and lower physical activity self-efficacy (and higher restrained eating with respect to body fat percentage) were significant predictors of obesity, central obesity and body fat percentage in the final models of Table 3.

Table 3. *The results from the multivariate logistic regression models predicting obesity and central obesity, and linear regression models predicting body fat percentage by gender.*

	Men (N=2107-2129)			Women (N=2420-2461)		
	Obesity[1]	Central[2] obesity	Fat %	Obesity[1]	Central[2] obesity	Fat %
	OR (95% CI)	OR (95% CI)	β (SE)	OR (95% CI)	OR (95% CI)	β (SE)
Model 1						
CES-D ≥ 16	1.57	1.82	0.09	1.78	1.81	0.13
	(1.21-2.04)[b]	(1.44-2.29)[a]	(0.38)[a]	(1.44-2.21)[a]	(1.49-2.20)[a]	(0.36)[a]
Model 2						
CES-D ≥ 16	1.37	1.56	0.05	1.53	1.62	0.09
	(1.05-1.80)[c]	(1.22-1.98)[a]	(0.35)[c]	(1.22-1.91)[a]	(1.32-1.99)[a]	(0.34)[a]
Model 3						
CES-D ≥ 16	0.87	0.93	-0.04	0.97	1.01	0.00
	(0.65-1.17)	(0.71-1.21)	(0.36)	(0.76-1.24)	(0.81-1.27)	(0.33)

[1] Body mass index ≥ 30 kg/m²; [2] Waist circumference ≥ 102 cm for men and ≥ 88 cm for women.

CES-D=Center for Epidemiological Studies–Depression Scale.

Model 1: Depressive symptoms (0=CES-D score < 16, 1=CES-D score ≥ 16).

Model 2: Model 1 + age, education years, marital status, chronic diseases and restrained eating.

Model 3: Model 2 + emotional eating and physical activity self-efficacy.

[a] $p<0.001$; [b] $p<0.01$; [c] $p<0.05$.

6.5 THE ABSOLUTE AND RELATIVE IMPORTANCE OF FOOD CHOICE MOTIVES AS MEDIATORS BETWEEN SOCIOECONOMIC POSITION AND DIETARY HABITS (STUDY IV)

Study IV investigated the absolute and relative importance of six food choice motives (health, pleasure, convenience, price, familiarity and ethicality) and their role in explaining the SEP gradient in dietary intake. First, correlations among the six motives were explored both in absolute and relative terms. Health, pleasure, convenience, price, familiarity and ethicality all correlated positively with each other on the absolute level (the only exception was that convenience had non-significant, $p>0.05$, correlations with pleasure and ethicality in men). The correlation coefficients ranged from 0.07 to 0.55 among men and from 0.06 to 0.48 among women, and the strongest association was between health and ethicality in both genders. The associations between the motives were altered on the relative level in both genders: health (r=-0.22– -0.39 in men and r=-0.14– -0.33 in women) and ethicality (r=-0.18– -0.43 and r=-0.14– -0.40, respectively) correlated negatively with all the other motives. Participants who considered convenience as relatively more important in their daily food choices rated

ethicality (r=-0.43 in men and -0.38 in women), health (r=-0.37 and -0.29, respectively) and pleasure (r=-0.15 and -0.17, respectively) as relatively less important, and price (r=0.28 and 0.22, respectively) and familiarity (r=0.28 and 0.22, respectively) as relatively more important. However, each relative food choice motive had a positive and high correlation with its absolute counterpart, with correlations ranging from 0.67 to 0.87 among men and from 0.60 to 0.92 among women.

Table 4 presents the age-adjusted correlations between food choice motives, SEP indicators and food variables. Participants with a lower education and income put more importance on price and familiarity motives in both absolute and relative terms. A minor gender difference was observed here: the relation between education and price was significant only among women. A higher SEP, especially in terms of income, was related to a greater relative importance of health considerations in food selection. All the motives had significant associations with the food variables on the relative level: pleasure, convenience, price and familiarity were associated with a lower consumption of vegetables/fruit and a higher consumption of energy-dense foods, whereas the opposite was the case with health and ethicality (Table 4). On the absolute level, the motives, except health and ethicality, had only weak correlations with these food variables (r ≤ ±0.10).

Table 4. *Age-adjusted Pearson's correlation coefficients between absolute and relative food choice motives, socioeconomic position indicators and food variables.*

	Men (N=1616-1686)				Women (N=1946-2047)			
	Education	Income	Vegetables /fruit	Energy-dense foods	Education	Income	Vegetables /fruit	Energy-dense foods
Absolute motives								
Health	0.04	0.03	0.25[a]	-0.19[a]	-0.01	0.02	0.23[a]	-0.23[a]
Pleasure	-0.02	-0.02	0.05[c]	0.06[c]	-0.08[a]	-0.02	0.04	0.00
Ethicality	-0.01	-0.06[c]	0.15[a]	-0.14[a]	0.01	-0.05[c]	0.14[a]	-0.11[a]
Convenience	0.01	-0.08[b]	-0.06[c]	0.10[a]	0.04	0.00	-0.06[c]	0.08[a]
Price	0.01	-0.26[a]	-0.06[c]	0.02	-0.15[a]	-0.32[a]	-0.08[b]	0.06[c]
Familiarity	-0.13[a]	-0.11[a]	-0.08[b]	0.03	-0.19[a]	-0.11[a]	-0.01	0.07[b]
Relative motives								
Health	0.07[b]	0.14[a]	0.20[a]	-0.19[a]	0.04	0.10[a]	0.19[a]	-0.22[a]
Pleasure	-0.04	0.02	-0.09[a]	0.17[a]	-0.06[b]	0.03	-0.09[a]	0.12[a]
Ethicality	-0.00	-0.04	0.09[a]	-0.12[a]	0.06[b]	-0.03	0.09[a]	-0.07[b]
Convenience	0.00	0.04	-0.16[a]	0.15[a]	0.06[c]	0.03	-0.17[a]	0.16[a]
Price	-0.01	-0.24[a]	-0.15[a]	0.08[b]	-0.13[a]	-0.30[a]	-0.17[a]	0.12[a]
Familiarity	-0.13[a]	-0.08[b]	-0.17[a]	0.09[b]	-0.19[a]	-0.09[a]	-0.09[a]	0.13[a]

[a] $p<0.001$; [b] $p<0.01$; [c] $p<0.05$.

63
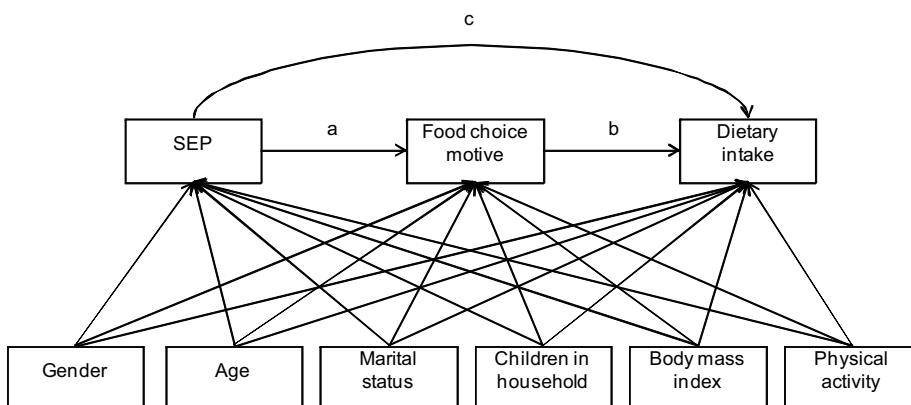
Figure 8. The structural equation model used to estimate the total, direct and indirect (through food choice motives) effects of the SEP (socioeconomic position) indicators (education and income) on dietary intake (vegetables/fruit and energy-dense foods). Gender, age, marital status, the presence of children in the household, body mass index and physical activity were included as covariates in the models. The models for vegetables/fruit were also adjusted for total energy intake. The rectangles represent the measured variables, and the arrows the regression paths between the variables. a=the direct effect of the SEP indicator on the food choice motive. b=the direct effect of the food choice motive on dietary intake. c=the direct effect of the SEP indicator on dietary intake. a*b=the indirect effect of the SEP indicator on dietary intake through the food choice motive. The total effect of the SEP indicator on dietary intake=direct effect c + indirect effect.

Figure 8 shows the mediation model, which was estimated separately for all the SEP indicators (education and income), food choice motives (absolute and relative) and food variables (vegetables/fruit and energy-dense food intake). In these models, participants with a higher education (standardised total effect $\beta=0.12$, $p<0.001$) and income (total effect $\beta=0.12$, $p<0.001$) consumed more vegetables/fruit, whereas education had an inverse association with energy-dense food intake (total effect $\beta=0.09$, $p<0.001$) (Table 5). The absolute importance of price, familiarity and ethicality significantly mediated the effects of the SEP indicators on the intake of vegetables/fruit and/or energy-dense foods, but the magnitude of the standardised indirect effects were very small ($\beta\leq0.010$). In terms of relative importance, the sizes of the indirect effects were larger, and health, price and familiarity partly attenuated the associations between the SEP indicators and the food variables (the largest standardised indirect effect was for price in the model for income and vegetable/fruit intake, $\beta=0.033$, SE=0.005, $p<0.001$) (Table 5). Multi-group analyses were performed to test gender differences in the mediation models, and significant ($p\leq0.01$) differences between men and women emerged only with respect to the associations between education, price and food variables: the indirect effects of education through price

(absolute and relative importance) on the consumption of vegetables/fruit and energy-dense foods were significant only among women.

Table 5. *The results from the structural equation modelling: the standardised total, direct and indirect (through relative food choice motives) effects of education and income on the consumption of vegetables/fruit and energy-dense foods.*

		Total effect of education	Direct effect of education	Specific indirect effects	Total effect of income	Direct effect of income	Specific indirect effects
		β (SE)	β (SE)	β (SE)	β (SE)	β (SE)	β (SE)
Vegetables/fruit (N=3565)	Health	0.12 (0.02)[a]	0.11 (0.02)[a]	0.010 (0.004)[b]	0.12 (0.02)[a]	0.10 (0.02)[a]	0.020 (0.004)[a]
	Familiarity	0.12 (0.02)[a]	0.10 (0.02)[a]	0.017 (0.003)[a]	0.12 (0.02)[a]	0.11 (0.02)[a]	0.009 (0.002)[a]
	Price[1]				0.12 (0.02)[a]	0.09 (0.02)[a]	0.033 (0.005)[a]
	Men	0.15 (0.03)[a]	0.14 (0.03)[a]	0.003 (0.004)			
	Women	0.09 (0.02)[a]	0.07 (0.02)[b]	0.019 (0.004)[a]			
Energy-dense foods (N=3620)	Health	-0.09 (0.02)[a]	-0.08 (0.02)[a]	-0.010 (0.004)[b]	-0.03 (0.02)[c]	-0.01 (0.02)	-0.021 (0.004)[a]
	Familiarity	-0.09 (0.02)[a]	-0.08 (0.02)[a]	-0.014 (0.003)[a]	-0.03 (0.02)[c]	-0.03 (0.02)	-0.008 (0.002)[a]
	Price[1]				-0.03 (0.02)[c]	-0.01 (0.02)	-0.023 (0.005)[a]
	Men	-0.06 (0.03)[c]	-0.06 (0.03)[c]	-0.002 (0.002)			
	Women	-0.14 (0.03)[a]	-0.12 (0.03)[a]	-0.013 (0.004)[b]			

[1] Gender-stratified results are shown because the multi-group analyses indicated significant (p≤0.01) gender differences in the associations between education, price and food variables.

[a] p<0.001, [b] p<0.01, [c] p<0.05.

7   DISCUSSION

The aim of the present doctoral dissertation was to explore the associations of emotional and cognitive factors with dietary habits and obesity as well as the role these factors have in socioeconomic disparities in diet. The findings can be considered to have four main contributions to the existing knowledge: First, obesity status and dieting history moderated the relationships of restrained eating with obesity indicators, overeating tendencies and self-control, while the associations of emotional eating, uncontrolled eating and self-control were consistent across these groups (Study I). Second, the susceptibility for emotional eating and low physical activity self-efficacy were relevant in explaining the associations of depressive symptoms with unhealthier dietary habits and greater body weight and size (Studies II and III). Third, the relative importance of price, health and familiarity motives in daily food selection, rather than the absolute importance, partly accounted the SEP disparities in diet (Study IV). Finally, the patterns of associations were similar between the genders and age groups, although significant gender differences were observed in the mean levels of psychological eating styles, food choice motives and depressive symptoms (Studies I-IV). Next, these findings are discussed in detail in relation to the previous empirical evidence and theoretical considerations.

7.1 OVEREATING TENDENCIES, SELF-CONTROL, DEPRESSIVE SYMPTOMS AND OBESITY

Investigating psychological eating styles in relation to the general psychosocial factors related to negative emotions and self-control may increase the understanding of the nature of these eating styles. Studies I and II demonstrated that emotional and uncontrolled eating were related to lower levels of self-control and elevated levels of depressive symptoms. All these associations were moderate in size, which suggests that depressive mood and difficulties in exerting control over one's impulses and behaviours are both reflected in uncontrolled and emotional eating. Similar associations have been observed in previous studies conducted mainly among female university students and obese women (Heaven et al., 2001; Lyke & Spinella, 2004; Yeomans et al., 2008; Elfhag & Morey, 2008; Provencher et al., 2008; Ouwens et al., 2009), and the findings from Studies II and III extend these results to men and women in the general population. As obesity status and dieting history moderated the associations of restrained eating with self-control (as well as with other variables), the findings related to restraint are discussed separately in Section 7.2.

Studies I and II also showed that, on average, obese and overweight participants were more vulnerable to emotional and uncontrolled eating, had higher levels of depressive symptoms and poorer self-control than those with normal weight. Interestingly, uncontrolled and emotional eating emerged as the strongest correlates of obesity indicators in this sample, and adjusting for restrained eating did not affect these associations, which highlights that these tendencies play an important role in obesity independent of restrained eating. Empirical research and theorisation on the psychological aspects related to eating and obesity has previously been dominated by restrained eating, and therefore it appears that there is a need for a more balanced approach in this field.

Consistent with the previous studies (de Lauzon et al., 2004; Keskitalo et al., 2008; Cappelleri et al., 2009), emotional and uncontrolled eating correlated highly and positively with each other, and their associations with depressive symptoms, self-control and obesity indicators were highly similar. This raises the question of whether these two overeating tendencies can be separated from each other empirically. While emotional eating can be defined as eating in response to negative emotions, uncontrolled eating refers to general problems in the regulation of eating, i.e. having extreme feelings of hunger and eating in response to external food-related cues. In particular, emotional eating is conceptually more closely related to depressive symptoms than uncontrolled eating, but this was not reflected in their correlations with depressive symptoms. The question of overlap, however, can also be considered to concern other overeating tendencies that have been proposed to exist in recent decades based on theoretical considerations or psychometric analyses of the questions developed to measure eating styles, i.e. susceptibility to food-related cues (e.g., external eating), sensitivity to satiety and hunger cues (e.g., susceptibility to hunger) and disinhibited eating. Some of these overlap by definition (e.g., disinhibited eating refers to both emotionally and externally triggered eating), but it would be important to have a more profound overall understanding of how the various overeating tendencies are related to each other and whether they can be empirically differentiated from each other.

Many researchers have emphasised that restrained eating and overeating tendencies do not act in isolation, but exert their effects in interaction with each other (van Strien, 1999; Bryant, King, & Blundell, 2008). A high level of restraint has been observed to attenuate the positive relation between disinhibited eating and BMI (Williamson et al., 1995; Lawson et al., 1995; Dykes et al., 2004; Hays et al., 2002). In contrast, a few experimental studies have found that only those participants who score high on both restraint and overeating scales are vulnerable to problems in regulating eating (Westenhoefer et al., 1994; Haynes et al., 2003). However, Study I implies that obesity status and dieting history may modify these interactions, as the relationships of restrained eating with overeating tendencies and indicators

of obesity differed between normal weight and obese participants and between dieters and never dieters, respectively.

7.2 RESTRAINED EATING AND THE MODERATING ROLE OF OBESITY STATUS AND DIETING HISTORY

Although the concept of restrained eating has dominated the research for several decades, certain questions still remain unresolved: there is no consensus in the literature on whether the cognitive restriction of eating is helpful, merely ineffective or actually harmful in weight control, whether these effects vary between individuals and whether restrained eating is a cause or a consequence of problems with eating and weight (see, e.g., Lowe & Timko, 2004). Study I contributed to this discussion by examining in a large population-based sample whether the associations of restrained eating vary according to the obesity status and dieting history. Among obese participants, higher restrained eating was related to lower BMI, WC and susceptibility to overeating, which could imply that restrained eating is related to more successful weight control among the obese. In contrast, the associations were the opposite among normal weight participants, and higher restraint could indicate problems with eating among them. These results are consistent with the previous studies in which the associations of restrained eating with disinhibited eating and susceptibility to hunger (Lindroos et al., 1997; Bellisle et al., 2004) and obesity indicators (Provencher et al., 2003; de Lauzon-Guillain et al., 2006) were positive in participants of normal weight and negative or non-significant in those with obesity. Study I was also the first study to show that the moderating effects of dieting history on the relations of restrained eating were highly similar to the effects of obesity status, with obese individuals resembling current and past dieters and normal weight individuals never dieters. This is understandable as weight loss attempts were far more frequent among the obese (66% of obese men and 81% of obese women were current or past dieters, whereas 82% of normal weight men and 59% of normal weight women had never dieted).

Thus, the nature and meaning of restrained eating seems to vary according to the body weight level and motivation to lose weight. Susceptibility for emotional and uncontrolled eating was clearly less common among normal weight participants than those with overweight or obesity (Study I) and restraint in people of normal weight may act as a marker for struggles with food intake and an attempt to solve them. Nevertheless, it is also possible that among some of them restraint is a consequence of trying to reach unrealistic slim body ideals favoured by the society. The same eating characteristic may instead reflect a successful weight control strategy in obese people, who are often motivated to lose weight. Consistently, increases in restrained eating have predicted weight loss among obese adults participating in weight-loss programmes (e.g., Foster et al., 1998; Dalle

Grave et al., 2009), while restraint predicts the onset of disordered eating and obesity among normal weight adolescent females (e.g., Stice, Presnell, & Spangler, 2002; Stice, Presnell, Shaw, & Rohde, 2005), although the latter results might be attributable to high levels of body dissatisfaction in adolescents who restrain their eating (Johnson & Wardle, 2005).

The findings from Study I provide support for Lowe's (1993) argument that current weigh loss dieting should be separated from a general tendency to cognitively control eating. According to Lowe, the former refers to resisting the temptation to eat *what is needed,* while the latter refers to resisting the temptation to eat *more than is needed*. However, Study I also implies that the nature of restrained eating differs between individuals with dieting experiences (irrespective of whether they are currently trying to lose weight) and those who have never dieted: higher restrained eating was related to lower BMI, WC and tendency for overeating among current and past dieters, which may reflect that restrained eaters in these groups are resisting the temptation to eat what their body requires. In contrast, the associations of restraint were the opposite or non-significant among never dieters and restraint may signify eating less than desired among them.

Additional support for the interpretation that the nature of restrained eating varies according to obesity status and dieting history is provided by differential associations with self-control. Higher level of restraint was related to a better general ability to control one's behaviours and impulses in overweight and obese participants and those with dieting experiences, but no such associations emerged in normal weight participants and those without dieting experiences (Study I). Earlier studies exploring how restrained eating is linked with personality dispositions related to self-control have produced contradictory findings, which could be explained by the inclusion of participants with varying weight levels. In a study by Yeomans et al. (2008), in which restrained eating was unrelated to impulsivity, the participants were mainly female university students or staff members of normal weight (81%). In contrast, the samples in the studies of Provencher et al. (2008) and Elfhag and Morey (2008) consisted of obese women, and restraint was found to be positively associated with the personality trait of conscientiousness, i.e. persistence and impulse control.

The relationships between restrained eating and dietary habits were not the focal interest of this study, since restrained eating has consistently been related to a healthier self-reported dietary intake in previous studies (e.g., Lindroos et al., 1997; Lluch et al., 2000; Provencher et al., 2003; de Lauzon et al., 2004). There is also evidence that individuals who restrict their eating cognitively tend to report their dietary habits less accurately (Maurer et al., 2006). Hence, it is likely that the associations of restrained eating are at least partly attributable to the under-reporting of unhealthy foods and the over-reporting of healthy foods. This perhaps also explains why the associations of restraint with lower energy-dense food and higher vegetable/fruit intake did not vary according to the obesity status in Study II.

It should be pointed out that the present study is based on a cross-sectional design and cannot answer the still unresolved question of whether restrained eating is a cause or a consequence of problems with eating and weight. While Polivy and Herman (1985) considered restrained eating to be dysfunctional and a risk factor for disordered eating and weight gain, opposing arguments have also been made: many researchers argue that restrained eaters may be mostly those who have a susceptibility to gain weight (e.g., genetic susceptibility) and are controlling their eating cognitively to counteract this disposition (Johnson, Pratt, & Wardle, 2011; Stroebe, 2008, p. 136; Lowe & Butryn, 2007; Hill, 2004). Indeed, recent twin studies have shown that appetitive characteristics (e.g., responsiveness to internal satiety signals and external food cues) are heritable and may be one mechanism through which genes influence vulnerability to weight gain (Wardle & Carnell, 2009).

7.3 THE INTERPLAY BETWEEN BEHAVIOUR-SPECIFIC PSYCHOSOCIAL FACTORS AND DEPRESSIVE SYMPTOMS

Research on emotional eating and depressive symptoms in relation to dietary behaviours and obesity has mainly been conducted in two separate lines. This is surprising as they are conceptually related and as studies on eating disorders, especially on binge eating disorder, provide evidence that negative emotional states often precede uncontrolled eating episodes (Greeno, Wing, & Shiffman, 2000) and that depressive symptoms prospectively predict the development of eating disorders (Measelle, Stice, & Hogansen, 2006). Individuals with elevated levels of depressive symptoms are in a negative mood state that may lead to increased eating among some of them. However, the presence of depressive symptoms is not necessary for emotional eating to occur as it can be triggered by various negative emotions that are part of everyday life. Studies II and III were unique in investigating the possible interplay between depressive symptoms and emotional eating with respect to dietary habits and obesity. In addition to emotional eating, physical activity self-efficacy was included in Study III, as the interest was on the potential mechanisms between depressive symptoms and obesity.

7.3.1 EMOTIONAL EATING AND DIETARY HABITS

Study II indicates that emotional eating and depressive symptoms are both related to less healthy food choices and that emotional eating is one factor explaining the associations of depressive symptoms, although other factors are also important. Tendency for emotional eating was related to consuming more sweet and non-sweet energy-dense foods, while it was unrelated to the consumption of vegetables and fruit/berries. This supports the hypothesis

that emotional eating is particularly related to the increased intake of sweet and high fat foods (Macht, 2008). It was suggested in Section 3.1 that the measurement level of food intake (specific food groups vs. total energy and macronutrient intake) may explain the previous contradictory results concerning emotional eating and habitual dietary intake (Lluch et al., 2000; Anschutz et al., 2009; de Lauzon et al., 2004; Elfhag et al., 2008): indeed, in Study II (for details, see the original publication of Study II) and a study by de Lauzon et al. (2004), emotional eating was mainly unrelated to total energy and macronutrient intake, while it was positively associated with the consumption of various energy-dense foods. It should be acknowledged, however, that this might be partly caused by the net effect of biases in self-reported dietary intake, which is greater for macronutrient and total energy intakes than for intakes of defined food groups (Giskes et al., 2010). A gender difference emerged with respect to emotional eating in Study II: emotional eating was significantly associated with the higher consumption of non-sweet energy-dense foods only among men. Differences in food preferences between men and women are likely to be important in this respect: Wansink, Cheney and Chan (2003) found that men preferred meal-type comfort foods (such as non-sweet foods in the present study), whereas women preferred sweet snacks as comfort foods.

The above-discussed findings that emotional eaters consume more of those foods considered palatable by most people probably reflect that they are using food to regulate their emotions. Consistent with this emotion regulation hypothesis, Macht and Mueller (2007) found in two experiments that higher emotional eating was related to a greater improvement of an experimentally induced negative mood after eating chocolate. As discussed in Section 2.2, several specific psychological processes have been proposed to be involved in the tendency for emotional eating such as eating as a consequence of escaping from aversive self-awareness (Heatherton and Baumeister, 1991) and eating as a learned emotion regulation strategy (Kaplan & Kaplan, 1957), but they share the assumption that increased food intake is a result of trying to cope with negative emotional experiences.

The participants with elevated levels of depressive symptoms consumed sweet and non-sweet energy-dense foods more frequently and vegetables/fruit less often compared to those with no symptoms (Study II). This is consistent with the few earlier studies conducted (Allgöwer et al., 2001; Cohen et al., 2002; Sarlio-Lähteenkorva et al., 2004; Akbaraly et al., 2009; Jeffery et al., 2009; Mikolajczyk et al., 2009). Interestingly, the association between depressive symptoms and sweet foods was accounted for by emotional eating, while this was not the case for non-sweet foods or vegetables/fruit. Hence, eating triggered by negative emotions does not seem to be the only reason for the depressed participants' unhealthier food choices. The non-sweet food items (hamburgers, pizza, French fries, sausages and savoury pasties) included in this study are fast-food items that are easy to purchase and prepare, which could be one reason why depressed

individuals prefer them, as a characteristic feature of depressed mood is the loss of interest and motivation. The same interpretation might be extended to vegetables and fruit, since eating them usually requires some sort of planning and preparation. It was also hypothesised that the participants with high scores on both emotional eating and depressive symptom scales would have the highest consumption of energy-dense foods, but the findings were not fully consistent with this hypothesis: only those with low scores on both of the scales consumed lower amounts of non-sweet foods. This result, however, provides further evidence that emotional eating and depressive symptoms are related to higher non-sweet energy-dense food intake independently of each other.

With respect to emotional eating, it is important to note that Evers and colleagues (Evers et al., 2009; Evers, Stok, & de Ridder, 2010; Adriaanse et al., 2011) have recently questioned the construct validity of the self-report emotional eating scales. They observed in a series of experiments that individuals describing themselves as emotional eaters did not increase their food intake during negative emotional encounters compared to their intake during neutral emotional states or the intake of individuals not judging themselves as emotional eaters (Evers et al., 2009). Evers and associates argue that it can be demanding to adequately assess one's own emotional eating behaviour, as people are often unaware of the impact of emotional states on their behaviour, and retrospective emotional ratings are sensitive to recall bias. Consequently, high scores on emotional eating scales may not capture a tendency to eat during negative emotions, but rather reflect beliefs about the relation between emotions and eating or be an expression of concerns about eating. In one of their study, Evers et al. (2010) found that using suppression as an emotion regulation strategy (rather than emotional eating ratings) predicts the increased eating of energy-dense foods during negative emotional states. However, the participants in all of the studies conducted by Evers and colleagues were female university students of normal weight, which limits the generalisability of their results. A few other studies exist in which food intake during stressful experiences has been explored in more heterogeneous samples, and results from these studies provide support for the predictive validity of emotional eating scales (O'Connor et al., 2008; Oliver et al., 2000). The inconsistency between the studies indicates that the construct validity of the emotional eating scales clearly deserves more research. As discussed in Section 7.1, the high correlation between emotional and uncontrolled eating and their similar associations with depressive symptoms, self-control and obesity indicators in this study raise the question of whether high scores on emotional eating scales simply reflect general problems in the regulation of eating.

7.3.2 EMOTIONAL EATING, PHYSICAL ACTIVITY SELF-EFFICACY AND OBESITY INDICATORS

There is increasing evidence that depressive symptoms and obesity are positively related and that the association is bidirectional (Atlantis & Baker, 2008; Blaine, 2008; Rooke & Thorsteinsson, 2008; Luppino et al., 2010). Nevertheless, the mechanisms linking them are not well understood. Study III set out to investigate whether psychosocial factors related to eating and physical activity have a role in explaining the associations of depressive symptoms with higher body weight and size. It was found that the positive bivariate associations between depressive symptoms and BMI, WC and body fat percentage became non-significant (or even significantly negative in some cases) after emotional eating and physical activity self-efficacy were included in the models. Study III, thus, suggests that emotional eating and physical activity self-efficacy both act as a mechanism between depressive symptoms and obesity. Furthermore, these findings were consistent in men and women and in age and education groups.

It is important to note, however, that the results *do not* imply that all individuals with elevated levels of depressive symptoms are vulnerable to overeating in response to negative emotions and weight gain or that emotional eating and physical activity self-efficacy are the only pathways. Depression itself is a heterogeneous syndrome, and the diagnostic criteria for major depression (American Psychological Association, 2000) include both increased appetite with weight gain and decreased appetite with weight loss as possible symptoms. Elevated depressive symptoms have also been found to predict both weight gain and loss in a three-year follow-up of middle-aged men and women from the general population (Haukkala et al., 2001). Rather, Study III implies that a tendency to eat in response to negative emotions and a low confidence in maintaining physical activity behaviours when facing barriers are one set of factors that explain why *some* depressed individuals have higher body weight and size. In addition to the possibility that depressive symptoms can lead to weight gain, they can also be a consequence of obesity (Rooke & Thorsteinsson, 2008; Luppino et al., 2010), reflecting the stigma and discrimination that obese people encounter (Puhl & Heuer, 2009), and body dissatisfaction could be one mechanism behind this (Friedman, Reichmann, Costanzo, & Musante, 2002; Jansen, Havermans, Nederkoorn, & Roefs, 2008; Chaiton et al., 2009).

Two recent cross-sectional studies conducted among US adults are relevant to the results from Study III. Beydoun and Wang (2010) observed that physical inactivity was a significant pathway between depressive symptoms and higher BMI among women. In another study (Beydoun et al., 2009), the inverse association between SEP and obesity indicators was mediated through depressive symptoms and unhealthy eating patterns in white women. A more comprehensive model in Study III would have included actual dietary and physical activity behaviours as mediators between emotional eating and physical activity self-efficacy and obesity

indicators, respectively. However, it is well-known that the associations between dietary intake and obesity are complicated, and many cross-sectional epidemiological studies have failed to find differences in dietary energy density between normal weight and obese individuals (Drewnowski, Almiron-Roig, Marmonier, & Lluch, 2004). In the present study, the associations between food variables and indicators of obesity were also weak.

7.4 SOCIOECONOMIC DISPARITIES IN DIETARY HABITS AND INDIVIDUAL PRIORITIES IN FOOD CHOICE MOTIVES

Study IV took into account the influence of socioeconomic factors on dietary habits and had two related aims: to examine whether low SEP individuals' less healthy dietary intake is partly explained by motives underlying the selection of food and whether individuals' motive priorities (i.e. relative motives) should be analysed rather than their absolute ratings of single motives (i.e. absolute motives). While the SEP inequalities in diet are well established (Darmon & Drewnowski, 2008; Giskes et al., 2010), the reasons for them remain unclear despite considerable research efforts.

Relative motives were derived by dividing a respondent's score on a single motive by his or her mean rating across all the motives, and two noteworthy discrepancies between the absolute and relative motives were observed. First, all the absolute motives correlated positively with each other, in accordance with the previous studies (Steptoe et al., 1995; Pollard et al., 1998), but convenience, familiarity and price were the only relative motives that were positively associated. The occurrence of negative as well as positive correlations on the relative level is understandable, as relative motives compete from the same overall level of importance. People commonly prioritise food choice motives, given that it is rare for all personally important motives to be fully satisfied in any particular eating situation (Sobal et al., 2006; Sobal & Bisogni, 2009), and relative motive variables produce the prioritising mathematically. One problem related to relative motives is that they do not distinguish between participants who rate all motives as equally important but on a different level of importance. In other words, relative motives do not capture the individual differences that have been observed on the level of involvement with food, some consumers being enthusiastic about every aspect of it and others being extremely uninvolved (Grunert, Baadsggaard, Larsen, & Madsen, 1996). Analysing individual priorities in food choice motives, rather than the absolute importance of single motives, however, may better reflect the complexity of the motive structure in that relatively unimportant motives might not affect food choices, even though their absolute importance is high (Scheibehenne, Miesler, & Todd, 2007). Second, in accordance with the above interpretation, the associations between food choice motives and dietary intake were weaker

on the absolute than on the relative level: all the relative motives were related to the consumption of vegetables/fruit and energy-dense foods in the predicted direction, albeit the associations were mainly small in size. In contrast, health and ethicality were the only absolute motives to show an association with these food variables.

Nevertheless, the differences between the SEP groups in the importance placed on various food choice motives were less affected by the analysis level. Consistent with previous studies (Lennernas et al., 1997; Steptoe & Wardle, 1999; Hupkens et al., 2000; Ball et al., 2006; Bowman, 2006), participants with a low SEP rated price and familiarity as more relevant and healthiness as less important in their daily food choices compared to their more advantaged counterparts, although for the health motive this was observed only on the relative level. The relation between income and price was the strongest of the associations between SEP indicators and food choice motives. It is reasonable that individuals with fewer financial resources place a higher emphasis on price in their food purchasing decisions. The greater importance attached to familiarity among individuals with lower levels of education and income might result in a more monotonous dietary intake, and could reflect various issues. Trying new food may represent a risk of waste that less affluent individuals cannot afford to take, for example (Barker et al., 2008). Moreover, a higher education may increase the willingness to experiment with new foods, thereby leading to a lower appreciation of food-related traditions and familiar dietary practices (Inglis, Ball, & Crawford, 2005). The result that considerations related to weight control and health were relatively more salient to participants with a high SEP, especially those with higher incomes, may partly reflect that more affluent individuals have the financial freedom to take health aspects into account in food purchasing, given the higher cost of healthy foods (Drewnowski, 2010). Consistent with this proposition, price has been found to be a barrier to purchasing healthy food items among socioeconomically disadvantaged groups (Giskes, Turrell, Patterson, & Newman, 2002; Dibsdall, Lambert, Bobbin, & Frewer, 2003; Inglis et al., 2005; Waterlander, de Mul, Schuit, Seidell, & Steenhuis, 2010).

Study IV also showed that the lower vegetable/fruit intake and higher energy-dense food intake among socioeconomically disadvantaged individuals were partly accounted for the relative importance of price, health and familiarity motives. The mediated effects of the absolute motives, however, were very small, although there were some significant indirect effects. The difference between the absolute and relative price and familiarity motives can be attributed to the fact that they were more strongly associated with food variables on the relative level. Similarly, Steptoe and Wardle (1999), analysing food choice motives in absolute terms, found that education groups differed in the importance they placed on four motives (i.e. price, familiarity, mood control and sensory appeal), but only familiarity seemed to contribute to the educational gradient in total fibre and fruit/vegetable intake. The findings from Study IV extend to those obtained

by Beydoun and Wang (2008) concerning the ratio of the importance of price relative to the healthiness of the food as a contributor to the SEP disparities in diet by implying that it is important to analyse also other food choice motives in relation to each other. It should be emphasised that the relative importance of price, familiarity and health motives explained only part of the SEP variations in dietary intake, reflecting that other factors are also relevant. However, it is reasonable to assume that no single set of factors fully accounts for the SEP gradient in diet, as food choice is a complex process influenced by the interplay between multiple factors. Food choice motives represent conscious considerations important in the selection of foods (Sobal et al., 2006), but many daily food choice decisions are automatic and habitual responses to situational cues rather than based on deliberate considerations (Wansink & Sobal, 2007).

7.5   GENDER AND AGE DIFFERENCES

Gender is an important aspect of the food and eating domain, as women in general have the main responsibility for household shopping and cooking and as norms concerning appropriate body shape and weight are more restrictive towards women (Rolls et al., 1991; Beardsworth & Keil, 1997, p. 173-192). As a consequence, the studies concerning the psychological aspects of eating have frequently recruited only women and, thus, studies comparing the associations between men and women are scarce. Therefore, all the present analyses were gender stratified.

In accordance with the previous studies (Lluch et al., 2000; de Lauzon et al., 2004; Bellisle et al., 2004; Steptoe et al., 1995; Glanz et al., 1998), women scored higher on all eating-specific psychological factors examined than men (except familiarity motive). Surprisingly few gender differences, however, were observed in the associations of these eating-specific psychological factors with dietary intake and obesity indicators. This implies that although women are more concerned about issues related to eating and food, eating-specific psychological factors play a relevant role in dietary habits and obesity in both genders. Gender differences in the associations between depressive symptoms, unhealthier dietary habits and obesity have been observed in some previous studies, with women having stronger associations (Heo et al., 2006; Scott et al., 2008; Mikolajczyk et al., 2009). However, all studies have not found such differences (Haukkala & Uutela, 2000; Dong et al., 2004; Sarlio-Lähteenkorva et al., 2004), and this was the case in the present study as well.

The influence of age on the relationships between psychosocial factors, dietary habits and obesity was also tested due to the wide age range of the sample. Interestingly, only three interactions out of the 74 interactions tested were significant, indicating that age had little or no effect on these associations. However, the youngest study participants were 25 years old,

leaving the possibility for divergent associations among young adults and adolescents.

7.6 METHODOLOGICAL CONSIDERATIONS

The investigation of various eating-specific and general psychosocial factors simultaneously in relation to dietary habits and obesity in a large population-based sample and using the most recent modelling techniques to analyse multivariate associations between variables are the primary strengths of this doctoral dissertation. A further strength is that several clinically measured indicators of obesity (BMI, WC and body fat percentage) were used that allowed the different aspects of excess body weight and fat to be separately examined. Interestingly, all three indicators correlated highly with each other (the correlation coefficients ranged between 0.88 and 0.92) and had similar associations with psychosocial factors. There is evidence that WC (an indicator of excess fat in the abdominal area) is a better predictor of the health risks related to obesity than BMI (Janssen, Katzmarzyk, & Ross, 2004), but on the basis of this study, it seems that the associations of various obesity indicators with psychosocial factors are fairly equivalent. However, several methodological limitations should be taken into account when interpreting the results of the dissertation, and these limitations are discussed next.

Cross-sectional design. The study was based on cross-sectional data, which does not allow for the ascertainment of causality or its direction. Studies II, III and IV examined mediation hypotheses, and mediation by definition refers to causal processes: according to MacKinnon (2008, p. 8), "In a mediation model, the independent variable causes the mediator which then causes the dependent variable." This might be problematic because cross-sectional approaches to mediation can substantially over- or underestimate longitudinal effects (Maxwell & Cole, 2007). Psychosocial factors were conceptualised as determinants of food intake and obesity in the current study, but many of the associations examined are likely to be bidirectional. Taking emotional eating as an example, while it is plausible that a depressive mood can trigger overeating in response to negative emotions, leading to later weight gain, this sequence of events may also result in a lowered mood state. Emotion regulation theories (Gross & Thompson, 2007) propose that there are feedback loops between chosen affect regulation strategies (e.g., emotional eating) and the following emotional states, and feelings of guilt are common after eating energy-dense snack foods, particularly among women (Wansink et al., 2003).

Nevertheless, the current cross-sectional study will provide an excellent knowledge base for the follow-up study that is planned to be conducted in 2012. The aim is to invite all the individuals who participated in 2007 to a follow-up health examination and gather the same information from them as

was done in 2007. The resulting prospective data will allow examining changes in dietary habits, weight and various psychosocial factors, and whether these changes are related to each other. It should be noted though that while prospective observational studies offer the opportunity to explore naturally occurring changes and their covariance, the experimental design enables testing theory-based hypotheses about causal relations in controlled settings.

Measures. A self-report 132-item FFQ was used to assess dietary intake, which allows the estimation of longer-term intake. It requires individuals to report their average consumption of more than one hundred food items. As a result, it is vulnerable to recall bias and depends on the individual's ability to correctly estimate his/her typical dietary intake. The present FFQ has been validated against 14-day (Männistö et al., 1996) and three-day food records (Paalanen et al., 2006), the results indicating reasonable validity. With regard to the foods analysed in the present study (vegetables/fruit and sweet and non-sweet energy-dense foods), 69-78% of the participants were classified in the same or an adjacent quintile of the consumption of vegetables, fruit, berries, wheat products, sausages and sugar by both the FFQ and the 14-day food record (Männistö et al., 1996). However, it is well known that all self-report dietary assessment methods are vulnerable to biases in reporting and that under-reporting of energy intake occurs more often in women, older adults, people with less education, overweight and obese persons, and restrained eaters (Maurer et al., 2006). The reporting bias was taken into account by adjusting for these variables and the total energy intake in the analyses, but misreporting is a complex problem that is difficult to resolve. Consequently, the possible effects of under- and over-reporting need to be considered when interpreting the results from Studies II and IV. Even though the objective assessment of food intake is possible in experimental studies, a drawback of the experimental design is that food intake is measured only at a given moment and in a context that is not an everyday eating situation. The health effects (including the influences on body weight and body composition) of the food intake depend mainly on longer-term intake, not on momentary food choices. Assessing overeating experimentally may also be problematic because eating behaviour is subject to social norms, overeating often being socially unacceptable behaviour (Bekker, van de Meerendonk, & Mollerus, 2004).

Psychological eating styles (TFEQ-R18), depressive symptoms (CES-D) and self-control (Brief Self-Control Scale) were assessed with pre-existing and pretested questionnaires, but the original 36-item questionnaire measuring food choice motives (FCQ) was shortened to reduce the answering burden of the respondents. As a result, two food choice motives, price and familiarity, were measured only with one item ("Is cheap" and "Is what I usually eat", respectively), which may not capture their nature comprehensively. The associations of familiarity and price were still consistent with those found in previous studies assessing them with more

items, however (Steptoe et al., 1995; Steptoe & Wardle, 1999). Confirmatory and exploratory factor analyses conducted to explore the structure of the shortened FCQ indicated that several motive dimensions of the original FCQ overlapped with each other (i.e. health and weight control; sensory appeal and mood; and ethical concern and natural content), and these dimensions were therefore merged in the analyses of Study IV. On one hand, this was probably partly due to the modifications made to the FCQ, but on the other hand, similar problems concerning the discriminant validity of the scales of the original FCQ have been observed in some previous studies (Eertmans et al., 2006; Fotopoulos et al., 2009).

The size of the associations. Most of the associations observed with respect to habitual dietary intake and obesity were small. An exception is the correlations between overeating tendencies and obesity indicators, which were medium in size according to criteria proposed by Cohen (1988). Nevertheless, it would be unrealistic to expect that psychosocial factors explain a large amount of variation in dietary habits and obesity in an observational study as they are a result of complex processes influenced by various other factors.

Attrition rate. The demanding study protocol, i.e. participation in two separate health examinations, led to a relatively high attrition rate: 10 000 people were initially invited to participate in the FINRISK Study 2007, of whom 6258 took part in the first phase. All these individuals were invited to the second phase, resulting in a final number of 5024 participants. Non-participant analyses conducted in the context of the FINRISK studies conducted in 1972–1992 have shown that non-participants have a lower SEP and have a higher risk of mortality, especially due to violent and alcohol-related deaths (Jousilahti, Salomaa, Kuulasmaa, Niemelä, & Vartiainen, 2005; Harald, Salomaa, Jousilahti, Koskinen, & Vartiainen, 2007). These findings suggest that health status and health behaviours are poorer among non-participants, which could make the estimates for the associations conservative in the current study. Despite the limitations brought by the high attrition rate, a large population-based sample is a strength of the study: many previous studies have been based on more selected and smaller samples, while the present sample allowed the associations of interest to be examined in various subgroups.

7.7 IMPLICATIONS FOR FUTURE RESEARCH

Several suggestions for future research can be drawn on the basis of the present doctoral dissertation. Study I implies that obesity status and dieting history should be taken into account when examining the effects of restrained eating on food intake and body weight changes and the interactions between restrained eating and overeating tendencies in affecting these outcomes. Indeed, a recent prospective study found that among dieters,

restraint attenuated the positive association between disinhibited eating and BMI, whereas among non-dieters restraint exacerbated this relationship (Savage et al., 2009). Moreover, the distinction between rigid and flexible control of eating (distinguishable in the cognitive restraint scale of the original 51-item TFEQ) postulated by Westenhoefer and colleagues (Westenhoefer, 1991; Westenhoefer, Stunkard, & Pudel, 1999) deserves more research attention. Whereas rigid restraint has been linked positively with disturbed eating patterns and obesity, the associations of flexible restraint have been the opposite. It would be interesting to examine whether obesity status and dieting history moderate the associations of these two types of restrained eating in the same way since investigating this aspect was not possible in the current study, in which Karlsson and colleagues' (2000) shortened version of the cognitive restraint scale was used. Overall, to better understand the processes underlying successful cognitive control of food intake, future research on restrained eating should be better integrated with currently active research and theorisation on general self-regulation processes.

An important question for further studies regarding various overeating tendencies is whether some of them are more relevant than others in contributing to weight gain or whether they are intertwined in a way that makes them difficult to separate empirically. Moreover, the construct validity of the emotional eating scales deserves further examination in various study populations, not only among female university students (Evers et al., 2009; Evers et al., 2010; Adriaanse et al., 2011). With respect to the effects of emotions on eating, positive emotions have received relatively little research interest compared to negative ones (Macht, 2008) and deserve more attention.

Study III was unique in exploring the role of emotional eating and physical activity self-efficacy in explaining the positive relationship between depressive symptoms and obesity. Although several psychosocial mechanisms between depression and obesity have been proposed in the literature (see e.g., Faith et al., 2002; Stunkard et al., 2003; Markowitz et al., 2008), the empirical evidence for them is scarce and, thus, future studies should continue to test various mechanisms, especially in prospective settings.

Health-related behaviours often cluster, for instance individuals with healthy dietary habits tend to be more physically active, and therefore the determinants of these behaviours can also be expected to be interrelated (Kremers, 2010). Accordingly, physical activity self-efficacy was negatively related to emotional eating in Study III. Exercise has been proposed to improve appetite regulation physiologically, at least in the short term (Martins, Morgan, & Truby, 2008), which implies that physical activity could be an effective tool influencing emotional eating and other eating styles. In support of this, a recent weight loss intervention study in which the increased flexible cognitive control of eating and a decreased tendency for emotional

eating explained the effects of physical activity on weight loss during a one year follow-up (Andrade et al., 2010). Hence, the interplay between eating styles and physical activity behaviours warrants more research.

Study IV was the first study to analyse food choice motives both on absolute and relative levels. Future studies should continue to investigate whether analysing motives in relative instead of absolute terms better reflects the complexity of the motive structure. With regard to the role of food choice motives in the SEP disparities in diet, an interesting task for future qualitative and quantitative research is to examine the interplay between motives and social and environmental factors in affecting the SEP differences.

8 PRACTICAL IMPLICATIONS AND CONCLUDING REMARKS

The food-rich environment of post-industrialised societies promotes an excessive intake of energy and weight gain and, consequently, has lead to an increased prevalence of chronic diseases such as type 2 diabetes. Policy interventions to change the obesogenic nature of the environment are definitely needed (Swinburn et al., 2011), but major changes to the globalised environment are difficult to implement rapidly. Therefore, knowledge of the factors that hinder or facilitate individuals' ability to cope with the environment is also necessary. Many psychosocial factors that affect food intake are amenable to change and more emphasis should be placed on these factors in weight loss and weight maintenance programmes. Long-term weight loss is extremely difficult (Jeffery et al., 2000) and weight control interventions should be developed and implemented systematically based on scientific evidence and theories to improve their effectiveness and replicability. The practical implications of the present doctoral dissertation are discussed next.

Study I proposes that restrained eating is a successful weight control strategy among obese individuals and those with dieting experiences, while among others it may function as an indicator of problems with eating and an attempt to solve them. Restrictions on dietary intake are often part of weight loss programmes, but it should be acknowledged that successful cognitive control of eating requires the ability to resist the food temptations abundant in the present environment. Although individuals differ in their ability to control their behaviours and impulses, evidence is accumulating that self-control can be strengthen by practising (Bauer & Baumeister, 2011). Nevertheless, numerous experimental studies have also demonstrated that self-control can be depleted temporarily as a result of use (Bauer & Baumeister, 2011) and therefore rigid control characterised by a dichotomous, all-or-nothing approach to eating and dieting is unlikely to be effective. Hence, flexible control, i.e. a more graduated approach to dieting in which energy-dense foods are eaten in limited quantities without feelings of guilt and where eating more on one day is balanced with eating less the next day, is likely to lead to better success in weight management in the long term (Westenhoefer et al., 1999).

Findings from Studies I, II and III imply that a susceptibility to overeating, which may be caused by a number of factors, such as negative emotions, is related to unhealthier dietary habits and a higher risk of obesity. Hence, overeating tendencies are barriers to successful weight control and should be assessed and addressed in dietary counselling in addition to providing information on the nutritional aspects of the diet. Emotional eating can be conceptualised as a dysfunctional emotion regulation strategy, and a

growing number of studies show that people's competencies in emotion regulation can be enhanced through training (Koole, van dillen, & Sheppes, 2011). For example, a recent study observed that a three-week relaxation training was effective in reducing emotional eating episodes and depressive and anxiety symptoms among obese women (Manzoni et al., 2009). As discussed in the previous section, physical activity is also a potentially effective tool influencing emotional eating and other eating styles, since there is evidence that exercise improves appetite regulation at least in the short-term (Martins et al., 2008).

Study III showed that the tendency for emotional eating and low physical activity self-efficacy were one set of mechanisms explaining the associations of depressive symptoms with less healthy food choices and obesity. Thus, especially among individuals with elevated depressive symptoms, weight loss interventions should focus on reducing the susceptibility for emotional eating and enhancing physical activity self-efficacy to promote healthy dietary habits and a physically active lifestyle. It should be pointed out that addressing the suffering caused by depression is important in its own right; however, regular physical exercise may be a useful tool also in this respect, as it has been observed to decrease the symptoms of depression or the likelihood of suffering from them (Teychenne, Ball, & Salmon, 2008).

The well established SEP disparities in dietary habits were replicated in Study IV, and the less healthy dietary intake among individuals with a low SEP was partly explained by the higher priority that they placed on price and familiarity motives and the lower priority that they gave to the health motive in their daily food choices. An effective environmental strategy to improve the diets of low SEP groups could be to reduce the price of healthy foods or increase the cost of less healthy items. A recent study conducted in real-life settings provided evidence that giving price discounts on healthier foods increased their purchasing irrespective of education or income level (Blakely et al., 2011). In Finland, a tax on sweets, ice cream and soft drinks was introduced in the beginning of 2011 leading to increased price for these products. However, the tax has been criticised for excluding other products with a high sugar content, such as biscuits and buns, because the difference in price may lead to an increased preference for these products by consumers and the food industry (Kotakorpi et al., 2011). With respect to familiarity as a motive for food choice, it is well known that mere exposure to a particular food increases the liking for it (Pliner, 1982), so providing regular exposure to various healthy but less familiar foods in workplaces and schools might lead to increased consumption across all SEP groups.

As a concluding remark, it is noted that obesity is not only a medical phenomenon, although its close relations with a number of serious health consequences are well established. Obesity is also socially constructed, and the contemporary body ideal is characterised by slimness and low body weight to an extent that is both unrealistic and unhealthy, although fewer and fewer people fit this ideal in the current obesogenic environment. As a

consequence, weight loss efforts are prevalent also in people of normal weight, especially among female adolescents. Furthermore, the lowered psychosocial functioning related to obesity is at least partly caused by the stigmatisation and discrimination that obese people encounter in societies that value slimness. Thus, weight-based stigmatisation and discrimination should be addressed and reduced, as they threaten psychological and physical health, generate health disparities, and interfere with effective obesity intervention efforts (Puhl & Heuer, 2010). It is acknowledged that the perspective taken on obesity in this dissertation has been influenced by the medical and health promotion perspectives, which are related to stigmatisation processes at the societal level. Nevertheless, the present research set out to increase the understanding of the psychosocial factors related to eating and weight control as knowledge of these factors may help individuals to better cope with the food-rich environment of contemporary societies.

REFERENCES

Abramson, L. Y., Metalsky, G. I., & Alloy, L. B. (1989). Hopelessness depression: A theory-based subtype of depression. *Psychological Review, 96*(2), 358-372.

Adler, N. E., Boyce, W. T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., et al. (1994). Socioeconomic status and health: The challenge of the gradient. *American Psychologist, 41*(1), 15-24.

Adriaanse, M. A., de Ridder, D. T. D., & Evers, C. (2011). Emotional Eating: Eating when emotional or emotional about eating? *Psychology & Health, 26,* 23-39.

Akbaraly, T. N., Brunner, E. J., Ferrie, J. E., Marmot, M. G., Kivimäki, M., & Singh-Manoux, A. (2009). Dietary pattern and depressive symptoms in middle age. *British Journal of Psychiatry, 195*(5), 408-413.

Allgöwer, A., Wardle, J., & Steptoe, A. (2001). Depressive symptoms, social support, and personal health behaviors in young men and women. *Health Psychology, 20*(3), 223-227.

American Psychiatric Association (APA). (2000). *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*. Washington, DC: American Psychiatric Association.

Andrade, A. M., Coutinho, S. R., Silva, M. N., Mata, J., Vieira, P. N., Minderico, C. S., et al. (2010). The effect of physical activity on weight loss is mediated by eating self-regulation. *Patient Education and Counseling, 79*(3), 320-326.

Angle, S., Engblom, J., Eriksson, T., Kautiainen, S., Saha, M. T., Lindfors, P., et al. (2009). Three Factor Eating Questionnaire-R18 as a measure of cognitive restraint, uncontrolled eating and emotional eating in a sample of young Finnish females. *International Journal of Behavioral Nutrition and Physical Activity, 6*, 41.

Anschutz, D. J., van Strien, T., van de Ven, M. O., & Engels, R. C. (2009). Eating styles and energy intake in young women. *Appetite, 53*(1), 119-122.

Atlantis, E., & Baker, M. (2008). Obesity effects on depression: Systematic review of epidemiological studies. *International Journal of Obesity, 32*(6), 881-891.

Azar, D., Ball, K., Salmon, J., & Cleland, V. J. (2010). Physical activity correlates in young women with depressive symptoms: A qualitative study. *International Journal of Behavioral Nutrition and Physical Activity, 7*, 3.

Ball, K., Crawford, D., & Mishra, G. (2006). Socio-economic inequalities in women's fruit and vegetable intakes: A multilevel study of individual, social and environmental mediators. *Public Health Nutrition, 9*(5), 623-630.

Bandura, A. (1997). *Self-Efficacy. The Exercise of Control*. New York: W.H. Freeman and Company.

Barker, M., Lawrence, W. T., Skinner, T. C., Haslam, C. O., Robinson, S. M., Inskip, H. M., et al. (2008). Constraints on food choices of women in the UK with lower educational attainment. *Public Health Nutrition, 11*(12), 1229-1237.

Bauer, I. M., & Baumeister, R. F. (2011). Self-regulatory strength. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of Self-Regulation: Research,*

Theory, and Applications (2nd edition), pp. 64-82. New York, NY: Guilford.

Baumeister, R.F., Heatherton, T.F., & Tice, D.M. (1994). *Losing Control: How and Why People Fail at Self-Regulation.* San Diego, CA: Academic Press.

Baumeister, R. F., Tice, D. L., & Zell, A. L. (2007). How emotions facilitate and impair self-regulation. In Gross, J. J. (Ed.), *Handbook of Emotion Regulation.* New York: Guilford Press.

Baumeister, R. F., Gailliot, M., DeWall, C. N., & Oaten, M. (2006). Self-Regulation and Personality: How interventions increase regulatory success, and how depletion moderates the effects of traits on behavior. *Journal of Personality, 74*(6), 1773–1801.

Beardsworth, A., & Keil, T. (1997). *Sociology on the Menu: An Invitation to the Study of Food and Society.* London: Routledge.

Beaulac, J., Kristjansson, E., & Cummins, S. (2009). A systematic review of food deserts, 1966-2007. *Preventing Chronic Disease, 6*(3), A105.

Beck, A. T. (1967). *Depression: Causes and Treatment.* Philadelphia: University of Pennsylvania Press.

Beck, A. T. (1987). Cognitive models of depression. *Journal of Cognitive Psychotherapy, 1*(1), 5-37.

Beekman, A. T., Deeg, D. J., van Limbeek, J., Braam, A. W., de Vries, M. Z., & van Tilburg, W. (1997). Criterion validity of the Center for Epidemiologic Studies Depression Scale (CES-D): Results from a community-based sample of older subjects in the Netherlands. *Psychological Medicine, 27*(1), 231-235.

Bekker, M. H., van de Meerendonk, C., & Mollerus, J. (2004). Effects of negative mood induction and impulsivity on self-perceived emotional eating. *International Journal of Eating Disorders, 36*(4), 461-469.

Bellisle, F., Clement, K., Le Barzic, M., Le Gall, A., Guy-Grand, B., & Basdevant, A. (2004). The eating inventory and body adiposity from leanness to massive obesity: A study of 2509 adults. *Obesity Research, 12*(12), 2023-2030.

Benton, D. (2002). Carbohydrate ingestion, blood glucose and mood. *Neuroscience and Biobehavioral Reviews, 26*(3), 293-308.

Benton, D., & Donohoe, R. T. (1999). The effects of nutrients on mood. *Public Health Nutrition, 2*(3A), 403-409.

Beydoun, M. A., Kuczmarski, M. T., Mason, M. A., Ling, S. M., Evans, M. K., & Zonderman, A. B. (2009). Role of depressive symptoms in explaining socioeconomic status disparities in dietary quality and central adiposity among US adults: A structural equation modeling approach. *American Journal of Clinical Nutrition, 90*(4), 1084-1095.

Beydoun, M. A., & Wang, Y. (2008). How do socio-economic status, perceived economic barriers and nutritional benefits affect quality of dietary intake among US adults? *European Journal of Clinical Nutrition, 62*(3), 303-313.

Beydoun, M. A., & Wang, Y. (2010). Pathways linking socioeconomic status to obesity through depression and lifestyle factors among young US adults. *Journal of Affective Disorders, 123*, 52-63.

Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition, 19*, 41-62.

Blaine, B. (2008). Does depression cause obesity?: A meta-analysis of longitudinal studies of depression and weight control. *Journal of Health Psychology, 13*(8), 1190-1197.

Blakely, T., Ni Mhurchu, C., Jiang, Y., Matoe, L., Funaki-Tahifote, M., Eyles, H. C., et al. (2011). Do effects of price discounts and nutrition education on food purchases vary by ethnicity, income and education? Results from a randomised, controlled trial. *Journal of Epidemiology and Community Health, 65*(10), 902-908.

Boon, B., Stroebe, W., Schut, H., & Ijntema, R. (2002). Ironic processes in the eating behaviour of restrained eaters. *British Journal of Health Psychology, 7*(Pt 1), 1-10.

Bowman, S. A. (2006). A comparison of the socioeconomic characteristics, dietary practices, and health status of women food shoppers with different food price attitudes. *Nutrition Research, 26*, 318-324.

Bruch, H. (1973). *Eating Disorders*. New York: Basic Books.

Bryant, E. J., King, N. A., & Blundell, J. E. (2008). Disinhibition: Its effects on appetite and weight regulation. *Obesity Reviews, 9*(5), 409-419.

Cappelleri, J. C., Bushmakin, A. G., Gerber, R. A., Leidy, N. K., Sexton, C. C., Lowe, M. R., et al. (2009). Psychometric analysis of the Three-Factor Eating Questionnaire-R21: Results from a large diverse sample of obese and non-obese participants. *International Journal of Obesity, 33*(6), 611-620.

Carmody, T. P., Brunner, R. L., & St Jeor, S. T. (1995). Dietary helplessness and disinhibition in weight cyclers and maintainers. *International Journal of Eating Disorders, 18,* 247-256.

Carver, C. S., & Scheier, M. F. (2011). Self-regulation of action and affect. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of Self-Regulation: Research, Theory, and Applications (2nd Edition),* pp. 3-21. New York, NY: Guilford.

Cattell, R. B. (1966). The scree test for the number of factors. *Multivariate Behavioral Research, 1*, 245-276.

Chaiton, M., Sabiston, C., O'Loughlin, J., McGrath, J. J., Maximova, K., & Lambert, M. (2009). A structural equation model relating adiposity, psychosocial indicators of body image and depressive symptoms among adolescents. *International Journal of Obesity, 33*(5), 588-596.

Chaput, J. P., Leblanc, C., Perusse, L., Despres, J. P., Bouchard, C., & Tremblay, A. (2009). Risk factors for adult overweight and obesity in the Quebec Family Study: Have we been barking up the wrong tree? *Obesity, 17*(10), 1964-1970.

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233-255.

Cohen, J. (1988). *Statistical Power Analysis for the Behavioral Sciences.* Mahwah, NJ: Erlbaum.

Cohen, J. H., Kristal, A. R., Neumark-Sztainaer, D., Rock, C. L., & Neuhouser, M. L. (2002). Psychological distress is associated with unhealthful dietary practices. *Journal of the American Dietetic Association, 102*(5), 699-703.

Connors, M., Bisogni, C. A., Sobal, J., & Devine, C. M. (2001). Managing values in personal food systems. *Appetite, 36*(3), 189-200.

Coyne, J. C. (1994). Self-reported distress: Analog or ersatz depression? *Psychological Bulletin, 116*(1), 29-45.

Craft, L. L., Perna, F. A., Freund, K. M., & Culpepper, L. (2008). Psychosocial correlates of exercise in women with self-reported depressive symptoms. *Journal of Physical Activity & Health, 5*(3), 469-480.

Craig, C. L., Marshall, A. L., Sjostrom, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., et al. (2003). International Physical Activity Questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise, 35*(8), 1381-1395.

Dalle Grave, R., Calugi, S., Corica, F., di Domizio, S., Marchesini, G., & QUOVADIS Study Group (2009). Psychological variables associated with weight loss in obese patients seeking treatment at medical centers. *Journal of American Dietetic Association, 109*(12), 2010–2016.

Darmon, N., & Drewnowski, A. (2008). Does social class predict diet quality? *American Journal of Clinical Nutrition, 87*(5), 1107-1117.

de Lauzon, B., Romon, M., Deschamps, V., Lafay, L., Borys, J. M., Karlsson, J., et al. (2004). The three-factor eating questionnaire-R18 is able to distinguish among different eating patterns in a general population. *The Journal of Nutrition, 134*(9), 2372-2380.

de Lauzon-Guillain, B., Basdevant, A., Romon, M., Karlsson, J., Borys, J. M., Charles, M. A., et al. (2006). Is restrained eating a risk factor for weight gain in a general population? *American Journal of Clinical Nutrition, 83*(1), 132-138.

de Ridder, D., & de Wit, J. (2006). Self-regulation of health behavior: concepts, theories and central issues. In D. de Ridder & J. de Wit (Eds.), Self-Regulation in Health Behavior, pp. 1-23. Chichester, UK: John Wiley & Sons, Ltd.

Dibsdall, L. A., Lambert, N., Bobbin, R. F., & Frewer, L. J. (2003). Low-income consumers' attitudes and behaviour towards access, availability and motivation to eat fruit and vegetables. *Public Health Nutrition, 6*(2), 159-168.

Dong, C., Sanchez, L. E., & Price, R. A. (2004). Relationship of obesity to depression: A family-based study. *International Journal of Obesity, 28*(6), 790-795.

Drewnowski, A. (2010). The cost of US foods as related to their nutritive value. *American Journal of Clinical Nutrition, 92*(5), 1181-1188.

Drewnowski, A., Almiron-Roig, E., Marmonier, C., & Lluch, A. (2004). Dietary energy density and body weight: Is there a relationship? *Nutrition Reviews, 62*(11), 403-413.

Dykes, J., Brunner, E. J., Martikainen, P. T., & Wardle, J. (2004). Socioeconomic gradient in body size and obesity among women: The role of dietary restraint, disinhibition and hunger in the Whitehall II study. *International Journal of Obesity, 28*(2), 262-268.

Eertmans, A., Victoir, A., Notelaers, G., Vansant, G., & van den Bergh, O. (2006). The food choice questionnaire: Factorial invariant over western urban populations? *Food Quality and Preference, 17*, 344-352.

Elfhag, K., & Morey, L. C. (2008). Personality traits and eating behavior in the obese: Poor self-control in emotional and external eating but personality assets in restrained eating. *Eating Behaviors, 9*(3), 285-293.

Elfhag, K., Tholin, S., & Rasmussen, F. (2008). Consumption of fruit, vegetables, sweets and soft drinks are associated with psychological dimensions of eating behaviour in parents and their 12-year-old children. *Public Health Nutrition, 11*(9), 914-923.

Emerging Risk Factors Collaboration, Wormser, D., Kaptoge, S., Di Angelantonio, E., Wood, A. M., Pennells, L., et al. (2011). Separate and

combined associations of body-mass index and abdominal adiposity with cardiovascular disease: Collaborative analysis of 58 prospective studies. *Lancet, 377*(9771), 1085-1095.

Evers, C., de Ridder, D. T., & Adriaanse, M. A. (2009). Assessing yourself as an emotional eater: Mission impossible? *Health Psychology, 28*(6), 717-725.

Evers, C., Stok, F. M., & de Ridder, D. T. (2010). Feeding your feelings: Emotion regulation strategies and emotional eating. *Personality & Social Psychology Bulletin, 36*(6), 792-804.

Faith, M. S., Fontaine, K. R., Baskin, M. L., & Allison, D. B. (2007). Toward the reduction of population obesity: Macrolevel environmental approaches to the problems of food, eating, and obesity. *Psychological Bulletin, 133*(2), 205-226.

Faith, M. S., Matz, P. E., & Jorge, M. A. (2002). Obesity-depression associations in the population. *Journal of Psychosomatic Research, 53*(4), 935-942.

Falk, L. W., Bisogni, C. A., & Sobal, J. (1996). Food choice processes of older adults. *Journal of Nutrition Education, 28,* 257–265.

Fay, S. H., & Finlayson, G. (2011). Negative affect-induced food intake in non-dieting women is reward driven and associated with restrained-disinhibited eating subtype. *Appetite, 56*(3), 682-688.

Flett, G. L., Vredenburg, K., & Krames, L. (1997). The continuity of depression in clinical and nonclinical samples. *Psychological Bulletin, 121*(3), 395-416.

Foster, G. D., Sarwer, D. B., & Wadden, T. A. (1997). Psychological effects of weight cycling in obese persons: A review and research agenda. *Obesity Research, 5*(5), 474-488.

Foster, G. D., Wadden, T. A., Swain, R. M., Stunkard, A. J., Platte, P., & Vogt, R. A. (1998). The eating inventory in obese women: Clinical correlates and relationship to weight loss. *International Journal of Obesity, 22*(8), 778-785.

Fotopoulos, C., Krystallis, A., Vassallo, M., & Pagiaslis, A. (2009). Food Choice Questionnaire (FCQ) revisited. Suggestions for the development of an enhanced general food motivation model. *Appetite, 52*(1), 199-208.

French, S. A., & Jeffery, R. W. (1994). Consequences of dieting to lose weight: Effects on physical and mental health. *Health Psychology, 13*(3), 195-212.

Friedman, K. E., Reichmann, S. K., Costanzo, P. R., & Musante, G. J. (2002). Body image partially mediates the relationship between obesity and psychological distress. *Obesity Research, 10*(1), 33-41.

Furst, T., Connors, M., Bisogni, C. A., Sobal, J., & Falk, L. W. (1996). Food choice: A conceptual model of the process. *Appetite, 26*(3), 247-265.

Ganley, R. M. (1988). Emotional eating and how it relates to dietary restraint, disinhibition, and perceived hunger. *International Journal of Eating Disorders, 7,* 635-647.

Ganley, R. M. (1989). Emotion and eating in obesity: *A review of the literature. International Journal of Eating Disorders, 8,* 343–361.

Gibson, E. L. (2006). Mood, emotions and food choice. In Shepherd R., & Raats M. (Eds.), *The Psychology of Food Choice* (pp. 113-140). Wallingford, UK: CABI.

Giskes, K., Avendano, M., Brug, J., & Kunst, A. E. (2010). A systematic review of studies on socioeconomic inequalities in dietary intakes

associated with weight gain and overweight/obesity conducted among european adults. *Obesity Reviews, 11*(6), 413-429.

Giskes, K., Turrell, G., Patterson, C., & Newman, B. (2002). Socio-economic differences in fruit and vegetable consumption among Australian adolescents and adults. *Public Health Nutrition, 5*(5), 663-669.

Giskes, K., van Lenthe, F. J., Brug, J., Mackenbach, J. P., & Turrell, G. (2007). Socioeconomic inequalities in food purchasing: The contribution of respondent-perceived and actual (objectively measured) price and availability of foods. *Preventive Medicine, 45*(1), 41-48.

Glanz, K., Basil, M., Maibach, E., Goldberg, J., & Snyder, D. (1998). Why Americans eat what they do: Taste, nutrition, cost, convenience, and weight control concerns as influences on food consumption. *Journal of the American Dietetic Association, 98*(10), 1118-1126.

Greeno, C. G., & Wing, R. R. (1994). Stress-induced eating. *Psychological Bulletin, 115*(3), 444-464.

Greeno, C. G., Wing, R. R., & Shiffman, S. (2000). Binge antecedents in obese women with and without binge eating disorder. *Journal of Consulting and Clinical Psychology, 68*(1), 95-102.

Griffiths, L. J., Parsons, T. J., & Hill, A. J. (2010). Self-esteem and quality of life in obese children and adolescents: A systematic review. *International Journal of Pediatric Obesity, 5,* 282-304.

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation. conceptual foundations. In J. J. Gross (Ed.), *Handbook of Emotion Regulation*. New York: Guilford Press.

Grunert, K. G., Baadsggaard, A., Larsen, H. H., & Madsen, T. K. (1996). *Market orientation in food and agriculture*. USA: Kluwer Academic Publishers.

Haslam, N. (2007). The latent structure of mental disorders: A taxometric update on the categorical vs. dimensional debate. *Current psychiatry reviews, 3,* 172-177.

Harald, K., Salomaa, V., Jousilahti, P., Koskinen, S., & Vartiainen, E. (2007). Non-participation and mortality in different socioeconomic groups: The FINRISK population surveys in 1972-92. *Journal of Epidemiology and Community Health, 61*(5), 449-454.

Haukkala, A., & Uutela, A. (2000). Cynical hostility, depression, and obesity: The moderating role of education and gender. *International Journal of Eating Disorders, 27*(1), 106-109.

Haukkala, A., Uutela, A., & Salomaa, V. (2001). Depressive symptoms, cynical hostility, and weight change: A 3-year follow-up among middle-aged men and women. *International Journal of Behavioral Medicine, 8*(2), 116-133.

Hayes, A. F., & Matthes, J. (2009). Computational procedures for probing interactions in OLS and logistic regression: SPSS and SAS implementations. *Behavior Research Methods, 41,* 924-936.

Haynes, C., Lee, M. D., & Yeomans, M. R. (2003). Interactive effects of stress, dietary restraint, and disinhibition on appetite. *Eating Behaviors, 4*(4), 369-383.

Hays, N. P., Bathalon, G. P., McCrory, M. A., Roubenoff, R., Lipman, R., & Roberts, S. B. (2002). Eating behavior correlates of adult weight gain and obesity in healthy women aged 55-65 y. *American Journal of Clinical Nutrition, 75*(3), 476-483.

Hays, N. P., & Roberts, S. B. (2006). The anorexia of aging in humans. *Physiology & Behavior, 88*(3), 257-266.

Heatherton, T. F., & Baumeister, R. F. (1991). Binge eating as escape from self-awareness. *Psychological Bulletin, 110*(1), 86-108.

Heatherton, T. F., Herman, C. P., Polivy, J., King, G. A., & McGree, S. T. (1988). The (mis)measurement of restraint: An analysis of conceptual and psychometric issues. *Journal of Abnormal Psychology, 97*(1), 19-28.

Heaven, P. C., Mulligan, K., Merrilees, R., Woods, T., & Fairooz, Y. (2001). Neuroticism and conscientiousness as predictors of emotional, external, and restrained eating behaviors. *International Journal of Eating Disorders, 30*(2), 161-166.

Heo, M., Pietrobelli, A., Fontaine, K. R., Sirey, J. A., & Faith, M. S. (2006). Depressive mood and obesity in US adults: Comparison and moderation by sex, age, and race. *International Journal of Obesity, 30*(3), 513-519.

Herman, C. P., & Mack, D. (1975). Restrained and unrestrained eating. *Journal of Personality, 43*(4), 647-660.

Herman, C. P., & Polivy, J. (1975). Anxiety, restraint, and eating behavior. *Journal of Abnormal Psychology, 84*(6), 66-72.

Herman, C. P., & Polivy, J. (1984). A boundary model for the regulation of eating. In A. J. Stunkard & E. Stellar (Eds.), *Eating and Its Disorders* (pp. 141–156). New York: Raven Press.

Hill, A. J. (2004). Does dieting make you fat? *British Journal of Nutrition, 92 Suppl 1*, S15-8.

Hu, G., Barengo, N. C., Tuomilehto, J., Lakka, T. A., Nissinen, A., & Jousilahti, P. (2004). Relationship of physical activity and body mass index to the risk of hypertension: A prospective study in Finland. *Hypertension, 43*(1), 25-30.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55.

Hupkens, C. L. H., Knibbe, R. A., & Drop, M. J. (2000). Social class differences in food consumption. The explanatory value of permissiveness and health and cost considerations. *European Journal of Public Health, 10*, 108-113.

Hyland, M.E., Irvine, S. H., Thacker, C., Dann, P. L., & Dennis, I. (1989). Psychometric analysis of the Stunkard-Messick Eating Questionnaire (SMEQ) and comparison with the Dutch Eating Behavior Questionnaire (DEBQ). *Current Psychological Research & Reviews, 8,* 228-233.

Inglis, V., Ball, K., & Crawford, D. (2005). Why do women of low socioeconomic status have poorer dietary behaviours than women of higher socioeconomic status? A qualitative exploration. *Appetite, 45*(3), 334-343.

Inglis, V., Ball, K., & Crawford, D. (2008). Socioeconomic variations in women's diets: What is the role of perceptions of the local food environment? *Journal of Epidemiology & Community Health, 62,* 191-7.

Ingram, R. E., & Siegle, G. J. (2002). Contemporary methodological issues in the study of depression: Not your father's oldsmobile. In I. H. Gotlib, & C. L. Hammen (Eds.), *Handbook of Depression* (pp. 86-114). New York: Guilford Press.

Irala-Estevez, J. D., Groth, M., Johansson, L., Oltersdorf, U., Prattala, R., & Martinez-Gonzalez, M. A. (2000). A systematic review of socio-economic

differences in food habits in Europe: Consumption of fruit and vegetables. *European Journal of Clinical Nutrition, 54*(9), 706-714.

Jansen, A., Havermans, R., Nederkoorn, C., & Roefs, A. (2008). Jolly fat or sad fat? Subtyping non-eating disordered overweight and obesity along an affect dimension. *Appetite, 51*(3), 635-640.

Janssen, I., Katzmarzyk, P. T., & Ross, R. (2004). Waist circumference and not body mass index explains obesity-related health risk. *American Journal of Clinical Nutrition, 79*(3), 379-384.

Jeffery, R. W., Drewnowski, A., Epstein, L. H., Stunkard, A. J., Wilson, G. T., Wing, R. R., Hill, D. R. (2000). Long-term maintenance of weight loss: current status. *Health Psychology, 19*(1 Suppl), 5-16.

Jeffery, R. W., Linde, J. A., Simon, G. E., Ludman, E. J., Rohde, P., Ichikawa, L. E., et al. (2009). Reported food choices in older women in relation to body mass index and depressive symptoms. *Appetite, 52*(1), 238-240.

Johnson, F., Pratt, M., & Wardle, J. (2011). Dietary restraint and self-regulation in eating behaviour. *International Journal of Obesity*, doi: 10.1038/ijo.2011.156. [Epub ahead of print].

Johnson, F., & Wardle, J. (2005). Dietary restraint, body dissatisfaction, and psychological distress: A prospective analysis. *Journal of Abnormal Psychology, 114*(1), 119-125.

Jousilahti, P., Salomaa, V., Kuulasmaa, K., Niemelä, M., & Vartiainen, E. (2005). Total and cause specific mortality among participants and non-participants of population based health surveys: A comprehensive follow up of 54 372 Finnish men and women. *Journal of Epidemiology and Community Health, 59*(4), 310-315.

Kaplan, H. I., & Kaplan, H. S. (1957). The psychosomatic concept of obesity. *The Journal of Nervous and Mental Disease, 125*(2), 181-201.

Karlsson, J., Persson, L. O., Sjöstrom, L., & Sullivan, M. (2000). Psychometric properties and factor structure of the Three-Factor Eating Questionnaire (TFEQ) in obese men and women. Results from the Swedish Obese Subjects (SOS) Study. *International Journal of Obesity, 24*(12), 1715-1725.

Kautiainen, S., Koivisto, A. M., Koivusilta, L., Lintonen, T., Virtanen, S. M., & Rimpela, A. (2009). Sociodemographic factors and a secular trend of adolescent overweight in Finland. *International Journal of Pediatric Obesity, 4*(4), 360-370.

Keski-Rahkonen, A., Bulik, C. M., Neale, B. M., Rose, R. J., Rissanen, A., & Kaprio, J. (2005). Body dissatisfaction and drive for thinness in young adult twins. *International Journal of Eating Disorders, 37*(3), 188-199.

Keskitalo, K., Tuorila, H., Spector, T. D., Cherkas, L. F., Knaapila, A., Kaprio, J., et al. (2008). The Three-Factor Eating Questionnaire, body mass index, and responses to sweet and salty fatty foods: A twin study of genetic and environmental associations. *American Journal of Clinical Nutrition, 88*(2), 263-271.

Keys, A., Brozek, J., Henschel, A., Mickelsen, O., & Taylor, H. L. (1950). *The biology of human starvation (2 vols.)*. Minneapolis: University of Minnesota Press.

Koole, S. L., van Dillen, L. F., & Sheppes, G. (2011). The self-regulation of emotion. In K. D. Vohs & R. F. Baumeister (Eds.), *Handbook of Self-Regulation: Research, Theory, and Applications (2nd Edition),* pp. 22-40. New York, NY: Guilford.

Kotakorpi, K., Härkänen, T., Pietinen, P., Reinivuo, H., Suoniemi, I., & Pirttilä, J. (2011). Terveysperusteisen elintarvikeverotuksen vaikutukset

kansalaisten terveydentilaan ja terveyseroihin (THL Raportti 7/2011). Helsinki: Terveyden ja hyvinvoinnin laitos.

Kremers, S. P. (2010). Theory and practice in the study of influences on energy balance-related behaviors. *Patient Education and Counseling, 79*(3), 291-298.

Krieger, N., Williams, D. R., & Moss, N. E. (1997). Measuring social class in US public health research: Concepts, methodologies, and guidelines. *Annual Review of Public Health, 18***,** 341-78.

Lappalainen, R., Saba, A., Holm, L., Mykkanen, H., Gibney, M. J., & Moles, A. (1997). Difficulties in trying to eat healthier: Descriptive analysis of perceived barriers for healthy eating. *European Journal of Clinical Nutrition, 51 Suppl 2*, S36-40.

Lazarus, R. S. (1993). From psychological stress to the emotions: A history of changing outlooks. *Annual Review of Psychology, 44,* 1-21.

Lawrence, W., & Barker, M. (2009). A review of factors affecting the food choices of disadvantaged women. *Proceedings of the Nutrition Society, 68*(2), 189-194.

Lawson, O. J., Williamson, D. A., Champagne, C. M., DeLany, J. P., Brooks, E. R., Howat, P. M., et al. (1995). The association of body weight, dietary intake, and energy expenditure with dietary restraint and disinhibition. *Obesity Research, 3*(2), 153-161.

Lean, M. E., Han, T. S., & Morrison, C. E. (1995). Waist circumference as a measure for indicating need for weight management. *BMJ (Clinical Research Ed.), 311*(6998), 158-161.

Lennernas, M., Fjellstrom, C., Becker, W., Giachetti, I., Schmitt, A., Remaut de Winter, A., et al. (1997). Influences on food choice perceived to be important by nationally-representative samples of adults in the European Union. European Journal of Clinical Nutrition, 51 Suppl 2, S8-15.

Li, S., Zhao, J. H., Luan, J., Ekelund, U., Luben, R. N., Khaw, K. T., et al. (2010). Physical activity attenuates the genetic predisposition to obesity in 20,000 men and women from EPIC-norfolk prospective population study. *PLoS Medicine, 7*(8), e1000332.

Lindroos, A. K., Lissner, L., Mathiassen, M. E., Karlsson, J., Sullivan, M., Bengtsson, C., et al. (1997). Dietary intake in relation to restrained eating, disinhibition, and hunger in obese and nonobese Swedish women. Obesity Research, 5(3), 175-182.

Lluch, A., Herbeth, B., Mejean, L., & Siest, G. (2000). Dietary intakes, eating style and overweight in the Stanislas Family Study. *International Journal of Obesity, 24*(11), 1493-1499.

Lowe, M. R. (1993). The effects of dieting on eating behavior: A three-factor model. *Psychological Bulletin, 114*(1), 100-121.

Lowe, M. R., & Butryn, M. L. (2007). Hedonic hunger: A new dimension of appetite? *Physiology & Behavior, 91*(4), 432-439.

Lowe, M. R., & Timko, C. A. (2004). Dieting: Really harmful, merely ineffective or actually helpful? *British Journal of Nutrition, 92 Suppl 1*, S19-22.

Luppino, F. S., de Wit, L. M., Bouvy, P. F., Stijnen, T., Cuijpers, P., Penninx, B. W., et al. (2010). Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry, 67*(3), 220-229.

Lyke, J. A., & Spinella, M. (2004). Associations among aspects of impulsivity and eating factors in a nonclinical sample. *International Journal of Eating Disorders, 36*(2), 229-233.

Lynch, J., & Kaplan, G. A. (2000). Socioeconomic position. In Berkman L. F., & Kawachi I. (Eds.), *Social Epidemiology* (pp. 13-35). New York: Oxford University Press.

Macht, M. (2008). How emotions affect eating: A five-way model. *Appetite, 50*(1), 1-11.

Macht, M., & Mueller, J. (2007). Immediate effects of chocolate on experimentally induced mood states. *Appetite, 49*(3), 667-674.

MacKinnon, D.P. (2008). *Introduction to Statistical Mediation Analysis.* Mahwah, NJ: Erlbaum.

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence limits for the indirect effect: Distribution of the product and resampling methods. *Multivariate Behavioral Research, 39*(1), 99.

Manzoni, G. M., Pagnini, F., Gorini, A., Preziosa, A., Castelnuovo, G., Molinari, E., et al. (2009). Can relaxation training reduce emotional eating in women with obesity? An exploratory study with 3 months of follow-up. *Journal of the American Dietetic Association, 109*(8), 1427-1432.

Markowitz, S., Friedman, M. A., & Rutgers, S. M. A. (2008). Understanding the relation between obesity and depression: Causal mechanisms and implications for treatment. *Clinical Psychology: Science and Practice, 15*(1), 1-20.

Martins, C., Morgan, L., & Truby, H. (2008). A review of the effects of exercise on appetite regulation: An obesity perspective. *International Journal of Obesity, 32*(9), 1337-1347.

Maurer, J., Taren, D. L., Teixeira, P. J., Thomson, C. A., Lohman, T. G., Going, S. B., et al. (2006). The psychosocial and behavioral characteristics related to energy misreporting. *Nutrition Reviews, 64*(2 Pt 1), 53-66.

Maxwell, S. E., & Cole, D. A. (2007). Bias in cross-sectional analyses of longitudinal mediation. *Psychological Methods, 12*(1), 23-44.

McElhone, S., Kearney, J. M., Giachetti, I., Zunft, H. J., & Martinez, J. A. (1999). Body image perception in relation to recent weight changes and strategies for weight loss in a nationally representative sample in the European Union. *Public Health Nutrition, 2*(1A), 143-151.

McGuire, M. T., Wing, R. R., Klem, M. L., Lang, W., & Hill, J. O. (1999). What predicts weight regain in a group of successful weight losers? *Journal of Consulting and Clinical Psychology, 67*(2), 177-185.

McLaren, L. (2007). Socioeconomic status and obesity. *Epidemiological Review, 29,* 29-48.

Measelle, J. R., Stice, E., & Hogansen, J. M. (2006). Developmental trajectories of co-occurring depressive, eating, antisocial, and substance abuse problems in female adolescents. *Journal of Abnormal Psychology, 115*(3), 524-538.

Mikolajczyk, R. T., El Ansari, W., & Maxwell, A. E. (2009). Food consumption frequency and perceived stress and depressive symptoms among students in three European countries. *Nutrition Journal, 8*, 31.

Milligan, R. A., Burke, V., Beilin, L. J., Richards, J., Dunbar, D., Spencer, M., et al. (1997). Health-related behaviours and psycho-social characteristics of 18 year-old Australians. *Social Science & Medicine, 45*(10), 1549-1562.

Miura, K., Giskes, K., & Turrell, G. (2011). Socio-economic differences in takeaway food consumption among adults. *Public Health Nutrition, Jul 11*, 1-9 [Epub ahead of print].

Morley, J. E. (2001). Anorexia, body composition, and aging. *Current Opinion in Clinical Nutrition and Metabolic Care, 4,* 9–13.

Muhtz, C., Zyriax, B. C., Klahn, T., Windler, E., & Otte, C. (2009). Depressive symptoms and metabolic risk: Effects of cortisol and gender. *Psychoneuroendocrinology, 34*(7), 1004-1011.

Muraven, M., & Baumeister, R. F. (2000). Self-regulation and depletion of limited resources: Does self-control resemble a muscle? *Psychological Bulletin, 126*(2), 247-259.

Muthen, L. K., & Muthen, B. O. (1998-2009). *Mplus User's Guide. Fifth Edition*. Los Angeles, CA: Muthen & Muthen.

Männistö, S., Virtanen, M., Mikkonen, T., & Pietinen, P. (1996). Reproducibility and validity of a food frequency questionnaire in a case-control study on breast cancer. *Journal of Clinical Epidemiology, 49*(4), 401-409.

Nisbett, R. E. (1972). Hunger, obesity, and the ventromedial hypothalamus. *Psychological Review, 79*(6), 433-453.

O'Connor, D. B., Jones, F., Conner, M., McMillan, B., & Ferguson, E. (2008). Effects of daily hassles and eating style on eating behavior. *Health Psychology, 27,* S20–S31.

Official Statistics of Finland (OSF). (2011). Educational structure of population [e-publication]. Helsinki: Statistics Finland. Retrieved 5.12.2011, from http://www.stat.fi/til/vkour/2010/vkour_2010_2011-12-02_tie_001_en.html

Oliver, G., & Wardle, J. (1999). Perceived effects of stress on food choice. *Physiology & Behavior, 66*(3), 511-515.

Oliver, G., Wardle, J., & Gibson, E. L. (2000). Stress and food choice: A laboratory study. *Psychosomatic Medicine, 62*(6), 853-865.

Organisation for Economic Co-operation and Development (OECD). (1982). *The OECD list of social indicators*. Paris: OECD Social Indicator Development Programme.

Ouwens, M. A. (2005). The disinhibition effect: Tendency toward overeating and not restraint predicts food consumption. Unpublished doctoral dissertation. Radboud University of Nijmegen, Nijmegen, the Netherlands.

Ouwens, M. A., van Strien, T., & van Leeuwe, J. F. (2009). Possible pathways between depression, emotional and external eating. A structural equation model. *Appetite, 53*(2), 245-248.

Paalanen, L., Männistö, S., Virtanen, M. J., Knekt, P., Räsänen, L., Montonen, J., et al. (2006). Validity of a food frequency questionnaire varied by age and body mass index. *Journal of Clinical Epidemiology, 59*(9), 994-1001.

Paturi, M., Tapanainen, H., Reinivuo, H., & Pietinen, P. (2008). Finravinto 2007 -tutkimus – The National FINDIET 2007 Survey. Publications of the National Public Health Institute, B23/2008.

Pereira, M. A., Kartashov, A. I., Ebbeling, C. B., Van Horn, L., Slattery, M. L., Jacobs, D. R.,Jr, et al. (2005). Fast-food habits, weight gain, and insulin resistance (the CARDIA study): 15-year prospective analysis. *Lancet, 365*(9453), 36-42.

Pietinen, P., Paturi, M., Reinivuo, H., Tapanainen, H., & Valsta, L. M. (2010). FINDIET 2007 survey: Energy and nutrient intakes. *Public Health Nutrition, 13*(6A), 920-924.

Piiroinen, S., & Järvelä, K. (2006). Kokemuksella ja tiedolla. Tutkimus kuluttajien ruoan valinnasta. Kuluttajatutkimuskeskuksen julkaisuja, 8/2006.

Pischon, T., Nothlings, U., & Boeing, H. (2008). Obesity and cancer. *Proceedings of the Nutrition Society, 67*(2), 128-145.

Pliner, P. (1982). The effects of mere exposure on liking for edible substances. *Appetite, 3*(3), 283-290.

Polivy, J., & Herman, C. P. (1985). Dieting and binging. A causal analysis. *American Psychologist, 40*(2), 193-201.

Polivy, J., & Herman, C. P. (1999). Distress and eating: Why do dieters overeat? *International Journal of Eating Disorders, 26*(2), 153-164.

Pollard, T. M., Steptoe, A., & Wardle, J. (1998). Motives underlying healthy eating: Using the Food Choice Questionnaire to explain variation in dietary intake. *Journal of Biosocial Science, 30*(2), 165-179.

Prescott, J., Young, O., O'Neill, L., Yau, N. J. N., & Stevens, R. (2002). Motives for food choice: A comparison of consumers from Japan, Taiwan, Malaysia and New Zealand. *Food Quality and Preference*, 13, 489–495.

Provencher, V., Begin, C., Gagnon-Girouard, M. P., Tremblay, A., Boivin, S., & Lemieux, S. (2008). Personality traits in overweight and obese women: Associations with BMI and eating behaviors. *Eating Behaviors, 9*(3), 294-302.

Provencher, V., Drapeau, V., Tremblay, A., Despres, J. P., Bouchard, C., Lemieux, S., et al. (2004). Eating behaviours, dietary profile and body composition according to dieting history in men and women of the Quebec Family Study. *British Journal of Nutrition, 91*(6), 997-1004.

Provencher, V., Drapeau, V., Tremblay, A., Despres, J. P., & Lemieux, S. (2003). Eating behaviors and indexes of body composition in men and women from the Quebec Family Study. *Obesity Research, 11*(6), 783-792.

Puhl, R. M., & Heuer, C. A. (2009). The stigma of obesity: A review and update. *Obesity, 17*(5), 941-964.

Puhl, R. M., & Heuer, C. A. (2010). Obesity stigma: Important considerations for public health. *American Journal of Public Health, 100*(6), 1019-1028.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement, 1*, 385-401.

Reinivuo, H., Hirvonen, T., Ovaskainen, M. L., Korhonen, T., & Valsta, L. M. (2010). Dietary survey methodology of FINDIET 2007 with a risk assessment perspective. *Public Health Nutrition, 13*(6A), 915-919.

Rissanen, A., Heliovaara, M., Knekt, P., Reunanen, A., Aromaa, A., & Maatela, J. (1990). Risk of disability and mortality due to overweight in a Finnish population. *BMJ, 301*(6756), 835-837.

Roininen, K., Tuorila, H., Zandstra, E. H., de Graaf, C., Vehkalahti, K., Stubenitsky, K., et al. (2001). Differences in health and taste attitudes and reported behaviour among Finnish, Dutch and British consumers: A cross-national validation of the health and taste attitude scales (HTAS). *Appetite, 37*(1), 33-45.

Rolls, B J., Fedoroff, I., & Guthrie, J. F. (1991). Gender differences in eating behavior and body weight regulation. *Health Psychology, 10*(2),133-142.

Rooke, S. E., & Thorsteinsson, E. B. (2008). Examining the temporal relationship between depression and obesity: Meta-analyses of prospective research. *Health Psychology Review, 2*(1), 94-109.

Roos, E., Talala, K., Laaksonen, M., Helakorpi, S., Rahkonen, O., Uutela, A., et al. (2008). Trends of socioeconomic differences in daily vegetable consumption, 1979-2002. *European Journal of Clinical Nutrition, 62*(7), 823-833.

Roshanaei-Moghaddam, B., Katon, W. J., & Russo, J. (2009). The longitudinal effects of depression on physical activity. *General Hospital Psychiatry, 31*(4), 306-315.

Ross, C. E. (1994). Overweight and depression. *Journal of Health and Social Behavior, 35*(1), 63-79.

Rozin, P. (2006). The integration of biological, social, cultural and psychological influences on food choice. In Shepherd R., & Raats M. (Eds.), *The Psychology of Food Choice* (pp. 19-40). Wallingford, UK: CABI.

Sarlio-Lähteenkorva, S., Lahelma, E., & Roos, E. (2004). Mental health and food habits among employed women and men. *Appetite, 42*(2), 151-156.

Savage, J. S., Hoffman, L., & Birch, L. L. (2009). Dieting, restraint, and disinhibition predict women's weight change over 6 y. *American Journal of Clinical Nutrition, 90*(1), 33-40.

Schachter, S., & Rodin, J. (1974). *Obese Humans and Rats*. Potomac, MD: Erlbaum.

Scheibehenne, B., Miesler, L., & Todd, P. M. (2007). Fast and frugal food choices: Uncovering individual decision heuristics. *Appetite, 49*(3), 578-589.

Schousboe, K., Willemsen, G., Kyvik, K. O., Mortensen, J., Boomsma, D. I., Cornes, B. K., et al. (2003). Sex differences in heritability of BMI: A comparative study of results from twin studies in eight countries. *Twin Research, 6*(5), 409-421.

Schwartz, S. H. (1992). Universals in the content and structure of values: Theoretical advances and empirical tests in 20 countries. In M. Zanna (Ed.), *Advances in Experimental Social Psychology* (Vol. 25 ed., pp. 1-65). New York: Academic Press.

Schwartz, S. H., & Rubel, T. (2005). Sex differences in value priorities: Cross-cultural and multimethod studies. *Journal of Personality and Social Psychology, 89*(6), 1010-1028.

Schwarzer, R., & Renner, B. (2000). Social-cognitive predictors of health behavior: Action self-efficacy and coping self-efficacy. *Health Psychology, 19*(5), 487-495.

Scott, K. M., McGee, M. A., Wells, J. E., & Oakley Browne, M. A. (2008). Obesity and mental disorders in the adult general population. *Journal of Psychosomatic Research, 64*(1), 97-105.

Serdula, M. K., Mokdad, A. H., Williamson, D. F., Galuska, D. A., Mendlein, J. M., & Heath, G. W. (1999). Prevalence of attempting weight loss and strategies for controlling weight. *JAMA, 282*(14), 1353-1358.

Shafer, A. B. (2006). Meta-analysis of the factor structures of four depression questionnaires: Beck, CES-D, Hamilton, and Zung. *Journal of Clinical Psychology, 62*(1), 123-146.

Shepherd, R. (1985). Dietary salt intake. *Nutrition & Food Science, 96*, 10–11.

Shepherd, R. (1989). Factors influencing food preferences and choice. In R. Shepherd (Ed.), *Handbook of the Psychobiology of Human Eating (*pp. 3–24). Chichester, UK: John Wiley & Sons, Ltd.

Simon, G. E., Ludman, E. J., Linde, J. A., Operskalski, B. H., Ichikawa, L., Rohde, P., et al. (2008). Association between obesity and depression in middle-aged women. *General Hospital Psychiatry, 30*(1), 32-39.

Sobal, J., & Bisogni, C. A. (2009). Constructing food choice decisions. *Annals of Behavioral Medicine, 38 Suppl 1*, S37-46.

Sobal, J., Bisogni, C. A., Devine, C. M., & Jastran, M. (2006). A conceptual model of the food choice process over the life course. In R. Shepherd, & M. Raats (Eds.), *The Psychology of Food Choice* (pp. 1-18). Oxsfordshire: CABI.

Solomon, A., Haaga, D. A., & Arnow, B. A. (2001). Is clinical depression distinct from subthreshold depressive symptoms? A review of the continuity issue in depression research. *The Journal of Nervous and Mental Disease, 189*(8), 498-506.

Steptoe, A., Pollard, T. M., & Wardle, J. (1995). Development of a measure of the motives underlying the selection of food: The Food Choice Questionnaire. *Appetite, 25*(3), 267-284.

Steptoe, A., & Wardle, J. (1999). Motivational factors as mediators of socioeconomic variations in dietary intake patterns. *Psychology & Health, 14*, 391-402.

Stice, E., Cooper, J. A., Schoeller, D. A., Tappe, K., & Lowe, M. R. (2007). Are dietary restraint scales valid measures of moderate- to long-term dietary restriction? Objective biological and behavioral data suggest not. *Psychological Assessment, 19*(4), 449-458.

Stice, E., Fisher, M., & Lowe, M. R. (2004). Are dietary restraint scales valid measures of acute dietary restriction? Unobtrusive observational data suggest not. *Psychological Assessment, 16*(1), 51-59.

Stice, E., Presnell, K., Shaw, H., & Rohde, P. (2005). Psychological and behavioral risk factors for obesity onset in adolescent girls: A prospective study. *Journal of Consulting and Clinical Psychology, 73*(2), 195-202.

Stice, E., Presnell, K., & Spangler, D. (2002). Risk factors for binge eating onset in adolescent girls: A 2-year prospective investigation. *Health Psychology, 21*(2), 131-138.

Stice, E., Sysko, R., Roberto, C. A., & Allison, S. (2010). Are dietary restraint scales valid measures of dietary restriction? Additional objective behavioral and biological data suggest not. *Appetite, 54*(2), 331-339.

Stroebe, W. (2008). *Dieting, Overweight, and Obesity: Self-Regulation in a Food-Rich Environment.* Washington, DC: American Psychological Association.

Stunkard, A. J., Faith, M. S., & Allison, K. C. (2003). Depression and obesity. *Biological Psychiatry, 54*(3), 330-337.

Stunkard, A. J., & Messick, S. (1985). The Three-Factor Eating Questionnaire to measure dietary restraint, disinhibition and hunger. *Journal of Psychosomatic Research, 29*(1), 71-83.

Swinburn, B. A., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L., et al. (2011). The global obesity pandemic: Shaped by global drivers and local environments. *Lancet, 378*(9793), 804-814.

Tangney, J. P., Baumeister, R. F., & Boone, A. L. (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality, 72*(2), 271-324.

Tanskanen, A., Hibbeln, J. R., Tuomilehto, J., Uutela, A., Haukkala, A., Viinamaki, H., et al. (2001). Fish consumption and depressive symptoms in the general population in Finland. *Psychiatric Services, 52*(4), 529-531.

Teixeira, P. J., Going, S. B., Sardinha, L. B., & Lohman, T. G. (2005). A review of psychosocial pre-treatment predictors of weight control. *Obesity Reviews, 6*(1), 43-65.

Tennen, H., Hall, J. A., & Affleck, G. (1995). Depression research methodologies in the journal of personality and social psychology: A review and critique. *Journal of Personality and Social Psychology, 68*(5), 870-84.

Teychenne, M., Ball, K., & Salmon, J. (2008). Physical activity and likelihood of depression in adults: A review. *Preventive Medicine, 46*(5), 397-411.

Thornton, L. E., Bentley, R. J., & Kavanagh, A. M. (2011). Individual and area-level socioeconomic associations with fast food purchasing. *Journal of Epidemiology and Community Health, 65*(10), 873-880.

Treasure, J., Claudino, A. M., & Zucker, N. (2010). Eating disorders. *Lancet, 375*(9714), 583-593.

Trost, S. G., Owen, N., Bauman, A. E., Sallis, J. F., & Brown, W. (2002). Correlates of adults' participation in physical activity: Review and update. *Medicine and Science in Sports and Exercise, 34*(12), 1996-2001.

van den Bree, M. B., Przybeck, T. R., & Cloninger, C. R. (2006). Diet and personality: Associations in a population-based sample. *Appetite, 46*(2), 177-188.

van Strien, T. (1999). Success and failure in the measurement of restraint: Notes and data. *International Journal of Eating Disorders, 25*(4), 441-449.

van Strien, T., Cleven, A., & Schippers, G. (2000). Restraint, tendency toward overeating and ice cream consumption. *International Journal of Eating Disorders, 28*(3), 333-338.

van Strien, T., Engels, R. C., van Staveren, W., & Herman, C. P. (2006). The validity of dietary restraint scales: Comment on Stice et al. (2004). *Psychological Assessment, 18*(1), 89-94.

van Strien, T., Frijters, J. E., Bergers, G. P., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders, 5*(2), 295-315.

van Strien, T., Herman, C. P., & Verheijden, M. W. (2009). Eating style, overeating, and overweight in a representative Dutch sample. Does external eating play a role? *Appetite, 52*(2), 380-387.

Vartiainen, E., Laatikainen, T., Peltonen, M., Juolevi, A., Männistö, S., Sundvall, J., et al. (2010). Thirty-five-year trends in cardiovascular risk factors in Finland. *International Journal of Epidemiology, 39*(2), 504-518.

Vazquez, G., Duval, S., Jacobs, D. R.,,Jr, & Silventoinen, K. (2007). Comparison of body mass index, waist circumference, and waist/hip ratio in predicting incident diabetes: A meta-analysis. *Epidemiologic Reviews, 29*, 115-128.

Verkasalo, M., Tuomivaara, P., & Lindeman, M. (1996). 15-year-old pupils' and their teachers' values, and their beliefs about the values of an ideal pupil. *Educational Psychology, 16*, 35-47.

Vogelzangs, N., Suthers, K., Ferrucci, L., Simonsick, E. M., Ble, A., Schrager, M., et al. (2007). Hypercortisolemic depression is associated with the

metabolic syndrome in late-life. *Psychoneuroendocrinology, 32*(2), 151-159.

Wansink, B., & Sobal, J. (2007). Mindless eating: The 200 daily food decisions we overlook. *Environment and Behavior*, *39*(1), 106–123.

Wansink, B., Cheney, M. M., & Chan, N. (2003). Exploring comfort food preferences across age and gender. *Physiology & Behavior, 79*(4-5), 739-747.

Wardle, J. (1986). The assessment of restrained eating. *Behaviour Research and Therapy, 24*(2), 213-215.

Wardle, J., & Carnell, S. (2009). Appetite is a heritable phenotype associated with adiposity. *Annals of Behavioral Medicine, Sep 3* [Epub ahead of print].

Wardle, J., Haase, A. M., Steptoe, A., Nillapun, M., Jonwutiwes, K., & Bellisle, F. (2004). Gender differences in food choice: The contribution of health beliefs and dieting. *Annals of Behavioral Medicine, 27*(2), 107-116.

Wardle, J., & Johnson, F. (2002). Weight and dieting: Examining levels of weight concern in British adults. *International Journal of Obesity, 26*(8), 1144-1149.

Waterlander, W. E., de Mul, A., Schuit, A. J., Seidell, J. C., & Steenhuis, I. H. (2010). Perceptions on the use of pricing strategies to stimulate healthy eating among residents of deprived neighbourhoods: A focus group study. *International Journal of Behavioral Nutrition and Physical Activity, 7*, 44.

Wenzlaff, R. M., Wegner, D. M., & Roper, D. W. (1988). Depression and mental control: The resurgence of unwanted negative thoughts. *Journal of Personality and Social Psychology, 55*(6), 882-892.

Westenhoefer, J. (1991). Dietary restraint and disinhibition: Is restraint a homogeneous construct. *Appetite, 16,* 45-55.

Westenhoefer, J. (2005). Age and gender dependent profile of food choice. *Forum of Nutrition, 57,* 44-51.

Westenhoefer, J., Broeckmann, P., Munch, A. K., & Pudel, V. (1994). Cognitive control of eating behaviour and the disinhibition effect. *Appetite, 23*(1), 27-41.

Westenhoefer, J., Stunkard, A. J., & Pudel, V. (1999). Validation of the flexible and rigid control dimensions of dietary restraint. *International Journal of Eating Disorders, 26*(1), 53-64.

Williamson, D. A., Lawson, O. J., Brooks, E. R., Wozniak, P. J., Ryan, D. H., Bray, G. A., et al. (1995). Association of body mass with dietary restraint and disinhibition. *Appetite, 25*(1), 31-41.

Wing, R. R., & Hill, J. O. (2001). Successful weight loss maintenance. *Annual Review of Nutrition, 21,* 323-341.

World Health Organization (WHO). (2004). *Obesity: Preventing and managing the global epidemic.* Report of a WHO Consultation (WHO Technical Report Series 894). Geneva: World Health Organization.

Wurtman, R. J., & Wurtman, J. J. (1989). Carbohydrates and depression. *Scientific American, 260*(1), 68-75.

Yen, I. H., & Moss, N. (1999). Unbundling education: A critical discussion of what education confers and how it lowers risk for disease and death. *Annals of the New York Academy of Sciences, 896*, 350-351.

Yeomans, M. R., Leitch, M., & Mobini, S. (2008). Impulsivity is associated with the disinhibition but not restraint factor from the Three Factor Eating Questionnaire. *Appetite, 50*(2-3), 469-476.

APPENDIXES

Appendix 1. *The four-factor structure of the shortened Food Choice Questionnaire[1].*

	Health	Convenience	Pleasure	Ethicality
1. Is low in fat[2]	**0.81**		-0.10	
2. Helps me control my weight[2]	**0.78**			
3. Is low in calories[2]	**0.76**			
4. Is high in fiber and roughage[3]	**0.66**			0.16
5. Keeps me healthy[3]	**0.49**		0.12	0.15
6. Contains a lot of vitamins and minerals[3]	**0.46**		0.11	0.31
7. Keeps me awake/alert[4]	**0.43**		0.31	
8. Is good for my skin/teeth/hair/nails etc.[3]	**0.43**		0.19	0.23
9. Is high in protein[3]	0.30		0.15	0.21
10. Takes no time to prepare[5]		**0.92**		-0.14
11. Is easy to prepare[5]		**0.80**	-0.11	-0.16
12. Can be bought in shops close to where I live or work[5]		**0.38**		0.14
13. Is cheap[6]		0.30		
14. Is what I usually eat[10]		0.20		0.20
15. Smells nice[7]			**0.86**	
16. Makes me feel good[4]			**0.74**	
17. Looks nice[7]			**0.61**	
18. Tastes good[7]			**0.57**	-0.12
19. Helps me cope with stress[4]			**0.52**	
20. Is organically grown				**0.74**
21. Is packaged in an environmentally friendly way[8]				**0.74**
22. Carries the Fairtrade mark				**0.69**
23. Comes from countries I approve of politically[8]				**0.68**
24. Contains no artificial ingredients[9]	0.16	-0.10		**0.65**
25. Contains no additives[9]	0.25			**0.52**
26. Is domestically produced	0.10			**0.50**
Cronbach's alphas	0.87	0.67	0.79	0.86

[1] Factor loadings with absolute values ≥ 0.10 are shown, and items with loadings > 0.35 are considered to belong to the respective factor. [2] Item is part of the weight control factor of the original Food Choice Questionnaire (Steptoe et al., 1995). [3] Item is part of the health factor. [4] Item is part of the mood factor. [5] Item is part of the convenience factor. [6] Item is part of the price factor. [7] Item is part of the sensory appeal factor. [8] Item is part of the ethical concern factor. [9] Item is part of the natural content factor. [10] Item is part of the familiarity factor.

Appendix 2. *Descriptive characteristics of the study sample.*

	Men	Women
	Mean (SD)	Mean (SD)
Sociodemographic factors		
Age (years)	53.5 (13.3)[a]	52.1 (13.6)
Education (years)	12.2 (4.0)[a]	12.9 (4.0)
Household income (€)	25543.0 (14161.7)[a]	24060.0 (13413.3)
Married (%)	75.9[a]	69.6
Children in the household (%)	24.0[a]	27.0
Obesity indicators		
Body mass index (kg/m²)	27.2 (4.2)[a]	26.9 (5.3)
Obesity (body mass index ≥ 30.0) (%)	19.7[a]	23.4
Waist circumference (cm)	96.7 (12.0)[a]	87.1 (13.4)
Central obesity (%)[1]	29.0[a]	41.7
Body fat percentage	24.9 (6.7)[a]	35.6 (7.4)
Dieting status and history		
Current dieters (%)	21.6[a]	34.5
Past dieters (%)	17.7[a]	25.0
Never dieters (%)	60.7[a]	40.5
Food variables[1]		
Sweet energy-dense foods (freq./week)	1.3 (1.3)	1.2 (1.0)
Non-sweet energy-dense foods (freq./week)	0.7 (0.5)[a]	0.5 (0.4)
Vegetables/fruit (freq./week)	2.1 (1.4)[a]	3.0 (1.8)
Energy intake (KJ/day)	11573.3 (3825.3)[a]	9305.6 (3038.5)
General psychosocial factors		
Depressive symptoms	9.7 (7.2)[a]	10.6 (7.7)
Self-control	3.4 (0.5)	3.4 (0.5)
Psychological eating styles		
Restrained eating	44.3 (16.6)[a]	50.6 (16.5)
Uncontrolled eating	28.4 (17.0)[a]	31.3 (18.1)
Emotional eating	22.8 (21.1)[a]	36.9 (25.9)
Absolute food choice motives[2]		
Health	2.82 (0.51)[a]	3.10 (0.48)
Pleasure	2.83 (0.51)[a]	3.03 (0.52)
Ethicality	2.36 (0.55)[a]	2.52 (0.57)
Convenience	2.62 (0.59)[a]	2.81 (0.59)
Familiarity	2.34 (0.68)[a]	2.26 (0.75)
Price	2.63 (0.71)[a]	2.79 (0.70)
Relative food choice motives[2]		
Health	1.06 (0.12)[a]	1.09 (0.11)
Pleasure	1.08 (0.17)	1.07 (0.16)
Ethicality	0.89 (0.14)	0.88 (0.14)
Convenience	1.00 (0.24)	1.00 (0.22)
Familiarity	0.89 (0.26)[a]	0.80 (0.25)
Price	1.00 (0.27)	0.99 (0.25)

[1] Waist circumference ≥ 102 cm for men and ≥ 88 cm for women.
[2] The values are for participants aged 25–64.
[a] Significant ($p<0.05$) difference between genders (analysis of variance or chi-square test).