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# Parent-child feeding dynamics and childhood obesity

*The importance of foreign background and effects  
of early obesity treatment*

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### **Abstract**

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Childhood obesity is often characterised as a global epidemic. Yet, little progress has been made in addressing its increasing levels, especially among certain populations. The present thesis includes five studies and offers an examination of parenting practices and child behaviours, in relation to foreign background in Sweden and in the context of obesity treatment among pre-schoolers. In Studies I and II, parental feeding practices and perceived child eating behaviours, respectively, were compared between Swedish-born mothers and mothers of foreign background. Data were merged from a population-based sample in Malmö and two samples (school and clinical) in Stockholm. Studies III through V offer an evaluation of secondary outcomes (parenting practices and child behaviours) of the More and Less study (ML study), a randomised controlled trial for obesity treatment in Sweden. The ML study includes two treatment approaches, namely a parent support programme (enhancing evidence-based parenting practices)–with and without boosters–and standard treatment (focusing on lifestyle modifications).

Compared to Swedish-born mothers, mothers with a foreign background exerted higher levels of unfavourable and controlling feeding practices by restricting access to and intake of energy-dense foods and pressuring their children to eat. Accordingly, mothers with a foreign background perceived their children to overeat in response to external cues (whether food or emotion related), but also to eat according to their internal cues for satiety and hunger to a larger degree than Swedish-born mothers. Maternal concerns about child weight status influenced the observed associations. In the context of early obesity treatment, controlling feeding practices of both mothers and fathers overall remained stable, while the parent support programme particularly affected fathers' evidence-based parenting practices when compared to standard treatment. While child food intake did not change during treatment, children showed a trend for decreasing certain behaviours, which relate to excess eating.

In conclusion, the thesis highlights the importance of foreign background in obesity-related parenting practices and child behaviours, and also provides insights into some of the mechanisms that may be at play to facilitate reductions in child weight status.

*Keywords:* childhood obesity, parenting practices, feeding practices, child eating behaviours, food intake, obesity treatment, foreign background

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To my parents,  
*Theonymfi and Vasilis*



# List of Studies

This thesis is based on the following studies, which are referred to in the text by their Roman numerals.

- I Somaraki M, Eli K, Ek A, Lindberg L, Nyman J, Marcus C, Flodmark C-E, Pietrobelli A, Faith MS, Sorjonen K, Nowicka P. Controlling feeding practices and maternal migrant background: an analysis of a multicultural sample. *Public Health Nutrition*. 2017; 20(5):848-858
- II Somaraki M, Eli K, Sorjonen K, Flodmark C-E, Marcus C, Faith MS, Persson Osowski C, Ek A, Nowicka P. Perceived child eating behaviours and maternal migrant background. *Appetite*. 2018;125:302-313
- III Somaraki M, Eli K, Sorjonen K, Ek A, Sandvik P, Nowicka P. Changes in parental feeding practices and preschoolers' food intake following a randomized controlled childhood obesity trial [published online ahead of print, 2020 May 21]. *Appetite*. 2020;154:104746
- IV Somaraki M, Ek A, Eli K, Ljung S, Mildton V, Sandvik P, Nowicka P. Parenting and childhood obesity: Validation of a new questionnaire and evaluation of treatment effects during the pre-school years. *Submitted to PLoS One*
- V Somaraki M, Ek A, Sandvik P, Byrne R, Nowicka P. How do young children eat after an obesity intervention? Validation of the Child Eating Behaviour Questionnaire using the Rasch Model in diverse samples from Australia and Sweden. *Manuscript*

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## Relevant Studies

- I Sandvik P, Ek A, Somaraki M, Hammar U, Eli K, Nowicka P. Picky eating in Swedish preschoolers of different weight status: application of two new screening cut-offs. *International Journal of Behavioral Nutrition and Physical Activity*. 2018;15(1):74
- II Eiffener E, Eli K, Ek A, Sandvik P, Somaraki M, Kremers S, Sleddens E, Nowicka P. The influence of preschoolers' emotional and behavioural problems on obesity treatment outcomes: Secondary findings from a randomized controlled trial. *Pediatric Obesity*. 2019;14(11):e12556
- III Ek A, Lewis Chamberlain K, Sorjonen K, Hammar U, Etminan Malek M, Sandvik P, Somaraki M, Nyman J, Lindberg L, Nordin K, Ejderhamn J, Fisher PA, Chamberlain P, Marcus C, Nowicka P. A Parent Treatment Program for Preschoolers With Obesity: A Randomized Controlled Trial. *Pediatrics*. 2019; 144(2):e20183457
- IV Sandvik P, Ek A, Eli K, Somaraki M, Bottai M, Nowicka P. Picky eating in an obesity intervention for preschool-aged children - what role does it play, and does the measurement instrument matter? *International Journal of Behavioral Nutrition and Physical Activity*. 2019;16(1):76

# Contributions

The contributions of Maria Somaraki to the studies included in the thesis are as follows:

Study I: Contributed to planning the study. Participated in data entry, retrieved and processed questionnaire data. Conducted the statistical analyses under supervision of the co-authors. Drafted and revised the manuscript in collaboration with co-authors.

Study II: Planned the study in collaboration with co-authors. Participated in data entry, retrieved and processed questionnaire data. Conducted the statistical analyses under supervision of the co-authors. Drafted and revised the manuscript in collaboration with co-authors.

Study III: Planned the study in collaboration with co-authors. Participated in data entry. Conducted the statistical analyses under supervision of the co-authors. Main responsibility for writing and revising the manuscript, in collaboration with co-authors.

Study IV: Planned the study in collaboration with co-authors. Participated in data entry, retrieved and processed questionnaire data. Main responsibility for the statistical analyses. Main responsibility for writing and revising the manuscript, in collaboration with co-authors.

Study IV: Planned the study in collaboration with co-authors. Participated in data entry, retrieved and processed questionnaire data. Main responsibility for the statistical analyses. Main responsibility for writing and revising the manuscript, in collaboration with co-authors.



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# Abbreviations

RCT	Randomised Controlled Trial
ML study	More and Less study
CFQ	Child Feeding Questionnaire
CEBQ	Child Eating Behaviour Questionnaire
FFQ	Food Frequency Questionnaire
EDNP foods	Energy-Dense Nutrient-Poor foods
ECoP questionnaire	Emotions and Communication in Parenting Questionnaire



# Introduction

Parents and children develop a special relationship, which defines several aspects of child development. Against this backdrop, research on childhood obesity, characterised as a global epidemic, will benefit by an understanding of the feeding dynamics between parents and their children. In particular, dynamics, which pertain to the way in which parents feed their children and help them to develop their likings for foods, are important in obesity prevention and management. Having a background in nutrition, dietetics and public health, I embarked on this PhD journey aiming to understand these feeding dynamics. Although I have no children myself, I was parented. Hence, it has been fascinating to unravel patterns of behaviours from my own childhood, but also understand the ways in which our most immediate environment –our families– shape our relationship with food.

Understanding the parent-child feeding dynamic represents an integrative and accurate approach to studying obesity from an early age. Family is the unit of study, and, on top of the nutrient content of the food, context becomes important. In other words, the family context wherein we are raised provides the conditions under which our parents offer foods and in which we accept, try, or reject the foods. The processes that define the parent-child feeding dynamic and implicate parenting practices and child behaviours, can be assessed through psychometric tools. These tools quantify parenting practices and child behaviours and describe them in a way that informs public health interventions and their evaluation. In the present thesis, I had the opportunity to use several of those tools, which were developed by influential researchers in the field of childhood obesity (Birch et al., 2001; Wardle et al., 2001), in order to describe aspects of parenting and behaviours relating to child food intake and excess weight gain.

The present thesis focuses on the parenting practices and child behaviours, which shape the parent-child feeding dynamics. These concepts are examined in relation to foreign background and in the context of obesity treatment.

# Childhood obesity

## Criteria and prevalence

Obesity is defined as an excess accumulation of fat in the human body by the World Health Organization (WHO, 2020). Body Mass Index (BMI) [ $\text{BMI} = \text{weight} / (\text{height})^2$ ] is the most widely used criterion to measure weight status and define overweight and obesity (WHO, 2000). Children grow constantly; thus, their BMI is adjusted for age and sex (e.g. standard deviation scores), according to reference data (Cole, Bellizzi, Flegal, & Dietz, 2000; Cole, Flegal, Nicholls, & Jackson, 2007; Cole & Lobstein, 2012). In the past four decades, there has been an upward trend in the prevalence of childhood obesity (NCD Risk Factor Collaboration, 2017). In 2015, the global prevalence was 5%, and 107.7 million children between the ages 2 and 19-years-old were estimated to have obesity worldwide (GBD 2015 Obesity Collaborators, 2017). In addition, 38 million children under five years old had overweight or obesity in 2019 (United Nations Children's Fund (UNICEF), the World Health Organization, and the International Bank for Reconstruction and Development/The World Bank, 2020). In Sweden, the prevalence of obesity among children at 6-years-old is 5%, while it is twice as much among children who are 9-years-old (Public Health Agency of Sweden, 2020a). According to recent estimates, the obesity prevalence among school-aged children in Sweden has increased five times over the past three decades, with the steepest increase observed in the last 10 years (Public Health Agency of Sweden, 2020b).

## Health implications—Physical and psychosocial

Childhood obesity once established, does track into adolescence and adulthood (Aarestrup et al., 2016; Buscot et al., 2018; Simmonds, Llewellyn, Owen, & Woolacott, 2016), and increases adult morbidity and mortality (Bjerrgaard et al., 2018; GBD 2015 Obesity Collaborators, 2017; Global BMI Mortality Collaboration, 2016; Juonala et al., 2011). Moreover, children with obesity have higher cardiometabolic risk, risk for liver disease and musculoskeletal pain (Sanders, Han, Baker, & Coble, 2015; Skinner, Perrin, Moss, & Skelton, 2015). In addition to the impact on physical health, childhood obesity has a number of psychosocial consequences. Among those are poor quality of

life, low self-esteem, decreased social functioning, weight stigmatisation, bullying, and low educational level in adulthood (Hagman et al., 2017; Pont, Puhl, Cook, & Slusser, 2017; Rupp & McCoy, 2019; Williams, Wake, Hesketh, Maher, & Waters, 2005).

## What causes obesity among children?

Obesity is a chronic multifaceted condition, which stems from energy imbalance, i.e. excess energy intake in relation to one's needs (Bray, Kim, & Wilding, 2017). However, obesity is not a simple function of energy intake and energy expenditure, since genetic susceptibility plays a clear role in obesity variability (Min, Chiu, & Wang, 2013; Stunkard et al., 1986; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997). Specifically, interrelationships between parents and their children may affect the child's obesity status to varying degrees (Connell & Francis, 2014; Schrempft et al., 2018; Wardle et al., 2008). A recent study in the UK provided evidence that genetic predisposition to obesity manifests as excess weight gain among children in obesogenic home environments, as described by availability of energy-dense foods and maladaptive parent-child interactions, compared to less obesogenic home environments (Schrempft et al., 2018). These parent-child feeding dynamics are particularly influential among young children in the pre-school years (between 2 and 6 years of age).

## Pre-school years

Trajectories of obesity are largely established in the pre-school years and continue through the life course (Buscot et al., 2018). In addition, pre-schoolers experience a greater variety in their food intake than earlier in childhood, which may be accompanied by food rejections and/or high interest in food and overeating (Birch & Fisher, 1998). Child's approach to eating may be a source of concern among parents of pre-schoolers and influences the parent-child feeding dynamic (Daniels, 2019). Moreover, these interrelationships operate in a broader context of developing parent-child communication, which takes place in the pre-school years (Geeraerts et al., 2020; Salari, Wells, & Sarkadi, 2014). Thus, pre-school years offer an important window for understanding the parent-child feeding dynamics, which influence excess weight gain. This is why pre-school years are in focus for all studies in the thesis.

# Parent-child feeding dynamics

Parent-child feeding dynamics comprise parenting practices (evidence-based parenting practices and feeding practices) and child behaviours (child food intake and child eating behaviours).

## Parenting

Parents shape the environment in which their children develop, in addition to contributing genetic risk (Savage, Fisher, & Birch, 2007; Whitaker et al., 1997). Thus, the overall emotional climate of the parent-child relationship and specific parenting practices are relevant predictors of the child's weight trajectory (Balantekin et al., 2020; Birch & Fisher, 1998; Gerards & Kremers, 2015; Niermann, Gerards, & Kremers, 2018).

## Parenting styles and parenting practices

Parenting styles set the climate between the parent and the child, and parenting practices capture what parents do in specific situations (Darling & Steinberg, 1993). Parents may control child behaviour, while they remain responsive to what the child needs and attune to the child's emotions (Sleddens et al., 2014). These distinct dimensions of parenting reflect parental demandingness (behavioural control) and parental responsiveness (attention to child's needs), respectively (Baumrind, 1966; Maccoby & Martin, 1983). Although they seem to represent opposite sides in parenting, it is best when they co-occur, i.e. when parents communicate structure and limit setting in a way that is responsive and takes into account the child's perspective. This approach to parenting describes an authoritative parenting style, which is characterised by high demandingness and high responsiveness (Baumrind, 1966; Maccoby & Martin, 1983). When parental responsiveness is the dominant dimension in parenting, a permissive style emerges. By contrast, an authoritarian parenting style is characterised by high demandingness and low levels of responsiveness (Baumrind, 1966; Maccoby & Martin, 1983).

While parenting styles describe the overarching aspects of parenting, they relate to specific parenting practices, which describe what parents do when they interact with their children (Hubbs-Tait, Kennedy, Page, Topham, & Har-

rist, 2008; Sleddens et al., 2014; Lopez et al., 2018). For example, authoritative parenting includes clear rules and routines with the child along with child-centred strategies, such as breaking down new behaviours into small achievable steps and encouraging the child's efforts at each step (Ek et al., 2015). In particular, evidence-based parenting practices that support an authoritative parenting style are monitoring (keeping track of child behaviours), encouragement (use of positive attention to reinforce a desired child behaviour), limit setting (providing clear structures and routines in the home) and emotional regulation during parent-child interactions (Dishion, Forgatch, Chamberlain, & Pelham, 2016; Ek et al., 2015). Such practices have been associated with optimal social and emotional development among children (Barlow, Bergman, Kornør, Wei, & Bennett, 2016; Boylan, Cundiff, Jakubowski, Pardini, & Matthews, 2018; Fisher & Skowron, 2017; Patterson, Forgatch, & DeGarmo, 2010). Notably, most research has been conducted in homogeneous high-income settings (Balantekin et al., 2020; Barlow et al., 2016), but evidence suggests that favourable effects on child outcomes can also be seen in low-income settings (Arlinghaus et al., 2018; Devlin, Wight, & Fenton, 2018; Loth, MacLehose, Fulkerson, Crow, & Neumark-Sztainer, 2013a; Yavuz & Selcuk, 2018). Literature integrating parenting into obesity research suggests that evidence-based parenting practices relate favourably to child eating and lower weight status (Chai et al., 2019; Collins, Duncanson, & Burrows, 2014; Rhee, Lumeng, Appugliese, Kaciroti, & Bradley, 2006; Rollins, Savage, Fisher, & Birch, 2016; Sleddens, Gerards, Thijs, de Vries, & Kremers, 2011; Tiberio et al., 2014). However, the effects of both mothers' and fathers' practices on child weight status, are rarely examined (Davison, Haines, Garcia, Douglas, & McBride, 2020; Lloyd, Lubans, Plotnikoff, & Morgan, 2014).

## Parental feeding practices

Parental feeding practices aim to capture the specific goal-oriented strategies, which parents use when they feed their children (Birch et al., 2001; Musher-Eizenman & Holub, 2007; Power et al., 2013; Savage et al., 2007). Parents may control the amount and/or type of foods available to their child, and/or prompt their child to eat (Bergmeier et al., 2017; Russell et al., 2018). These controlling feeding practices have been conceptualised as coercive forms of control, which direct what and how much the child eats without taking into account the child's perspective, i.e. they are parent-centred approaches (Loth, Friend, Horning, Neumark-Sztainer, & Fulkerson, 2016; Vaughn et al., 2016; Wood et al., 2020).

Restriction of energy-dense foods and pressuring children to eat (the 'clean plate' rule) are the most extensively studied controlling feeding practices in relation to childhood obesity (Shloim, Edelson, Martin, & Hetherington, 2015; Vaughn et al., 2016). Controlling feeding practices may produce immediate

effects that are in line with parental wishes (i.e. lower consumption of ‘un-healthy’ foods and ‘cleaning the plate’ during meals). However, since they are parent-centred, they interfere with the child’s self-regulation of food intake, in particular, when children find themselves outside of their parents’ sphere of influence (Bergmeier et al., 2020). For example, restricting palatable energy-dense foods has been shown to increase the preference for and intake of those foods when they are made available (Bergmeier, Skouteris, & Hetherington, 2015; Birch, Fisher, & Davison, 2003; Faith, Scanlon, Birch, Francis, & Sherry, 2004; Fisher & Birch, 1999; Jansen, Mulken, & Jansen, 2007; Rodgers et al., 2013). By contrast, children who are pressured to eat according to parental perceptions of them ‘not eating enough’ may develop a long-term rejection of a varied and nutritionally adequate dietary pattern (Galloway, Fiorito, Lee, & Birch, 2005; Galloway, Fiorito, Francis, & Birch, 2006).

Cross-sectional studies are common in the field of food parenting; thus, there is no conclusive evidence on the directionality of effects between controlling feeding practices, child eating and child weight status (Wood et al., 2020). Bidirectional effects are the most plausible scenario, with child characteristics (i.e. child weight status and child eating) prompting controlling feeding practices, while feeding practices also affect the child (Afonso et al., 2016; Jansen, Williams, Mallan, Nicholson, & Daniels, 2018; Jansen et al., 2014; Mallan et al., 2018). Parental concerns about child weight status and eating (i.e. overeating or fussy eating) are suggested to elicit controlling feeding (Brown et al., 2016; Byrne, Jansen, & Daniels, 2017; Ek et al., 2016; Gregory, Paxton, & Brozovic, 2010; Harris, Jansen, Mallan, Daniels, & Thorpe, 2018; May et al., 2007; Webber, Hill, Cooke, Carnell, & Wardle, 2010). Nevertheless, it is important to acknowledge that controlling feeding practices may override child’s self-regulation of food intake among children who are already susceptible to excess weight gain (Anzman & Birch, 2009; Birch et al., 2003; Faith et al., 2004; Gubbels et al., 2011; Haszard, Russell, Byrne, Taylor, & Campbell, 2019).

While controlling feeding practices relate to coercion, structure-based approaches in feeding represent favourable practices (Frankel, Powell, & Jansen, 2018; Vaughn et al., 2016). For example, the concepts of overt and covert control distinguish between positive and negative aspects of control (Nowicka, Flodmark, Hales, & Faith, 2014; Ogden, Reynolds, & Smith, 2006). While the child perceives overt control in the form of restriction or pressure to eat, covert control relates to structuring the environment and modelling food intake to promote healthy eating (Rodenburg, Kremers, Oenema, & van de Mheen, 2014). However, the need to capture the differences between coercion and structure regarding feeding practices through refined measurement tools has only been voiced in recent years, and they are expected to guide future research on food parenting (Rollins et al., 2016; Savage, Rollins, Kugler, Birch, & Marini, 2017; Vaughn et al., 2016).

## Child behaviours

Children's behaviours relating to food, i.e. food intake and general eating behaviours, are important drivers of weight gain. Food intake refers to 'what' the child eats, which is linked to the caloric content of the diet, while child eating behaviours describe 'how' children eat, which explains child's general interest in food and how s/he approaches eating occasions (Wood, 2018).

### Child food intake

Child food intake is a determinant of energy imbalance and weight gain (Ambrosini et al., 2012; Dalrymple et al., 2020; Hohman, Paul, Birch, & Savage, 2017). In particular, EDNP foods (energy-dense nutrient poor foods), i.e. sugary drinks, sweets and processed foods, represent less healthy dietary patterns, which in addition to weight gain, carry health consequences (GBD 2017 Diet Collaborators, 2019; Wirfält, Drake, & Wallström, 2013). The intake of EDNP foods among young children follows through childhood, promoting excess weight gain over time (Ambrosini, Emmett, Northstone, & Jebb, 2014). Higher availability and accessibility of EDNP foods within the home environment (i.e. an obesogenic home environment) promote less healthy food intake (Schrempft, van Jaarsveld, Fisher, & Wardle, 2015). However, an obesogenic home environment may have a larger impact on excess weight gain among children who have a genetic predisposition, as was recently shown in the Gemini twin cohort (Schrempft et al., 2018). Thus, parents may influence their child's weight status through monitoring the child's food intake and making less EDNP foods available in the home (Davison, Jurkowski, & Lawson, 2013; Fildes et al., 2014; Montano, Smith, Dishion, Shaw, & Wilson, 2015). This may be facilitated by structuring the home environment accordingly, e.g. by not purchasing EDNP foods or through limit setting and routines around their consumption.

### Child eating behaviours

Child eating behaviours describe a child's appetite in terms of 'self-regulation of eating', i.e. children consume food according to their internal cues of hunger and satiety (Blundell et al., 2010). Overall states of hunger and satiety have been conceptualised as food approach and food avoidance behaviours (Carnell & Wardle, 2008a; Ek et al., 2016; Wood, Momin, Senn, & Hughes, 2018). While food avoidance behaviours represent a general state of responsiveness to satiety cues (absence of hunger), food approach behaviours describe eating in the absence of hunger and in response to external influences (such as emotions and food cues) (Wardle, Guthrie, Sanderson, & Rapoport, 2001). Food approach behaviours relate to higher energy intake, faster eating rate and eating in the absence of hunger (Carnell et al., 2016; Carnell & Wardle, 2008a;

Fogel et al., 2018; Kling, Roe, Keller, & Rolls, 2016). By contrast, food avoidance behaviours manifest as slower eating rate and lower food intake (Carnell et al., 2016; Carnell & Wardle, 2008a; Syrad, Johnson, Wardle, & Llewellyn, 2016). Accordingly, food approach and food avoidance behaviours have been associated with higher and lower weight status, respectively, across multiple contexts (Behar et al., 2018; Cao et al., 2012; Carnell & Wardle, 2008b; Dommoff, Miller, Kaciroti, & Lumeng, 2015; Ek et al., 2016; Purwaningrum et al., 2020; Quah et al., 2019; Sanchez, Weisstaub, Santos, Corvalan, & Uauy, 2016; Sleddens, Kremers, & Thijs, 2008; van Jaarsveld, Boniface, Llewellyn, & Wardle, 2014; Viana, Sinde, & Saxton, 2008).

Some eating behaviours are heritable traits, which may partly explain weight gain in childhood (Llewellyn, Trzaskowski, van Jaarsveld, Plomin, & Wardle, 2014; Llewellyn, van Jaarsveld, Johnson, Carnell, & Wardle, 2010). According to the behavioural susceptibility theory of obesity, genetic predisposition to obesity may operate through appetitive traits, which make individuals more susceptible to overeating, especially in a ubiquitous obesogenic food environment (Llewellyn & Fildes, 2017; Carnell & Wardle, 2008b). Under these conditions, overeating and the subsequent weight gain describe an interaction between our genetic makeup and the environment in which we are raised (Schrempft et al., 2018). As an exception, emotional eating, i.e. eating more or less under powerful emotional states, is learned behaviour (Herle, Fildes, Steinsbekk, Rijdsdijk, & Llewellyn, 2017). In any case, the early home environment, which comprises parental feeding practices, determines the conditions for weight gain among susceptible children, and may further influence eating behaviours (Bjørklund, Wichstrøm, Llewellyn, & Steinsbekk, 2019; Jansen et al., 2018; Kininmonth, Smith, Llewellyn, & Fildes, 2020; Llewellyn & Fildes, 2017; Moller, de Hoog, van Eijsden, Gemke, & Vrijkotte, 2013; Steinsbekk, Belsky, & Wichstrom, 2016).

Most parents are sensitive to their child's cues for eating and adopt strategies to influence their child's food intake (Byrne et al., 2017; Fildes, van Jaarsveld, Llewellyn, Wardle, & Fisher, 2015; Harris et al., 2018). Among the widely studied child eating behaviours, which parents acknowledge and act upon (Jansen et al., 2012), are food responsiveness (responsiveness to sight/smell of food) and food fussiness (picky eating and food neophobia) (Gibson & Cooke, 2017; Kral et al., 2018). Regardless of child weight status, these behaviours relate to a liking for energy-dense foods (food responsiveness) and rejection of nutrient-dense foods, typically vegetables (food fussiness) (Fildes et al., 2015; Russell & Worsley, 2016). Moreover, child temperament, i.e. traits of behavioural patterns unique to the child, has been implicated in the complex interrelationships between food parenting and child eating behaviours (Anzman-Frasca, Stifter, & Birch, 2012; Holley, Haycraft, & Farrow, 2020; Steinsbekk, Bjørklund, Llewellyn, & Wichstrøm, 2020).

# Parent-child feeding dynamics in context: A social ecological perspective

Parent-child feeding dynamics and their effects on childhood obesity do not develop in a vacuum. Social and economic conditions, which are outside the direct influence of the family, are powerful determinants of childhood obesity (Davison et al., 2013; Jansen, Mensah, Nicholson, & Wake, 2013). Their effects, however, differ according to the context. While in developing countries, affluence relates to a higher weight status, the reverse holds true for developed countries (Broyles et al., 2015).

## The social gradient of childhood obesity in Sweden

In Sweden, a developed welfare state in Northern Europe (OECD, 2019), children from families of lower socio-economic position (according to parental education and employment status) were three to four times more likely to have overweight or obesity than children of families with high socio-economic position (Lissner et al., 2016). The social gradient in childhood obesity is easy to recognise in Stockholm County, which is the largest urban centre in Sweden, comprising 26 municipalities. In 2018, the prevalence of obesity among 4-year-olds was 1.8% in the Stockholm County, but it ranged between less than 1% and 5%, across different areas (Stockholm County Council, 2019). To put the figures into perspective, the proportion of combined overweight and obesity (~5%) among young children in the affluent areas in the County was equal to the proportion of obesity alone in the low-income area (Stockholm County Council, 2019). Disparities in childhood obesity, if unattended, may persist throughout the life course (Hayes, Tan, Killedar, & Lung, 2019; Jansen et al., 2013). Thus, tailored interventions to address obesity are needed (Elder et al., 2013; Tovar, Renzaho, Guerrero, Mena, & Ayala, 2014).

## Parent-child feeding dynamics according to the socio-ecological model of obesity

Tailoring obesity interventions requires an understanding of the contextual factors influencing the parent-child feeding dynamics. Literature suggests

that, among vulnerable populations with high levels of childhood obesity, parent-child feeding dynamics manifest as obesogenic food intake and controlling parenting (Besharat Pour et al., 2014; Besharat Pour et al., 2016; Blissett & Bennett, 2013; Cardel et al., 2012; Fernández-Alvira et al., 2013; Osei-Kwasi et al., 2016; Safsten, Nyberg, Elinder, Norman, & Patterson, 2016; Taveras, Gillman, Kleinman, Rich-Edwards, & Rifas-Shiman, 2010; Tovar et al., 2012; Vazquez & Cubbin, 2020). Empirical data fit into a socio-ecological model of obesity (Ayala-Marín, Iguacel, Miguel-Etayo, & Moreno, 2020; Harrison et al., 2011; Ohri-Vachaspati et al., 2015), which is based on Bronfenbrenner's ecological systems theory (Bronfenbrenner, 1979). The model explains the development of obesity by placing the child and his/her characteristics in the centre (i.e. child food intake and child eating behaviours). Parent-child feeding dynamics, as defined by feeding and other parenting practices, provide the immediate environment, which influences the child (Davison et al., 2013; Harrison et al., 2011). Socio-demographic characteristics represent a more distal level of influence to the child, but they determine the broader social and economic environments in which children develop and establish interactions with parents. Although the socio-ecological model of obesity has been used extensively in research, less than 10% of studies have included children younger than 5 years old and 1 out of 5 studies has additionally involved the child's parents (Pereira, Padez, & Nogueira, 2019). The present thesis examines influences of mother's foreign background (mother not born in Sweden) on her feeding practices and pre-schoolers' eating behaviours (Somaraki et al., 2016; Somaraki et al., 2018).

## Foreign background in Sweden

Individuals with foreign backgrounds make up a considerable proportion of the Swedish society. As of December 2019, among the 10,327,589 people residing in Sweden, one quarter had a foreign background (Statistics Sweden, 2019). Though situated in Sweden, this research is relevant to the European context overall (WHO, 2018). Other countries have experienced or will experience similar demographic changes, which are likely to affect the health status of their population over time.

According to Statistics Sweden, individuals born abroad who have immigrated to Sweden are defined as 'foreign-born', and this term coincides with the individual's migrant background, since both are based on country of birth (Statistics Sweden, 2019). Moreover, foreign-born individuals (based on country of birth) and Swedish-born individuals with two foreign-born parents are defined as 'having a foreign background' (Statistics Sweden, 2019). In 2019, the majority (roughly 77%) of people having a foreign background, had actually been born abroad (foreign-born/migrant background). Moreover, for-

eign-born individuals have driven the increase in the subgroup of people having a foreign background in Sweden from 2000 onwards (Statistics Sweden, 2019). Thus, parents identified as having a foreign background were largely born in a country other than Sweden. Particular historical and political events can be linked to the timing and trajectories of immigration to Sweden from various parts of the world. The most common birth countries among foreign-born individuals are Syria, Iraq, Finland, Poland and Iran (Statistics Sweden, 2019). The diversity in regions, where individuals with a foreign background come from, presents additional challenges in tailoring obesity interventions (Besharat Pour et al., 2014; Marquis, 2018; Public Health Agency of Sweden, 2019), as well as interventions for other chronic conditions (Aweko et al., 2018).

## Foreign background, food and health

Food relates to cultural identities and ties to the countries of origin (Mares, 2012). Moreover, food has symbolic value, for example, sweet foods are inextricably linked to celebrations and happy moments (Albon, 2005). Thus, giving priority to the preferences of the child, as shown in a study relating to food decision-making processes in India (Daivadanam, Wahlström, Thankappan, & Ravindran, 2015), or using energy-dense foods to mark special occasions and to show care of the child in the US (Namie, 2011) may reflect good and affectionate parenting. In addition, being born in a country other than the host country relates to structural and cultural differences compared to the native population, which may have a profound impact on the food choices of families with a foreign background (D'Souza et al., 2020; De Man et al., 2019; Satia-Abouta, Patterson, Neuhouser, & Elder, 2002).

For example, immigrants to Sweden, especially from Africa and the Middle East, are more likely to settle in socio-economically disadvantaged areas and stay there long-term (Vogiazides & Chihaya, 2020). Moreover, in the context of dietary transition and a westernised dietary pattern (Popkin, Adair, & Ng, 2012), cultural influence on food and the availability of traditional foods may affect dietary quality of immigrant groups in Sweden. Studies involving adults and children suggest that immigrant groups in the Nordic countries tend to preserve favourable dietary practices, i.e. high consumption of fruits and vegetables, but they also incorporate energy-dense foods into their diets, which characterises a western dietary pattern (Safsten et al., 2016; Wändell, 2013). Accordingly, children of parents who are not born in Sweden are more likely to have obesity (Besharat Pour et al., 2014).

However, there is great variation according to parents' country of birth, whereby children of families from western countries seem to be similar to Swedish-born children in terms of diet and exercise behaviours along with

obesity rates (Besharat Pour et al., 2014). In a similar manner, western immigrants in Sweden and native Swedes have the same health risks, e.g. cardiovascular and psychiatric disorders, while non-western immigrants show worse health outcomes twenty years post-migration (Helgesson, Johansson, Nordquist, Vingård, & Svartengren, 2019). Thus, a *healthy migrant effect* may be postulated among individuals and families who immigrate voluntarily, while it may not be the case when involuntary displacement occurs (Helgesson et al., 2019; WHO, 2018). In the latter case, having foreign background may act as a stressor and/or predispose to social vulnerability and suboptimal health outcomes (Bas-Sarmiento, Saucedo-Moreno, Fernández-Gutiérrez, & Poza-Méndez, 2017; Public Health Agency of Sweden, 2019; WHO, 2018), which may extend to affect second-generation immigrants, i.e. children of families with a foreign background, in a more severe way (Gkiouleka & Huijts, 2020).

To sum up, children, especially of non-western backgrounds, are second-generation immigrants, who may experience the cumulative health effects of changing dietary patterns and having an obesity status from a young age. Hence, an understanding of parent-child feeding dynamics, which contribute to weight gain trajectories in the context of immigration, is warranted.

# Parent-child feeding dynamics in treatment: effects of parenting programmes

Several national and international organisations, including the American Medical Association, the Obesity Society, and the European Association for the Study of Obesity, have acknowledged that obesity is a chronic condition, which requires continuous support by health professionals (Farpour-Lambert et al., 2015; Jastreboff, Kotz, Kahan, Kelly, & Heymsfield, 2019; Kyle, Dhurandhar, & Allison, 2016). The Commission on Ending Childhood Obesity, which was established by the World Health Organization, has identified key areas of action (WHO, 2017). Healthy food intake is priority number one, and is especially important for young children (WHO, 2017), who form life-long food preferences (Nicklaus & Remy, 2013). In addition, weight management efforts need to be family-based and incorporate health and nutrition education with parenting practices (Chai et al., 2019). The evidence base supports active involvement of parents to facilitate changes in lifestyle among young children, i.e. to influence parent-child feeding dynamics (Brown et al., 2019; Haines et al., 2019; Morgan, Schoonees, Sriram, Faure, & Seguin-Fowler, 2020; Pratt & Skelton, 2018; Smith, Montaña, Dishion, Shaw, & Wilson, 2015).

## Parent-child feeding dynamics in treatment

Treatment programmes, which address parent-child feeding dynamics, have been successful in reducing child weight status, especially if started early in childhood (Chai et al., 2019; Ek et al., 2019; Epstein, Paluch, Beecher, & Roemmich, 2008; Golan, Kaufman, & Shahar, 2006; Quattrin et al., 2012; Stark et al., 2018; Taylor et al., 2015). In fact, there is evidence for long-term effects, well beyond the end of treatment (Epstein, Valoski, Wing, & McCurley, 1990; Reinehr, Kleber, Lass, & Toschke, 2010). However, recent studies indicate that booster sessions are required post-treatment (Stark et al., 2019; Wilfley et al., 2017). In the pre-school years, active involvement of parents is necessary (Colquitt et al., 2016).

In addition to parents' increasing awareness of weight gain trajectories and healthy lifestyle in childhood, parents also receive training and practise parenting skills in order to facilitate healthy eating and active play (Chai et al.,

2019; Jang, Chao, & Whittemore, 2015; Kitzman-Ulrich et al., 2010). In fact, evidence-based parenting programmes, which have been proven successful in addressing several child behavioural problems, also facilitate obesity prevention and management (Sanders, Kirby, Tellegen, & Day, 2014; Smith, St George, & Prado, 2017). The Family Check-Up (FCU) programme in the US and the Lifestyle Triple P programme in Australia and the Netherlands focus on enhancing parenting skills, and they were both found to have a favourable impact on child food intake and parenting (Gerards et al., 2015; Montano et al., 2015; Smith et al., 2015; West, Sanders, Cleghorn, & Davies, 2010). However, the effects on child weight status were not consistently favourable (Gerards et al., 2015). Accordingly, both programmes include components relating to parenting, which have been shown to increase programme effectiveness, such as practices to promote positive interactions between parents and their children (Chai et al., 2019; Kaminski, Valle, Filene, & Boyle, 2008).

## Research gaps

Although parents' active involvement in treatment has been associated with clinically significant reductions in weight status (Colquitt et al., 2016; Ells et al., 2018), research on the parent-child feeding dynamic after treatment is still scarce. While some studies report changes in both weight status and outcomes of the parent-child feeding dynamic (Burrows, Warren, & Collins, 2010; Cohen, Hazell, Vanstone, Rodd, & Weiler, 2018; Collins et al., 2011; Epstein et al., 2008; Okely et al., 2010), others do not find consistent changes (Haines et al., 2016; Magarey et al., 2011). Notably, there is a lack of theoretically motivated treatment programmes in the field of obesity (Gicevic et al., 2016; Niermann et al., 2018; Skelton, Buehler, Irby, & Grzywacz, 2012). The added value in such programmes is that relevant concepts are linked *a priori*, which forms a theory of action to guide the evaluation of programme effectiveness (Ek et al., 2015; Smith et al., 2017). In addition, research has largely overlooked heterogeneous samples and fathers (Khandpur, Blaine, Fisher, & Davison, 2014; Lobstein et al., 2020; Morgan & Young, 2017; Morgan et al., 2017; Tovar et al., 2014). The limited research including fathers suggests that they are more likely to pressure their children to eat and endorse lower levels of limit setting than mothers (Khandpur et al., 2014). However, only one study has examined mothers' and fathers' parenting practices after a treatment programme (Lloyd et al., 2014). Similar limitations regarding the inclusion of fathers are evident in the parenting literature concerning child behavioural and emotional problems (Barlow et al., 2016).

## The More and Less study (ML study)

The present thesis evaluates data from the More and Less study (ML study) and thereby addresses several limitations in earlier research. The ML study is a randomised controlled trial (RCT) for obesity treatment among pre-schoolers, which evaluates the effectiveness of a parent support programme, with and without additional booster sessions, against standard treatment (Ek et al., 2015). The study was conducted in Stockholm, Sweden. The parent support programme has been designed to enhance parenting skills and, through them, facilitate a shift in parent-child feeding dynamics, which may ultimately lead to reductions in child weight status (Ek et al., 2015). In addition, in the ML study, a large proportion of families were of foreign background (60 %). Another novel feature is the assessment of parenting practices (including feeding practices) of both mothers and fathers of pre-schoolers.

The theoretical foundation of the parent support programme is Bandura's Social Learning Theory and Patterson's Social Interaction Learning Theory, which understand the development of child behaviours as a function of the interrelationships between parents and their children (Bandura, 1971; Patterson, 1979, 1997). Thus, enhancing parenting skills may reduce coercive control in the family and leverage evidence-based parenting practices (i.e. monitoring, positive involvement, encouragement, problem solving, limit setting and emotional regulation), which, in turn, may extend to the feeding domain and effect child weight status (Chai et al., 2019; Ek et al., 2015; Patterson et al., 2010). In addition, according to the socio-ecological model, the parent support programme involves microsystems around the parent-child feeding dynamic, such as the extended family and pre-school (Bronfenbrenner, 1979; Eli, Howell, Fisher, & Nowicka, 2016). The conceptual model of the ML study, as described by Ek et al. (2015), illustrates the suggested link between the parent support programme and evidence-based parenting practices, which may facilitate shifts in more distal feeding practices and child behaviours to eventually influence child weight status. The present thesis examines the links between the parent support programme and parenting practices (evidence-based parenting practices and feeding practices) along with child behaviours according to this theory of action (Ek et al., 2015; Patterson et al., 2010).

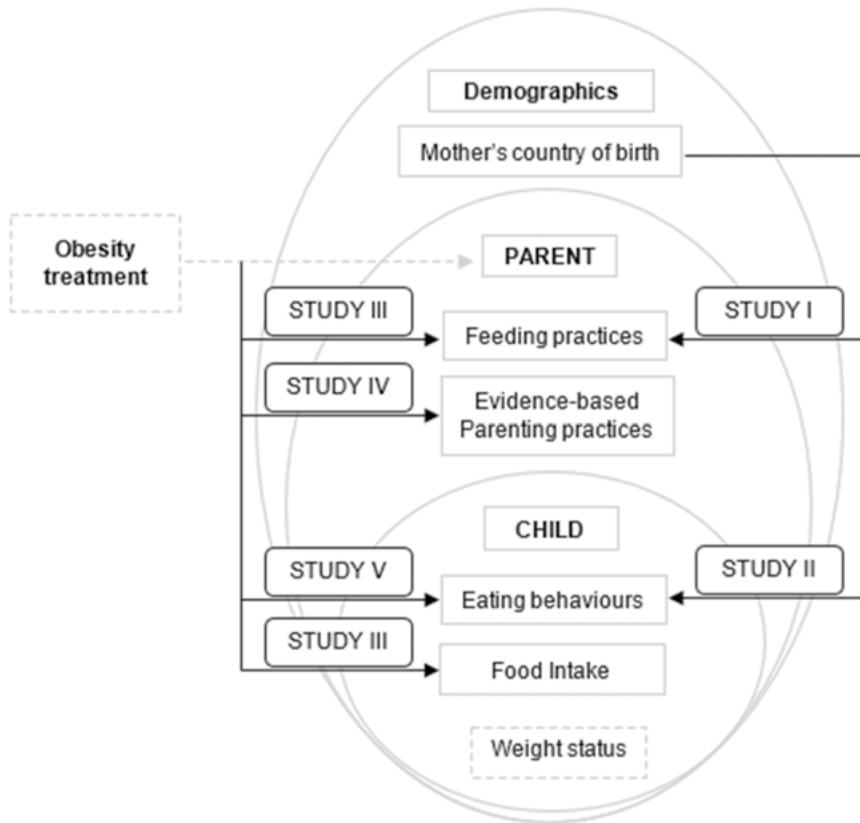
The recent publication on the ML study's primary outcome (child weight status) shows that the parent support programme has been successful in reducing child weight status among pre-schoolers (Ek et al., 2019). Three out of five studies compiling this thesis, further evaluate parenting practices and child behaviours in the context of treatment offered during the ML study (Studies III through V) (Somaraki et al., 2020).

# Aims

The overall aim is to examine parenting practices and child behaviours, in relation to foreign background and in the context of early obesity treatment. Figure 1 outlines the aims of the thesis and the respective studies.

The specific aims are:

- To examine controlling feeding practices and child eating behaviours according to maternal foreign background (Studies I and II)
- To examine parenting practices (evidence-based parenting practices and feeding practices) after obesity treatment (Studies III and IV)
- To examine child behaviours (child food intake and child eating behaviours) after obesity treatment (Studies III and V)



*Figure 1.* Solid grey outline represents an adaptation of the socio-ecological model (Bronfenbrenner, 1979), illustrating the different contexts associated with childhood obesity. Dashed grey outline represents obesity treatment through the ML parent support programme based on Bandura’s Social Cognitive Theory (1971) and Patterson’s Social Interaction Learning Theory (1979, 1997). The parent support programme has been effective in achieving clinically significant reductions in weight status among pre-schoolers (Ek et al., 2019). The programme aims to enhance evidence-based parenting skills among families with children referred for obesity within the socio-ecological model for obesity.

# Methods

An overview of the methodology used in the studies included in the thesis is provided in Table 1.

Table 1. Overview of the studies included in the thesis

Study	Design	Sample	Outcomes	Statistical approach
I	Cross-sectional	1,325 mother-child dyads in Sweden who provided background data	Food parenting practices (restriction and pressure to eat)	Descriptive statistics Linear regression models
II	Cross-sectional	1,376 mother-child dyads in Sweden who provided background data	Child eating behaviours (food approach and food avoidance)	Descriptive statistics Linear regression models
III	RCT	177 mother-child dyads and father-child dyads	Food parenting practices (restriction and pressure to eat) Intake of EDNP foods	Descriptive statistics Computation of individual regression coefficients according to time (individual slope) Between- and within-group comparisons
IV	RCT	177 mother-child dyads and father-child dyads.	Evidence-based parenting practices	Descriptive statistics Linear mixed models
	Validation sub-study	558 parent-child dyads who provided data on parenting practices		Principal Component Analysis Validity and reliability assessment
V	RCT	177 children	Child eating behaviours (food approach and food avoidance)	Descriptive statistics Linear mixed models
	Validation sub-study	1,724 mother-child dyads who provided data on child eating behaviours		Rasch model

## Study sample (Studies I and II)

The sample in studies I and II consists of three subsamples of mother-child dyads: a population sample, a school sample and a clinical sample. The recruitment process and study samples have been described previously (Ek et al., 2019; Ek et al., 2016; Nowicka, Sorjonen, Pietrobelli, Flodmark, & Faith, 2014; Somaraki et al., 2016; Somaraki et al., 2018).

Population sample in Malmö: The Swedish Population Registry was used to recruit mothers in Malmö. All 3,007 mothers of 4-year-olds were invited to participate, and 876 mothers completed and returned the questionnaires.

School sample in Stockholm: Schools and pre-schools in Stockholm County were recruited from areas with low, medium and high prevalence of obesity, according to mean prevalence rates (Stockholm County Council, 2013). In total, 431 parents, both fathers and mothers, completed the questionnaires. However, studies I and II used data provided by mothers (n=353).

Clinical sample in Stockholm: Families of children with obesity were referred from healthcare centres across Stockholm County to a randomised controlled trial for obesity treatment. Baseline data provided by mothers were included. An overview of the trial is provided in the following section.

## Study sample (Studies III, IV and V)

The sample in studies III through V includes participating families (n=177) in the More and Less study (ML study), which is a randomised controlled trial (NCT01792531). The study has been extensively described elsewhere (Ek et al., 2015; Ek et al., 2019). In brief, the aim of the study was to evaluate the effectiveness of obesity treatment among pre-school children. The study was designed to compare a parent support programme (with and without booster sessions) and standard treatment focusing on lifestyle modifications, according to the action plan for obesity in Stockholm County (Ek et al., 2015; Stockholm County Council, 2015).

Families were recruited from primary health care centres and outpatient paediatric clinics in Stockholm County, Sweden. The inclusion criteria for the study were as follows: The child: 1) was 4–6-years-old at baseline; 2) was classified as having obesity according to international age- and sex-specific criteria (Cole et al., 2000; Cole & Lobstein, 2012); 3) did not have any conditions that could influence his/her weight and height development; and 4) was not already in treatment for obesity. In addition, parents should be able to communicate in Swedish in order to be involved in treatment and fill out the questionnaires (Ek et al., 2015).

Seventy-five children were estimated in each of the treatment approaches (parent support programme and standard treatment), according to the primary

outcome (changes in child weight status) adjusting for dropout (Ek et al., 2015; Kleber et al., 2009; West et al., 2010).

After baseline measures, families were assigned to the following treatment groups: parent support programme with boosters, parent support programme without boosters and standard treatment in a 1:1:2 ratio (Ek et al., 2015; Ek et al., 2019). During the parent support programme, families and research group members remained blinded to allocation according to booster sessions. Booster sessions were offered after treatment was delivered. Data were collected at four time points over the 12-month follow-up period.

## Validation samples in sub-studies (Studies IV and V)

Studies IV and V included two validation sub-studies, respectively. The aim of those sub-studies was to examine the validity of measurement tools for assessing evidence-based parenting practices and child eating behaviours (two questionnaires) so that they could be used to evaluate treatment effects on these outcomes.

In the validation sub-study of study IV, the school sample in Stockholm and baseline data from the ML study (clinical sample in Stockholm) were merged.

In the validation sub-study of study V, the population sample in Malmö, the school sample in Stockholm and baseline data from the ML study (clinical sample in Stockholm) were merged, as described earlier (Somaraki et al., 2016; Somaraki et al., 2018). Additionally, for the purpose of this sub-study, data from the 5-year follow-up (child mean age, 5-years-old) of an obesity prevention trial in Australia (NOURISH RCT, n=388) were merged with the Swedish samples (Daniels et al., 2015; Magarey et al., 2016).

## Measurements

### Foreign background (Studies I and II)

Mothers reported their country of birth based on the question ‘In which country were you born?’ with two response options: ‘I was born in: (i) Sweden, (ii) another country, please specify’.

In Study I, mothers’ countries of birth were classified into four groups: 1) Sweden; 2) Nordic/Western Europe; 3) Eastern/Southern Europe; and 4) non-European.

In study II, mothers’ countries of birth were classified into seven groups: 1) Sweden; 2) Nordic/Western Europe; 3) Eastern/Southern Europe; 4) Middle East/North Africa; 5) East/South and Southeast Asia; 6) Sub-Saharan Africa; and 7) Central and South America.

## The Child Feeding Questionnaire (CFQ) (Studies I and III)

The CFQ is a widely used tool for assessing controlling feeding practices, namely restriction (8 items, e.g. 'I have to be sure that my child does not eat too many high-fat foods') and pressure to eat (4 items, e.g. 'My child should always eat all of the food on his/her plate') (Birch et al., 2001; Vaughn et al., 2016). Responses are rated using a 5-point scale ('1=disagree', '2=slightly disagree', '3=neutral', '4=slightly agree', '5=agree'). In addition, the CFQ addresses parental concerns in relation to child eating and weight status (3 items, e.g. 'How concerned are you about your child eating too much when you are not around?') (Birch et al., 2001). Responses are rated using a 5-point scale ('1=unconcerned', '2=a little concerned', '3=concerned', '4=fairly concerned', '5=very concerned').

The CFQ has been translated into Swedish and validated using Confirmatory Factor Analysis (Nowicka et al., 2014). According to this validation study, the two items under restriction, which describe food as a reward for good behaviour, were dropped (Nowicka et al., 2014). Therefore, they are not considered in the analyses of the thesis (Somaraki et al., 2016; Somaraki et al., 2020).

## The Child Eating Behaviour Questionnaire (CEBQ) (Studies II and V)

The CEBQ is the most widely used tool for assessing child eating behaviours, namely food approach and food avoidance behaviours (de Lauzon-Guillain et al., 2012; Wardle et al., 2001). It comprises 35 items, describing eight distinct behaviours: Food Responsiveness (FR), Emotional Overeating (EOE), Enjoyment of Food (EF), and Desire to Drink (DD) are under the food approach dimension; and Satiety Responsiveness (SR), Slowness in Eating (SE), Emotional Undereating (EUE), and Food Fussiness (FF) are under the food avoidance dimension. All the items describing each of these eating behaviours are detailed in the methods section of study II (Somaraki et al., 2018). Responses are rated using a 5-point scale ('1=never', '2=rarely', '3=sometimes', '4=often', '5=always').

The CEBQ has been translated into Swedish and validated using Confirmatory Factor Analysis (Ek et al., 2016). According to this validation study, one item describing SR ('the snacking item') was dropped. Study II analysed CEBQ data excluding this item (Somaraki et al., 2018). Study V, however, used a different validation method, namely the Rasch model. A strength of this model is that it allowed for the addition of an Australian sample of preschoolers (Daniels et al., 2015), which offers a wider range of responses and enhanced the sample for validating the CEBQ. In contrast to factorial validation, which is highly dependant on the sample and requires relatively similar items to yield reliable findings (Ek et al., 2016), the Rasch model is better

suited to process diverse responses (Bond & Fox, 2015). The Rasch analysis largely confirmed that the CEBQ is a valid tool for assessing eight distinct eating behaviours: 4 items (3 items describing FF –in particular food neophobia– and 1 item describing SR –not the same as in the earlier study) were dropped. A description of the Rasch analysis, its findings and comparison of the findings between the two validation methods can be found under the discussion section of study V.

### The Emotions and Communication in Parenting (ECoP) Questionnaire (Study IV)

The new questionnaire was developed according to international standards (Beaton, Bombardier, Guillemin, & Ferraz, 2000; Streiner, Norman, & Cairney, 2014), and 12 items were retained. Details on the process of development are provided in study IV. The 12-item questionnaire was validated using Exploratory Factor Analysis (EFA) and a 9-item structure was identified, which described two evidence-based parenting practices: limit setting and emotional regulation. Limit setting and emotional regulation map onto the overarching dimensions that define favourable parenting, i.e. responsiveness and demandingness. Setting limits to one's child corresponds to providing clear and consistent boundaries and structure, while being able to regulate one's own emotions when interacting with the child could be seen as a way for parents to be responsive to the child's needs (study IV). Limit setting and emotional regulation were used for the evaluation of parenting in the ML study (study IV).

### The Food Frequency Questionnaire (FFQ) (Study III)

Child food intake in relation to obesity treatment was assessed using a FFQ (Ek et al., 2015). The FFQ included information on the consumption frequency of EDNP foods (pizza/hamburgers, ice-cream, cookies/buns, soft drinks, sweets/chocolate, chips/snacks). Response options ranged from once per month or less to four times per day or more (13 options in total). The food items listed in the FFQ have been used in several international studies (Byrne et al., 2019; Golley et al., 2017), and Sweden (Doring et al., 2014; Enghardt Barbieri, Pearson, & Becker, 2006).

## Statistical Analyses

Descriptive statistics were used to examine differences in continuous (one-way ANOVA, independent samples t-tests) and categorical variables (chi-

squared test), across groups of mothers' countries of birth (studies I and II) and treatment groups (studies III-V).

In studies I and II, multiple linear regression models were fitted to examine the associations between maternal country of birth and mother-reported feeding practices as well as child eating behaviours. Unadjusted models were examined along with adjusted models, which accounted for relevant covariates, including child's weight status and maternal concern about child weight (Cachelin & Thompson, 2013; Farrow, Blissett, & Haycraft, 2011; Gevers et al., 2015; Loth, MacLehose, Fulkerson, Crow, & Neumark-Sztainer, 2013b; Svensson et al., 2011; Wardle et al., 2001; Wardle, Sanderson, Guthrie, Rapoport, & Plomin, 2002). Details on the models fitted and the covariates included are provided in the respective studies (Studies I and II).

Study III analysed data on parent-reported feeding practices and child food intake collected at four time points. Individual regression coefficients for each participating parent/child were computed in relation to time (baseline, 3- 6- and 12-months). Thus, a linear regression model was fitted for each participant, where the dependent variable was the outcome (feeding practice or food intake) and time was entered as a numeric independent variable (Somaraki et al., 2020). The resulting coefficients, which expressed the monthly change in the outcomes, were compared across treatment groups.

Studies IV and V analysed data on parent-reported limit setting and emotional regulation as well as perceived child eating behaviours using linear mixed models. These models accounted for data collected from the same family over time (baseline, 3- 6- and 12-months). The dependent variable was the outcome (parenting practice or child behaviour), and the models also included group (parents support programme –with and without boosters– or standard treatment), time (as a numeric variable), and group-by-time interaction.

The validation sub-studies embedded within studies IV and V used Principal Component Analysis, reliability and validity assessment, and Rasch analysis. More information on these approaches can be found in the respective manuscripts. The results of the validation sub-studies have been mentioned when describing the ECoP Questionnaire and the CEBQ under the Measurements section.

All analyses, except for the Rasch model (Winsteps), were performed using IBM SPSS Statistics and the statistical significance was set at 0.05.

## Ethical considerations

The study's ethics and consent procedures were approved for samples included in the thesis.

For the population sample in Malmö, recruitment and data collection were approved by the Regional Ethical Board in Lund (approval number 2009/362);

mothers provided written informed consent. For the school sample in Stockholm, ethics approval was granted by the Regional Ethical Board in Stockholm (approval number 2013/1628-31/2); data were collected anonymously and no informed consent was obtained. The ML study (study protocol, randomisation procedures, treatment programme, and follow-up measurements) was approved by the ethics committee in Stockholm (2011/1329-31/4, 2012/1104-32, 2012/2005-32, 2013/486-32); participating families provided written informed consent on behalf of their children. The study has been registered at [www.clinicaltrials.gov](http://www.clinicaltrials.gov) (NCT01792531). The NOURISH randomised controlled trial, which sourced the Australian sample added in the validation sub-study of study V, has received ethical approval by the Queensland University of Technology (ID0700000752; Australasian Clinical Trials Registration number 1260800056392).

# Results

## Parent-child feeding dynamics according to maternal foreign background

### Controlling feeding practices (Study I)

Significant associations were found between mothers' country of birth and controlling feeding practices –restriction and pressure to eat (Somaraki et al., 2016). In the fully adjusted models, mothers born in an eastern/southern European or non-European country reported higher levels of restriction compared to Swedish-born mothers ( $b=0.43$ , 95% CI 0.22, 0.64 and  $b=0.34$ , 95% CI 0.17, 0.50, respectively). Similarly, mothers born in an eastern/southern European or non-European country reported higher levels of pressure to eat compared to Swedish-born mothers ( $b=0.40$ , 95% CI 0.17, 0.63 and  $b=0.61$ , 95% CI 0.43, 0.79, respectively).

Maternal concern about child overweight was an influential predictor in all adjusted models (Somaraki et al., 2016). In particular, maternal concern accounted for 52% of the effect of maternal country of birth (non-European vs. Swedish-born) on restriction, and it was associated with higher levels of restriction ( $b=0.42$ , 95% CI 0.35, 0.50). In contrast, maternal concern about child overweight was associated with lower levels of pressure to eat ( $b=-0.14$ , 95% CI -0.22, -0.06).

### Child eating behaviours (Study II)

Significant associations were found between mothers' country of birth and food approach as well as food avoidance behaviours (Somaraki et al., 2018). The most consistent associations were found for mothers born in Middle East/North Africa. In the fully adjusted models, mothers born in Middle East/North Africa, reported higher levels of food approach behaviours, compared to Swedish-born mothers (e.g. Food Responsiveness,  $b=0.14$ , 95% CI 0.03, 0.26, and Desire to Drink,  $b=0.57$ , 95% CI 0.40, 0.74). However, mothers born in Middle East/North Africa also reported lower levels of Enjoyment of Food (a food approach behaviour) compared to Swedish-born mothers ( $b=-0.30$ , 95% CI -0.45, -0.16). Moreover, mothers born in Middle East/North Africa reported higher food avoidance behaviours, compared to Swedish-born

mothers (e.g. Satiety Responsiveness,  $b=0.22$ , 95% CI 0.10, 0.35, and Slowness in Eating,  $b=0.50$ , 95% CI 0.34, 0.67). Overall, there was variation in the associations between specific groups of maternal country of birth and child eating behaviours.

Maternal concern about child overweight was an influential predictor in all adjusted models (Somaraki et al., 2018). It was associated with higher food approach behaviours (e.g. Food Responsiveness,  $b=0.40$ , 95% CI 0.36, 0.44) and lower food avoidance behaviours (e.g. Satiety Responsiveness,  $b=-0.18$ , 95% CI -0.22, -0.14).

## Parent-child feeding dynamics after obesity treatment

### Parenting practices (Studies III and IV)

#### **Controlling feeding practices**

There were no differences between treatment groups regarding change in controlling feeding practices over time. These practices remained stable over time among mothers and fathers in all groups. The results section in Study III (Somaraki et al., 2020; Table 2) shows the mean monthly change in restriction and pressure to eat among mothers and fathers.

#### **Limit setting and emotional regulation practices**

Mothers across treatment groups did not differentially change their limit setting or emotional regulation practices (group-by-time interaction,  $p>0.05$ ). Fathers in the parent support programme –with and without boosters– decreased their emotional regulation compared to fathers in standard treatment (group-by-time interaction,  $p<0.05$ ). The trajectories for mothers and fathers are shown in Fig. 2 and Fig. 3, respectively.

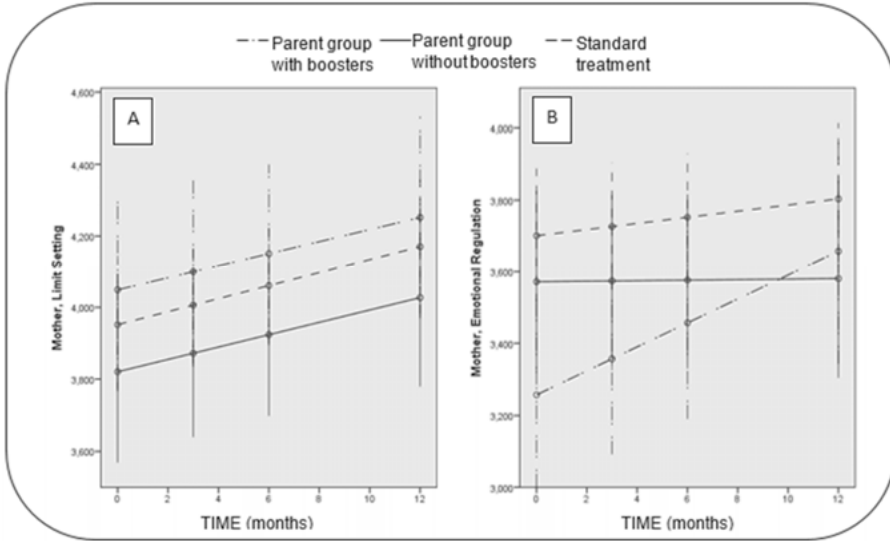


Figure 2. Mothers' limit setting and emotional regulation practices over 12 months follow-up of the ML study. Graphs are based on estimated marginal means of the linear mixed models fitted (holding time constant at 0, 3, 6, and 12 months). (A) Group effect ( $p=0.472$ ), Time effect ( $p=0.001$ ), Group-by-Time ( $p=0.993$ ), (B) Group effect ( $p=0.036$ ), Time effect ( $p=0.011$ ), Group-by-Time ( $p=0.075$ )

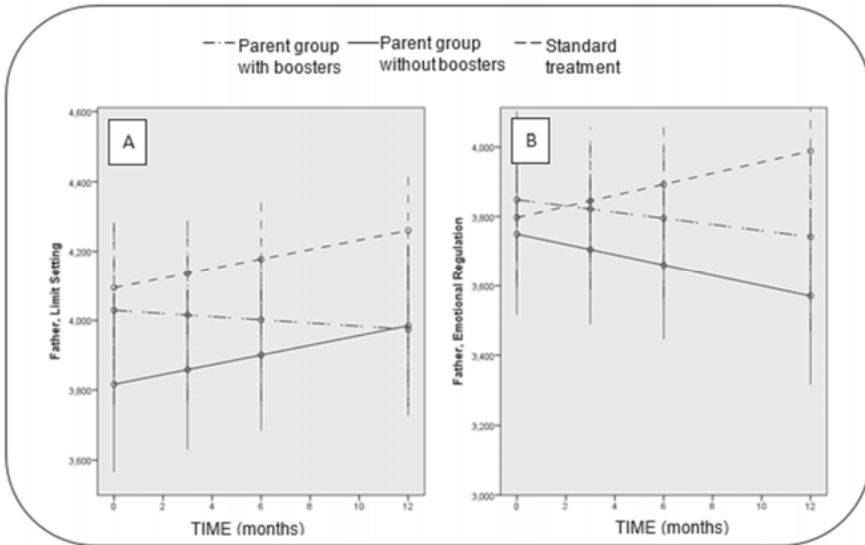


Figure 3. Fathers' limit setting and emotional regulation practices over 12 months follow-up of the ML study. Graphs are based on estimated marginal means of the linear mixed models fitted (holding time constant at 0, 3, 6, and 12 months). (A) Group effect ( $p=0.217$ ), Time effect ( $p=0.114$ ), Group-by-Time ( $p=0.237$ ) (B) Group effect ( $p=0.850$ ), Time effect ( $p=0.625$ ), Group-by-Time ( $p=0.026$ )

## Child behaviours (Studies III and V)

### **Child food intake**

There were no differences between treatment groups regarding changes in the consumption frequency of EDNP foods ( $p>0.05$ ). However, children in standard treatment consumed certain EDNP foods less frequently over time ( $p<0.05$ ). The results section in Study III (Somaraki et al., 2020; Table 3) shows the mean monthly change in EDNP foods.

### **Food approach behaviours**

Children across treatment groups did not differentially change their food approach behaviours (group-by-time interaction,  $p>0.05$ ). Over time, children decreased Desire to Drink ( $p=0.025$ ) and there was a downward trend for decreasing Food Responsiveness among children, though not significant ( $p=0.057$ ). The trajectories for child food approach behaviours are shown in Fig. 4.

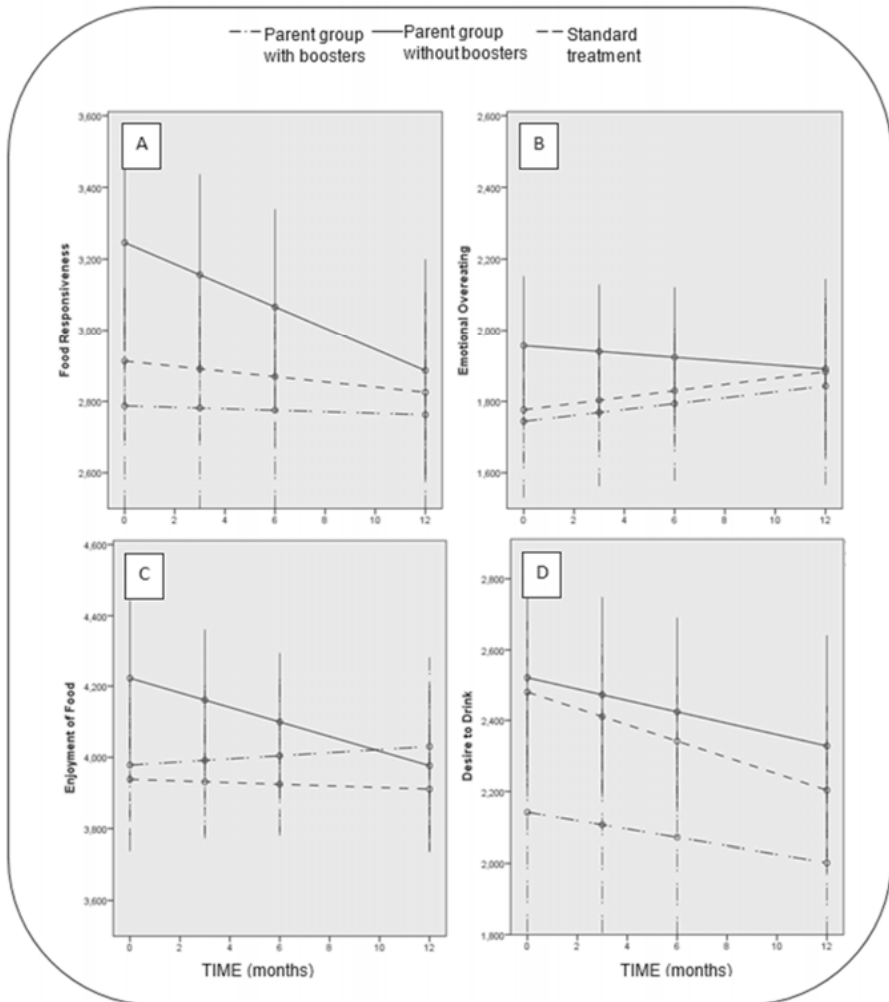


Figure 4. Child food approach behaviours over 12 months follow-up of the ML study. Graphs are based on estimated marginal means of the linear mixed models fitted (holding time constant at 0, 3, 6, and 12 months). (A) Group effect ( $p=0.105$ ), Time effect ( $p=0.057$ ), Group-by-Time ( $p=0.233$ ); (B) Group effect ( $p=0.258$ ), Time effect ( $p=0.451$ ), Group-by-Time ( $p=0.438$ ); (C) Group effect ( $p=0.115$ ), Time effect ( $p=0.261$ ), Group-by-Time ( $p=0.191$ ); (D) Group effect ( $p=0.189$ ), Time effect ( $p=0.025$ ), Group-by-Time ( $p=0.801$ )

## Food avoidance behaviours

Children across treatment groups did not differentially change their food avoidance behaviours (group-by-time interaction,  $p > 0.05$ ), except for Satiety Responsiveness (group-by-time interaction,  $p < 0.05$ ). Over time, children increased their Food Fussiness ( $p = 0.047$ ). The trajectories for fussy eating behaviours are shown in Fig. 5.

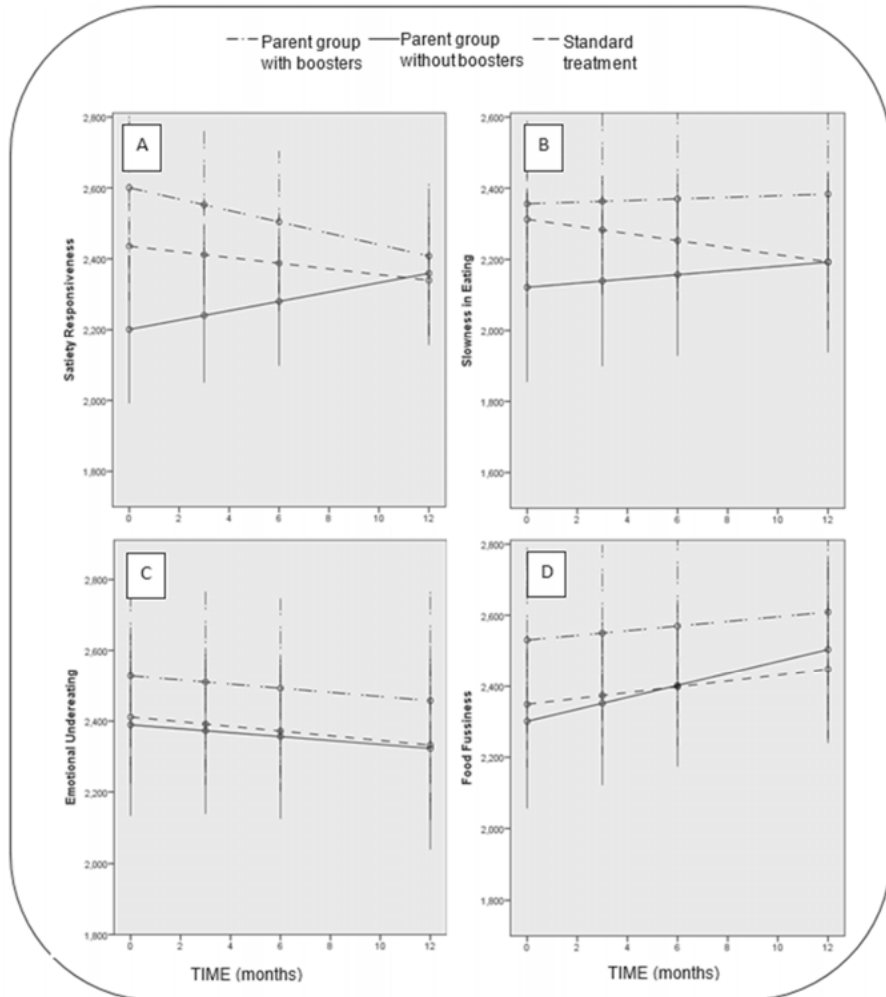


Figure 5. Child food avoidance behaviours over 12 months follow-up of the ML study. Graphs are based on estimated marginal means of the linear mixed models fitted (holding time constant at 0, 3, 6, and 12 months). (A) Group effect ( $p = 0.038$ ), Time effect ( $p = 0.424$ ), Group-by-Time ( $p = 0.039$ ); (B) Group effect ( $p = 0.421$ ), Time effect ( $p = 0.919$ ), Group-by-Time ( $p = 0.427$ ); (C) Group effect ( $p = 0.735$ ), Time effect ( $p = 0.351$ ), Group-by-Time ( $p = 0.997$ ); (D) Group effect ( $p = 0.412$ ), Time effect ( $p = 0.047$ ), Group-by-Time ( $p = 0.707$ )

# Discussion

## Main findings

Mothers born in another country than Sweden (in eastern/southern Europe and outside Europe) reported higher levels of controlling feeding practices (restriction and pressure to eat) compared to Swedish-born mothers. In addition, mothers born in another country than Sweden (Middle East/North Africa) perceived their children to exhibit more food approach (except for enjoyment of food) and more food avoidant behaviours compared to Swedish-born mothers. Maternal concern about child overweight was an influential predictor of controlling feeding practices and child eating behaviours, beyond child's actual weight status.

Neither mothers nor fathers in the parent support programme (with or without boosters) decreased their controlling feeding practices compared to parents in standard treatment. However, there were different trajectories of mothers' and fathers' evidence-based parenting practices after treatment. Mothers increased their limit setting strategies in general, and fathers in the parent support programme only decreased their emotional regulation.

Children in the parent support programme (with or without boosters) did not decrease their intake of EDNP foods, reported by parents, compared to children in standard treatment. However, child food approach behaviours, as reported by parents, decreased after obesity treatment. Moreover, child fussy eating behaviours, as reported by parents, increased after obesity treatment. The trajectories were not more pronounced in the parent support programme, compared to standard treatment.

## Parent-child feeding dynamics and foreign background

Studies I and II showed that mothers with a foreign background (especially non-western) endorsed higher levels of controlling feeding practices, and perceived their children to be both more avid eaters and more food avoidant compared to Swedish-born mothers (Somaraki et al., 2016; Somaraki et al., 2018). These findings largely confirm previous studies, which have compared groups residing in the same country according to their foreign background (Blissett

& Bennett, 2013; Cachelin & Thompson, 2013; Cardel et al., 2012; Gu, War-kentin, Mais, & Carnell, 2017; Loth et al., 2013b; Yılmaz, Renders, Nicolaou, & Vrijkotte, 2019). In addition, the findings extend research on socio-demo-graphic correlates of obesity, which influence the parent-child feeding dy-namic (Davison et al., 2013). Altogether, findings from studies I and II mirror associations between perceived child eating behaviours and controlling feed-ing practices, which have been extensively reported in the literature (Bauer et al., 2017; Boots, Tiggemann, & Corsini, 2018; Byrne et al., 2017; Ek et al., 2016; Jansen et al., 2018; Jansen et al., 2017; Pesch et al., 2016; Scaglioni et al., 2018). In addition, the findings highlight the relevance and importance of the socio-ecological model in understanding aspects of the family environ-ment, which may contribute to weight gain trajectories, particularly among children of foreign background (Ayala-Marín et al., 2020; Davison et al., 2013).

### Maternal concern about child overweight

Studies I and II showed that maternal concern about child overweight was an influential predictor of both controlling feeding practices and child eating be-haviours (Somaraki et al., 2016; Somaraki et al., 2018). Specifically, maternal concern about child overweight partly explained the associations between ma-ternal foreign background and both restrictive feeding and food approach be-haviours (except for child enjoyment of food). These findings demonstrate a role for maternal cognitions in the association between child food approach behaviours and restrictive feeding, and are line with the obesity proneness model (Afonso et al., 2016; Birch et al., 2001; Cachelin & Thompson, 2013; Costanzo & Woody, 1985; Derks et al., 2017; Ek et al., 2016; Gregory et al., 2010; May et al., 2007).

The obesity proneness model suggests that mothers' controlling feeding practices are elicited by maternal perceptions and concerns about child weight status and eating behaviours (Birch et al., 2001). Greater concern about child overweight among mothers of foreign background in Sweden may be ex-plaind by higher obesity prevalence among their children (Besharat Pour et al., 2014) along with higher child obesogenic food intake (Safsten et al., 2016). The latter (child food intake) is independently associated with maternal concern about child weight status (Keller, Olsen, Kuilema, Meyermann, & Belle, 2013). In addition, higher food approach behaviours have been associ-ated with an obesogenic dietary pattern (Fildes et al., 2015), which has been shown among children of foreign-born parents in Sweden (Besharat Pour et al., 2014; Safsten et al., 2016).

## Beyond concern about child overweight

In contrast, studies I and II showed that maternal concern about child overweight predicted lower food avoidance behaviours and lower pressure to eat, but it did not explain the associations with maternal foreign background (Somaraki et al., 2016; Somaraki et al., 2018). In fact, the associations were strengthened when adjusting for maternal concern. These findings suggest that maternal foreign background relates to other types of concerns, which were not captured by the measure used in studies I and II (concern about child overweight).

In particular, concerns –which are specific to child food intake and eating patterns– may be relevant in parent-child feeding dynamics among families with a foreign background (Dawson-Hahn et al., 2020; Jain et al., 2001; Keller et al., 2013; Kininmonth et al., 2020). Children with big appetites may provide examples of good and affectionate parenting among low-income families (Jain et al., 2001; Kaufman & Karpati, 2007). Moreover, histories of migration, structural barriers and food insecurity may underlie concerns about the child getting enough to eat, as demonstrated by Dawson-Hahn et al. (2020) among diverse migrant groups in the US. Thus, any occasion that the child does not eat when food is available, e.g. when large food portions are offered, may be interpreted as a sign of food rejection. Mothers of foreign background in study II may have overstated their children's food avoidance behaviours because they perceived them to be alarming. Moreover, higher perceived food avoidance among mothers of foreign background relate to higher levels of pressure to eat that they endorsed in study I, which aligns with previous research (Ek et al., 2016).

Study II showed that while mothers with a foreign background perceived their children to be more avid eaters overall, they also perceived them as enjoying food less compared to Swedish mothers (Somaraki et al., 2018). These findings are counter-intuitive, considering that all of these food approach behaviours relate to increased food intake and high child weight status, also shown in study II (Carnell et al., 2016; Somaraki et al., 2018). A possible explanation may be that perceived enjoyment of food ties to traditional foods and recipes provided by the mother. Offering these foods in the host country, however, relies on imported products that may not be considered of high quality by the mother, possibly downplaying the enjoyment the child may experience. Interviews with migrant groups in the US suggest that even if foods are accessed in the host country, they *'are less flavourful and lack a familiar smell'* (Dawson-Hahn et al., 2020, p.276).

## Controlling food parenting under stressful situations

Mothers of foreign background in study I endorsed higher levels of controlling food parenting. These findings relate to the literature linking foreign background and migration to higher stress, which influences mothers' mental health and their feeding practices (Eli et al., 2016; Hemmingsson, 2018; Jang, Owen, & Lauver, 2019; Spinosa, Christiansen, Dickson, Lorenzetti, & Hardman, 2019; Tovar et al., 2012). In particular, maternal anxiety and depression relate to higher levels of controlling food parenting (Benton, Skouteris, & Hayden, 2015; El-Behadli, Sharp, Hughes, Obasi, & Nicklas, 2015; Lampard, Franckle, & Davison, 2014). Moreover, perceived stress in life by mothers prospectively relates to weight gain among their children (Shankardass et al., 2014). In fact, stressful situations, which migrants are more like to face on a daily basis, such as unemployment and financial constraints, may elevate the use of controlling practices when they feed their children (Berge et al., 2018).

## What about fathers and other caregivers?

Although studies I and II examined mothers' feeding practices and child eating behaviours across maternal country of birth, only a minority of mothers born outside of Sweden had partners (fathers of the child) who were born in Sweden. Thus, proportionally, mothers' country of birth represented the family foreign background. However, the fathers' role should also be acknowledged in the parent-child feeding dynamics (Kuppens & Ceulemans, 2019; May, Chai, & Burrows, 2017; Niermann et al., 2018; Wells, Sarkadi, & Salari, 2016). A previous study in Sweden has shown that when only the father has a foreign background in the family, children have higher dietary quality compared to Swedish-born children (Besharat Pour et al., 2014). In addition, fathers' practices independently influence child health behaviours (Litchford, Savoie Roskos, & Wengreen, 2020). In studies I and II, the inclusion of mothers only has allowed for direct comparisons with previous studies in childhood obesity, which have mainly focused on the role of mothers (Davison et al., 2016). Future research should be more inclusive of fathers and other caregivers in the extended family in order to understand family food dynamics, where several family members are involved (Neuman, Eli, & Nowicka, 2019).

## Tailored interventions for childhood obesity

To conclude, findings from studies I and II show that interventions for childhood obesity prevention and treatment, which address the parent-child feeding dynamic, need to attend to socio-demographic factors and parents' characteristics (Arredondo et al., 2018; Ayala-Marín et al., 2020). In the context of the ML study in Sweden, fathers' foreign background influenced treatment effects

on child weight status (Ek et al., 2019). Specifically, the parent support programme was effective in decreasing child weight status in a diverse sample of families. However, boosters were a necessary addition to the parent support programme in order to achieve the same treatment effects when the father had a foreign background (Ek et al., 2019). Moreover, cultural differences in the early environment, which parents provide, should be considered in relation to child development, including weight gain trajectories. For example, a study in Sweden demonstrated that both Chinese and Swedish infants were able to predict the action of eating through the use of different means (chopsticks and spoons, respectively), suggesting that cultural norms and references as well as previous experiences are important for child outcomes (Green, Li, Lockman, & Gredebäck, 2016). Similarly, infants in the US and Sweden did not differ in their expressions of enjoyment, despite the apparent higher interaction tempo during play amongst US families (Hedenbro, Shapiro, & Gottman, 2006).

Future research should further examine parental concerns about child weight status and concerns about child's eating among families with a foreign background (especially non-western), which can inform tailored interventions. Tailored interventions could have a direct effect on parenting practices, placing the focus on positive interactions with children while feeding them. This may be particularly relevant for families with a non-western background, who are disproportionately affected by childhood obesity, and tend to endorse higher control in parent-child feeding dynamics (Khanolkar, Sovio, Bartlett, Wallby, & Koupil, 2013; Somaraki et al., 2016). Overall, interventions may address the parent-child feeding dynamic by providing parents of foreign background with the tools to withstand the particular challenges they may face (Ayala-Marín et al., 2020; Ek et al., 2020; Fox et al., 2020; Ohri-Vachaspati et al., 2015).

## Parent-child feeding dynamics in treatment

Studies III through V used data from an obesity treatment RCT (12 months follow-up of the ML study) to evaluate the separate components of parent-child feeding dynamics, i.e. parenting practices (including feeding practices), which were addressed during treatment, and child behaviours (food intake and eating behaviours). Obesity treatment is more effective in reducing weight status among younger children (Ells et al., 2018; Reinehr et al., 2010). In the ML study, the parent support programme was particularly effective in reducing child weight status over 12 months (Ek et al., 2019). However, there is scarce evidence on RCTs in this age group (Ells et al., 2018). The latest systematic review in the Cochrane Library regarding early obesity treatment identified seven studies involving families of pre-schoolers aged up to 6 years old (Colquitt et al., 2016). It is noteworthy that among these studies, only one trial in the US offers a more extensive investigation of parenting practices and child

behaviours as part of an obesity trial involving families of pre-schoolers (Stark et al., 2018; Stark et al., 2011).

## Parenting practices

Study III showed that controlling feeding practices remained consistent over time. The findings align with the evaluation of a US trial among pre-schoolers (Stark et al., 2014). This trial showed that treatment, which addresses parenting skills, facilitates a reduction in child weight status (Stark et al., 2018), similar to the parent support programme in the ML study (Ek et al., 2019). However, treatment approaches involving families of older children have been associated with a decrease in controlling feeding practices (Burrows et al., 2010; Epstein et al., 2008; Steele, Jensen, Gayes, & Leibold, 2014). These contrasting findings, according to child age, may relate to methodological considerations of using the CFQ among different age groups. It may be easier for families with younger children to reduce controlling feeding practices and increase their structure-based food parenting after treatment (i.e. lower availability of energy-dense foods in the home) (Farrow & Blissett, 2008; Rollins et al., 2016). However, the CFQ (Birch et al., 2001), which was used in study III, may not adequately capture this shift. For example, an item assessing restriction in the CFQ is 'I intentionally keep some foods out of my child's reach', which correlates with covert (favourable) control and structured food parenting (Nowicka et al., 2014). This methodological consideration will be further discussed later in the thesis.

Study IV showed that parental limit setting and emotional regulation were modified after obesity treatment, but mothers and fathers followed different trajectories. In particular, mothers increased their limit setting strategies after treatment (whether in standard treatment or parent support programme). Fathers' parenting practices were the only component of the parent-child feeding dynamic, which changed in different ways between the parent support programme and standard treatment; fathers in parent support programme only decreased their emotional regulation.

Altogether, these findings are counter-intuitive, given that children in the parent support programme decreased their weight status compared to standard treatment (Ek et al., 2019). Limit setting represents parental demandingness, and emotional regulation can be understood in relation to parental responsiveness. Both of these dimensions compose the favourable authoritative parenting style (Maccoby & Martin, 1983; Shloim et al., 2015). Thus, we would expect them to increase, in particular among caregivers in the parent support programme, which directly addressed evidence-based parenting practices in the family (Ek et al., 2015). While maternal practices changed in the expected direction (Burnett, Lamb, McCann, Worsley, & Lacy, 2020; Ek et al., 2020), the findings on decreased emotional regulation among fathers in the parent support programme are intriguing. This finding offers some new insights since

studies on parenting in the obesity field are mainly cross-sectional (Gicevic et al., 2016), and very few intervention studies have explicitly involved fathers (Morgan et al., 2017). In fact, the role of fathers as influential caregivers has been demonstrated in the context of emotional expressions, whereby infants of parents (mothers and fathers), who shared their parental leave, processed emotional information more effectively than infants who had been cared by mothers only (Gredebäck, Eriksson, Schmitow, Laeng, & Stenberg, 2012).

The decrease in fathers' emotional regulation in the parent support programme may represent a decrease in fathers' responsiveness, which has been associated with unfavourable child weight status among younger children (Taylor, Wilson, Slater, & Mohr, 2011). Similarly, responsiveness (and higher emotional regulation) may relate to the newly emerging overprotective parenting style, which has been associated with controlling food parenting (van der Horst & Sleddens, 2017) and higher child weight status (Sleddens et al., 2014). An earlier treatment study involving families of older children suggested that structure was communicated more effectively through the parallel reduction in chaos (instability) within the family and less direct expression of emotions over time (Nowicka, Pietrobelli, & Flodmark, 2007). However, study IV did not show any changes in fathers' limit setting, though it remained consistently high over time. Thus, fathers in the parent support programme may have become more efficient in communicating their limit setting strategies, by expressing their emotions in a more direct way. Alternatively, fathers' decrease in emotional regulation may coincide with fathers' increasing awareness of their practices, which reach the same levels as mothers' practices after the parent support programme.

Altogether, study IV supports previous evidence that fathers' (along with mothers') practices need to be assessed when a parenting programme is offered to families (Freeman et al., 2012; Morgan et al., 2019; Panter-Brick et al., 2014; Sarkadi, Kristiansson, Oberklaid, & Bremberg, 2008; Wells et al., 2016). Literature on parenting in obesity research has largely overlooked fathers' practices and often identifies mothers to be the primary caregivers (Morgan et al., 2017), presumably due to the higher responsibility for feeding that mothers have (Harris et al., 2018; Lindsay, Wallington, Munoz, & Greaney, 2018). However, in recent years, this has been changing and fathers are increasingly involved in child rearing (Yogman & Garfield, 2016), though their role may be somewhat different compared to the mothers (Khandpur et al., 2014). Fathers may be more influential in other obesity-related domains, such as engaging in exercise with their children (Lloyd, Lubans, Plotnikoff, Collins, & Morgan, 2014).

## Child behaviours

Study III showed that children in the parent support programme did not show a greater decrease in their intake of EDNP foods. This finding contradicts the

modified child food intake shown in a US trial among pre-schoolers (Robson et al., 2019). Notably, this US trial assessed the caloric content of child's diet and portion sizes, which were found to be amenable to change through treatment, and promoted reductions in child weight (Kuhl et al., 2014; Robson et al., 2019). In study III, the greater reduction in weight status among children in the parent support programme (Ek et al., 2019) implies that dietary modifications may have occurred among children in this group. Notably, pedagogical tools in the parent support programme facilitated nutrition education regarding portion sizes and alternatives for energy-dense foods (Ek et al., 2015; Ek et al., 2019). Interviews with families in the group suggest that both parents and children appreciated these tools, which, combined with enhanced parenting, improved food purchases and mealtimes (Ek et al., 2020). However, the measurement tool (FFQ) in study III, which assessed frequency of food intake rather than the corresponding portions, may not have captured changes in portions in the parent support programme. In support of this statement, an earlier randomised controlled trial in Sweden, which provided treatment of older children with overweight/obesity and their parents and assessed portions, has provided evidence that improvement in several aspects of dietary intake (e.g. lower intake of energy-dense foods and higher intake of more nutritious alternatives) is feasible (Waling & Larsson, 2012; Waling, Lind, Hernell, & Larsson, 2010). In addition, a recent meta-analysis of randomised controlled trials showed that the intake of EDNP foods is a modifiable aspect of diet (Duncan et al., 2020).

Study V showed that children's food approach behaviours, as perceived by their parents, had a decreasing trend, and fussy eating behaviours increased after obesity treatment (whether standard treatment or parent support programme). These findings confirm earlier studies among older children (Boutelle et al., 2019; Boutelle et al., 2014; Cohen et al., 2018; Hayes et al., 2016), which suggest that obesity treatment can directly affect child's appetite and decrease obesogenic food behaviours. Notably, fussy eating behaviours have been shown to decrease after treatment (Hayes et al., 2016), which contradicts the finding in study V. However, no previous study has evaluated eating behaviours among younger children post treatment. Fussy eating behaviours typically develop during the pre-school years (Taylor, Wernimont, Northstone, & Emmett, 2015), and findings of study V may simply reflect this developmental trajectory. Another explanation may relate to new foods, in particular vegetables, being introduced during (or because of) treatment, so that parents become aware of their child's fussiness. Alternatively, fussy eating behaviours may co-exist with an obesogenic appetitive profile among children with obesity in older (Crocker, Cooke, & Wardle, 2011) and younger (Sandvik et al., 2018) ages. Thus, tailored interventions may be needed to address food fussiness in the context of treatment. Notably, an earlier evaluation of the food fussiness scale using data from the ML study did not find any changes (Sandvik et al., 2019). However, this evaluation included all food neophobia

items, which had been eliminated from the measurement tool for the purpose of study V. This methodological consideration is addressed later in the thesis.

## How do parenting and child behaviours affect the child's obesity?

Studies III through V evaluated parenting practices and child behaviours in the ML study. Analyses addressed the individual components of the parent-child feeding dynamic, i.e. parenting practices and child behaviours. Moreover, when parenting practices were considered, they included mothers' and fathers' practices separately. This approach allows for the examination of the individual components, which converge to influence childhood obesity.

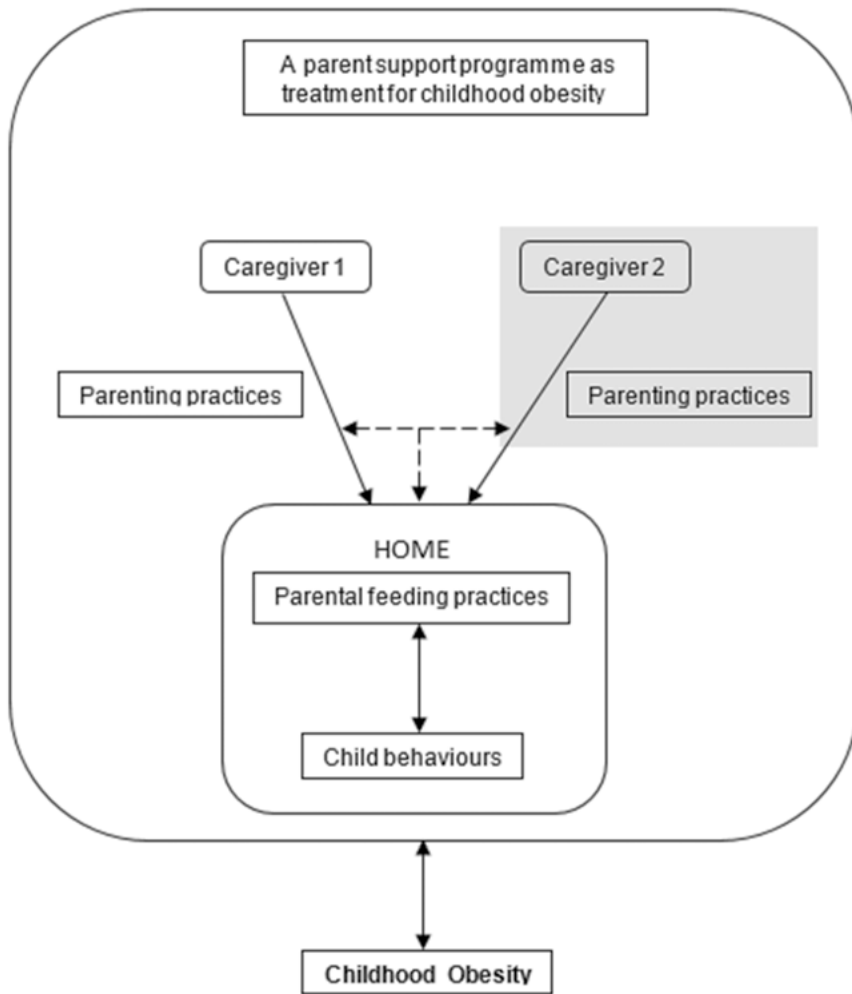
How does this happen?

Findings on child weight status in the ML study suggest that children in the parent support programme experienced greater reductions in their weight status (Ek et al., 2019). This piece of evidence provides the guide to understanding how the parent-child feeding dynamic may affect child weight status. Considering that a multitude of factors may influence treatment effects on childhood obesity (Bray et al., 2017), the present thesis addresses only parenting practices and child behaviours, as outlined using the measurements included in the thesis. All findings considered, only fathers' parenting practices were modified in a way to explain the greater decrease in child weight status in the parent support programme (study IV). On the contrary, mothers' parenting practices were modified by the mere participation in a structured treatment programme (study IV). These findings call for the inclusion of fathers in childhood obesity treatment and specifically, attending to fathers' parenting practices. In addition, the findings support the conceptual model of the ML study whereby the parent support programme directly influences evidence-based parenting practices (i.e. limit setting, emotional regulation), in order to affect child behaviours and weight status (Ek et al., 2015; Ek et al., 2019). However, parental (mothers' and fathers') feeding practices remained consistent post treatment, and child behaviours changed in the same way between standard treatment and the parent support programme.

The findings regarding parenting practices may be explained in different ways. A possible explanation is that fathers in the parent support programme may have uniquely influenced their children in other obesity-related domains, namely physical activity (Lloyd et al., 2014), which were not assessed in the ML study (Ek et al., 2015). Moreover, the unique changes in fathers' parenting practices may have influenced co-parenting, i.e. the joint parental influences in the home environment (Kuppens & Ceulemans, 2019; Niermann et al., 2018). For example, a Dutch study showed that paternal responsiveness favourably relates to child snacking if parents are congruent, in terms of their responsiveness (Gevers, van Assema, Sleddens, de Vries, & Kremers, 2015).

In turn, co-parenting may have modified the effects of feeding practices on child behaviours. The parent support programme may have indirectly influenced the parenting context and the family setting through direct links with each caregiver's parenting practices (Dishion et al., 2016). A previous study showed that controlling feeding practices might have favourable effects on child behaviours in a structured and responsive parenting context (Sleddens et al., 2014). In addition, child behaviours also influence parental feeding practices (Webber, Cooke, Hill, & Wardle, 2010) and maintaining controlling feeding practices in a clinical sample may be desirable (i.e. limiting access to energy-dense foods), while modifying other parenting skills and improving the overall communication with the child (which may dictate whether the controlling practice is actually perceived as coercive or not).

Figure 6 illustrates the suggested parent-child feeding dynamics, which took place in the ML study and facilitated greater reduction in child weight status in the parent support programme. Families included in studies III through V consisted of two biological parents, and the majority of children were living with both parents. Thus, caregivers' dynamics in this thesis were conceptualised as mother-father dyads, similar to previous studies in the field (Litchford et al., 2020; Lloyd et al., 2014; Pratt, Hoffmann, Taylor, & Musher-Eizenman, 2017). However, the interrelationships illustrated in Figure 6 may extend to include any caregivers' interpersonal relationships, such as LGBTQ families and the extended family (Costa & Bidell, 2017; Neuman et al., 2019). In this conceptualisation, there might also be a division of responsibility between caregivers, in affecting certain health behaviours of the child (i.e. food, sedentary activity and physical activity). Future research should elucidate these aspects of parenting.



*Figure 6.* The potential mechanism for how the parent support programme improved child weight status in a *diverse* clinical sample. Parental feeding practices remained consistent and child eating behaviours changed in the same direction in all groups. Thus, the parent-child feeding dynamics need to be considered in the context of changes in evidence-based parenting practices addressed during the programme (grey area). The pathways indicated by dashed lines were not examined, and they refer to co-parenting. The illustration does not distinguish between caregivers according to their gender (caregiver 1 and 2). This highlights that similar dynamics, as those observed in the ML study (which involved mother-father dyads as caregivers), may develop when the co-parenting couples differ.

## Methodological considerations

This section summarises the key methodological considerations and assumptions underlying the studies included in the thesis. These are relevant for interpreting the findings.

### Background factors

#### **Pre-school age (Studies I through V)**

Children of pre-school age have been involved in all studies. Although there is no consensus on a definition for pre-school age internationally, studies I through V include children up to 6 years. This approach aligns with the definition for pre-schoolers used in the latest Cochrane review on early obesity treatment (Colquitt et al., 2016), and other review studies about childhood obesity in the European context (Garrido-Miguel et al., 2019). The pre-school age is particularly promising for both obesity prevention and treatment (Brown et al., 2019; Ells et al., 2018). For one thing, trajectories of high weight status are already established at this young age (Buscot et al., 2018; Jansen et al., 2013), and for another, parents still exert great influence to facilitate lifestyle changes and modify the obesity trajectories of their children (Morgan et al., 2020).

#### **Mothers and fathers: caregivers (Studies I through V)**

The wording “mothers and fathers” refers to caregivers who have identified themselves as the biological mother/father of the child. In all studies, biological mothers and fathers have reported on their practices and their child’s behaviours. However, findings in this thesis may extend to any adult caregivers, including LGBTQ families and/or grandparents. Moreover, the effects of co-parenting need to be considered. Future research should address these questions.

#### **Foreign background (Studies I through V)**

In studies I and II, foreign background is explicitly defined according to mother’s country of birth (foreign-born/migrant background). This variable has been included in the analyses, and it has been used for the interpretation of the findings, similar to official statistics, and previous studies in Sweden (Besharat Pour et al., 2014; Khanolkar et al., 2013; Safsten et al., 2016). Although mothers in study I fell into four categories (Swedish-born, Nordic/western European, eastern/southern European, and non-European), study II offered a more elaborate classification of mothers born in a non-European country (Somaraki et al., 2018). The differences found in study II highlight the strength of using more detailed groupings, and call for additional work to understand the specific factors influencing the parent-child feeding dynamic across groups of foreign-born mothers.

In the ML study (studies III through V), the definition for foreign background is used, which also considers grandparents' (maternal or paternal) country of birth. This definition does not influence the interpretation of findings in studies III through V, because they are not explicitly linked to foreign background. However, consideration of parental foreign background shows that the ML study sample is representative of the general population. According to official statistics (2019), foreign-born individuals in Sweden (according to country of birth) were 2,019,733, while individuals with a foreign background (including foreign-born individuals and individuals who were born in Sweden but with two foreign-born parents) were 2,634,967 (Statistics Sweden, 2019). It, thus, becomes clear that the population in Sweden with a foreign background, mainly comprises people born in a country other than Sweden (77%). This corresponds to the ML study datasets, where roughly 80% of mothers and fathers identified as having a foreign background were actually born in a country other than Sweden. Thus, findings in parent-child feeding dynamics refer to a representative sample, which has not been shown in previous studies for obesity treatment (Colquitt et al., 2016; Ells et al., 2018) and strengthens the generalisability of the findings.

### **Parental education (Studies I through V)**

Parental education was used as a proxy for socio-economic status. This is in line with other studies conducted in Sweden examining the role of parental migrant background (Besharat Pour et al., 2014; Safsten et al., 2016), and nationwide studies on adult and childhood obesity and related behaviours (Barbieri et al., 2006; Lissner et al., 2016; Osowski, Lindroos, Barbieri, & Becker, 2015). In addition, the categories used in studies I through V are based on the International Standard Classification of Education, which sets the cut off for high levels of education at more than 12 years of schooling (UNESCO, 2012). However, it may not cover all aspects of socio-economic status, which relate to feeding practices. For example, socio-economic status has also been conceptualised based on both education and occupation (Cardel et al., 2012). This is especially relevant in studies I and II, where residual confounding, related to the definition of socio-economic status, may explain part of the associations between maternal migrant background and the examined aspects of the parent-child feeding dynamic.

## **Measurement tools**

### **Valid and reliable measurement (Studies I through V)**

All measurement tools used in studies I through V have been assessed for their validity and reliability in previous studies (Doring et al., 2014; Ek et al., 2016; Nowicka et al., 2014). In addition, a new tool for assessing evidence-based parenting practices was developed and validated, so that it can be used in the

ML study (study IV). In study V, the validation of the CEBQ using the Rasch model was an integral part of the analysis, which offered some additional insights into the use of the measurement tool (a discussion of this follows). These insights were considered when using the CEBQ for the evaluation of eating behaviours in the ML study.

### **Parent-reported data (Studies I through V)**

Parents reported on their behaviours (self-reported data) and their child's behaviours. In Sweden, children of the age group included in the present studies spend a great part of their days at the pre-school, where they are offered meals (Osowski et al., 2016). Thus, input by pre-school teachers, or a more detailed description of the quality of meals offered and the amount eaten by the children would be valuable. However, parents of pre-schoolers are reliable reporters of the child behaviours assessed in the thesis. For one thing, eating behaviours represent the general way children approach food, which underlie all their eating occasions, and parents can easily identify them. In addition, parental reports on their own parenting, including evidence-based parenting practices and feeding practices, as well as their children's behaviour may provide insights into the underlying concerns, beliefs, and attitudes that make up the home environment and the parent-child interaction that takes place therein. This perspective may not be captured when using observations of the behaviours in an unfamiliar lab setting. Moreover, the obesogenic foods assessed through the FFQ are rare in pre-schools, which are required to follow recommendations by the National Food Agency regarding nutritious meals (Swedish Food Agency, 2016). Thus, parents bear the main responsibility for providing the EDNP foods, which the FFQ assesses. An additional point in favour of using parent-reported data is the opportunity to collect data from larger samples, who participate in controlled trials that include multiple measurements over time along with a multitude of behavioural outcomes, in addition to the primary outcome. In fact, the latter has been the case in the ML study, which offers abundant data for secondary analyses in behavioural outcomes of both parents and their children.

### **The Child Feeding Questionnaire (Studies I and III)**

The CFQ has facilitated extensive research on parental feeding practices and has increased the understanding of control in food parenting (Shloim et al., 2015; Vaughn et al., 2016). However, it does not clearly differentiate between favourable forms of control and coercive control (e.g. 'I have to be sure that my child does not eat too many high-fat foods') (Birch et al., 2001). This is particularly relevant for pre-schoolers, who are still under the influence of their parents. In this age group, parents bear the main responsibility for food provision and, thus, they may apply control in ways that are not directly detected by the child.

Studies I and II did not include any form of intervention (they are cross-sectional), and, thus, unfavourable forms of control are captured by the CFQ, as demonstrated in previous studies (Birch et al., 2003; Galloway et al., 2006). However, study III used data from the ML study, which offered treatment to families. Thus, treatment, especially the parent support programme, may have influenced the form of control, and not necessarily the amount of control that parents of pre-schoolers have over their child's feeding. Since the CFQ items do not explicitly address the form of control, findings in study III may simply reflect the fact that parents of pre-schoolers with obesity apply structure-based control, as a response to treatment, in order to address their child's obesity (Balantekin et al., 2020; Rollins et al., 2016). Other measurement tools, for example, the Comprehensive Feeding Practices Questionnaire (CFPQ), may distinguish between favourable and unfavourable forms of control exercised by the parents in the feeding domain (Musher-Eizenman & Holub, 2007). The CFPQ is the tool of choice in the More and Less Europe study (Ek et al., 2019), which will evaluate the effectiveness of the parent support programme in three different settings (Sweden, Romania and Spain).

#### **The Emotions and Communication in Parenting questionnaire (Study IV)**

The new parenting questionnaire was developed according to international criteria in order to assess parenting practices, which were addressed in the parent support programme in the ML study. Study IV provides the validation of this tool using Exploratory Factor Analysis. The identified factors, i.e. limit setting and emotional regulation, which can be linked to the overarching dimensions of parental demandingness and responsiveness in parenting, provide evidence that the tool assesses relevant aspects of parenting. In addition, the validation of the parenting questionnaire considered internal consistency based on a single administration, but not other aspects of reliability, such as test-retest reliability (Streiner et al., 2014). Thus, variation between different reports by the same parent has not been accounted for, which is a limitation (Streiner et al., 2014).

#### **The Food Frequency Questionnaire (Study III)**

The FFQ assessed the frequency of intake of EDNP foods, which contribute to a high-calorie diet and excess weight gain. However, it does not include information on portion sizes, which is an important aspect of diet-induced weight gain among pre-schoolers (Syrad et al., 2016).

Study III, which is based on data from the ML study, did not identify any pronounced changes in child food intake, especially in the parent support programme. It is possible that children continued eating EDNP foods with the same frequency, but parents paid more attention to the portions offered. This assumption is based on interviews conducted with parents in the parent sup-

port programme who mentioned the visual pedagogical tools (including information on portion sizes), which were demonstrated during the group sessions (Ek et al., 2020). However, social desirability bias cannot be excluded, as the data are self-reported. This may be the reason why parents in standard treatment reported a decrease in the consumption frequency of some EDNP foods among their children compared to baseline. Standard treatment focuses on lifestyle modifications and to a large extent makes use of the recommendations by the National Food Agency (Stockholm County, 2015), which are directed to limiting consumption frequency. In the More and Less Europe study (Ek et al., 2020), child food intake will be assessed using urinary metabolites, which will be validated against 24-h recalls. These methods may bypass issues with self-reported food intake data.

### **The Child Eating Behaviour Questionnaire (Studies II and V)**

The CEBQ is the most valid and widely used tool for assessing child eating behaviours. It has been used throughout different contexts producing consistent results. In fact, study V in the thesis used a different method to evaluate the tool's psychometric properties, namely the Rasch analysis, compared to earlier validation procedures. The findings crystallise the validity of using the CEBQ in childhood obesity research. However, the use of the tool to evaluate behavioural outcomes of interventions may need to consider the relatively small number of items, which are not enough to assess the full range of the distinct food approach and food avoidance behaviours. The findings regarding food fussiness may illustrate this point. Out of the six items, describing manifestations of child food fussiness, the majority (four items) describe food neophobia (e.g. 'My child refuses new foods at first'). While there is no consensus on the definition of food fussiness (fussiness may include the rejection of both familiar and unfamiliar foods), it is striking that all the items clearly expressing neophobia attitudes of the child were found to represent the exact similar levels of food fussiness. This indicates that these four items are interchangeable in the CEBQ (i.e. they assess the same thing), and using only one to assess the neophobia aspect of food fussiness would suffice. Moreover, it shows that though food neophobia is a distinct concept, which is relevant to the overarching fussy eating behaviours, it does not relate to very high levels of food fussiness. Rather, the items describing more extreme behaviours seem to primarily reflect parental concerns about the (otherwise typical) rejection of foods in the pre-school years. Alternatively, high levels of parent-reported fussiness of the child may reflect broader behavioural problems (Cardona Cano et al., 2016), which the parents interpret as less enjoyable eating (i.e. 'My child enjoys a wide variety of foods' and 'My child is difficult to please with meals'). Notably, together with Sandvik et al. (2019), we have provided an evaluation of food fussiness outcomes in the ML study, using all six items (i.e. food neophobia is very influential in describing fussy eating behaviours). In this earlier study, food fussiness did not change in different ways across the

treatment groups, nor did it change overall. In the present thesis, after removing the additional neophobia items (keeping one only), we found an overall increase in food fussiness in the clinical sample of the ML study. These contrasting findings may indicate that after obesity treatment, parents place more focus on the family's nutrition and they try to introduce a greater variety of foods, or pay more attention to portions, while limiting the consumption of certain foods (in different ways). The children, who are encouraged to modify certain aspects of their diet, may not always meet this attempt in a positive way. Thus, parents may report less pleasurable eating in response to that.

## Missing data and power

Missing data is a limitation of the thesis.

While studies I and II included a large sample size, mothers with a migrant background had proportionally more missing data. This may have diluted the association between maternal migrant background and both controlling feeding practices and child eating behaviours.

The ML study (studies III-V), similar to earlier studies (Burrows et al., 2010; West et al., 2010), had missing data on parent-reported questionnaires over time (focus of the thesis). In the ML study, the missing data were more prevalent among families with a foreign background and without a university degree. However, the study was successful in recruiting a diverse sample (60% of the families with a foreign background, 40% with a university degree), compared to previous research. For example, Ells et al. (2018) provide an overview of the lack of diverse samples in obesity treatment. Language barriers and competing commitments may explain the issue; moreover, it is possible that missing data have influenced the overall estimations. We may assume that parents who did not provide data on their own or their child's behaviours would benefit more by the parenting programme, in particular by the addition of boosters (Ek et al., 2019). Thus, the effects of this treatment group on behavioural outcomes may have been underestimated, as compared to the other groups. Alternatively, families with missing data, who were lost to follow-up, may require a more tailored and sustained approach to address their child's obesity. Considering their data in the present analyses may have diluted any effects of treatment. Thus, qualitative work reaching out to communities from disadvantaged areas, with the aim to better understand the particular needs of families, may be worth considering. An example is the Healthy Beginnings prevention programme in Australia. This programme, which focuses on early child feeding, is currently being adapted to convey its key messages in a culturally appropriate manner among Chinese and Arabic mothers in Sydney (Marshall et al., 2020).

Studies III and IV, which revolve around parent behaviours, did not address the issue of attendance in treatment and how it may have influenced the out-

comes over time, because effectiveness and ‘real-life’ conditions were of interest. Notably, parents who missed any group sessions were contacted by the research group to secure that all families received the material. As for standard treatment, parents had the opportunity to reschedule, but this was not always the case (Ek et al., 2019).

After excluding families with missing data on the questionnaires, all families across treatment groups remained similar, in terms of their background characteristics (50-60% of families had a foreign background). Thus, the missing data did not influence the comparisons made across treatment groups and the assumptions of a randomised controlled trial were fulfilled. Yet, the findings may not be generalisable to other populations (e.g. populations in continental Europe with a different composition of migrant groups). To understand the generalisability of the treatment and the findings, the More and Less Europe study will offer an understanding of the effects of the parent support programme in different contexts (Sweden, Romania and Spain) (Ek et al., 2019).

Missing data add to the issue of power in the ML study in detecting change regarding behavioural outcomes through secondary analyses. Participant recruitment in the study was based on power calculations considering the primary outcome (changes in child weight status). Thus, analyses in the present thesis may not have enough power to detect significant changes between and across treatment groups over time. Notably, previous studies of similar sample size, which used similar behavioural measurement tools, have identified changes of similar magnitude (Burrows et al., 2010; Duncanson, Burrows, & Collins, 2016). The clinical relevance of such effects remains to be elucidated.

## Future research

Future research should focus on methodological aspects of measuring parent and child obesity-related behaviours. This does not necessarily mean that more tools should be developed, but existing measures and questions could be refined through multiple stages in order to assess a comprehensive set of parenting practices (Vaughn et al., 2016) and child behaviours (Byrne et al., 2019). Another issue, which relates to the measurement tools, is the identification of clusters of parents who apply certain combinations of practices. It is conceivable that favourable forms of control (e.g. monitoring and limit setting) promote health behaviours among children, but they may co-exist with other less favourable practices. The combined effects of practices, which may be commonly endorsed together, is yet unknown (Duncanson et al., 2016). In addition, feeding practices may have different effects on child food intake and/or weight status, depending on the overall interrelationships between parents and their children, as defined by evidence-based parenting practices. Hence, future studies should include measures of both evidence-based parenting practices and feeding practices and examine how they relate to each other and also

how they influence the child. Another point that has received attention is the effects of joint parenting (Kuppens & Ceulemans, 2019). This thesis contributes to understanding the unique contributions of fathers/other caregivers in obesity treatment. Yet, the joint effects of considering both caregivers may provide a more accurate representation of how parenting affects children. Portion sizes of child food intake, in addition to consumption frequency, need to be considered in treatment evaluation, especially if we consider that parents may find it particularly challenging to address the amount of food consumed in the home. From a systems perspective, the interrelationships between parents and their children during treatment and through long follow-up periods need to be incorporated in future evaluations of parenting programmes for obesity treatment.

Obesity research needs to address the demographic changes observed across many settings globally. Parent and child behaviours in relation to feeding, along with their effects on health behaviours and child weight status, need to be examined across groups of migrant backgrounds residing in the same context. Parental concerns around their child's eating and weight need to be addressed in prevention and treatment efforts, so that tailored approaches can be developed and tested. In addition, existing programmes may be adapted to better account for the specific needs of minority groups, and qualitative work may contribute to this end.

Although data in the present thesis were collected well before the outbreak of COVID-19 in the beginning of 2020, they highlight the importance of several obesity-related factors in the home environment, which may have already been affected or will be affected due to COVID-19 related policies (e.g. school closures). Overall, the health and social impact of events related to the outbreak have not yet been studied; nonetheless, scarce data suggest that it may affect obesity trends. Data from northern Italy suggest that lockdown measures had unfavourable effects on several health behaviours among children with obesity, which may exacerbate weight gain (Pietrobelli et al., 2020). Projections among US pre-schoolers demonstrated that the rise in childhood obesity might disproportionately affect ethnic minority groups (An, 2020). Data from Sweden show that the virus affects migrant groups to a larger extent (Hansson, Albin, Rasmussen, & Jakobsson, 2020). However, it is not yet known how these figures may affect health behaviours and obesity trends. Close monitoring and follow-up on obesity trends over time, especially among low-income and vulnerable groups, is, therefore, warranted. Similarly, aspects of the home environment and the parent-child feeding dynamic, which influence obesity, need to be evaluated under fast-paced changes.

## Conclusion

The starting point of the present thesis was the parent-child feeding dynamics, which relate to childhood obesity. In particular, parenting practices and child behaviours, which relate to weight gain in childhood, were examined in relation to foreign background and in the context of treatment.

Several differences were found between mothers born in Sweden and mothers born abroad. Mothers born in a country other than Sweden exerted more control in their food parenting compared to Swedish-born mothers. In particular, mothers born in an eastern/southern European and non-European country restricted access to and intake of energy-dense foods and pressured their children to eat to a larger degree. Accordingly, mothers born in a country other than Sweden perceived their children's eating behaviours in a different way compared to Swedish-born mothers. In particular, mothers born in a Middle Eastern/North African country perceived their children as exhibiting more frequent food approach and food avoidant behaviours. In other words, those mothers reported, on average, that their children would overeat in response to external cues (whether food or emotion related). At the same time, they reported that their children would eat according to their internal cues for satiety and hunger. Maternal concerns about child weight status influenced the observed associations, and should be the focus of further research in order to guide tailored obesity interventions in a context of rapid demographic change.

In the context of the More and Less study for obesity treatment, a parent support programme for obesity treatment was previously found to be more effective in reducing pre-schoolers' weight status compared to standard treatment. The present thesis examined possible mechanisms (parenting practices and child behaviours) for this finding. Obesity treatment influenced the parenting practices assessed, while the parent support programme particularly affected fathers' evidence-based parenting practices when compared to standard treatment. In contrast, obesity treatment did not affect controlling feeding practices, which remained stable. Similarly, children did not reportedly decrease their consumption frequency of energy dense foods. However, after obesity treatment, parents perceived that children exhibited certain food approach behaviours that may contribute to overeating less frequently. Methodological limitations should be considered in future work, which may employ a more comprehensive assessment of child food intake (assessment of food portions) and food parenting (assessment of favourable feeding practices).

Overall, the present thesis provides evidence that parent-child feeding dynamics, comprising parenting practices and child behaviours, need to be considered in a demographically diverse context in order to increase the effectiveness of obesity prevention and management approaches. In addition, the thesis highlights that both caregivers are important in affecting their child's obesity, possibly shifting the parent-child feeding dynamics in the family and providing an appropriate context for lifestyle changes.

# Svensk Sammanfattning

## Bakgrund

Andelen skolbarn med fetma har femdubblats de senaste trettio åren med en brantare ökning de senaste tio åren enligt statistik från Folkhälsomyndigheten. Detta är en oroande utveckling eftersom fetma har allvarliga konsekvenser för både fysisk och psykosocial hälsa.

Både ärftlighet och miljö har betydelse för utvecklingen av fetma. Hemmet är den första miljön barn möter och föräldrar har en viktig roll i att forma denna miljö. Vidare är tiden kring förskoleåldern av stor betydelse för hur interaktionen mellan barn och föräldrar utvecklas. Fokus i denna avhandling är därför samspelet mellan barn i förskoleåldern och deras föräldrar i relation till mat och ätande.

Både föräldrars och barns agerande avgör hur samspelet utvecklas i hemmet. Föräldrabetenden kan benämnas som föräldrategniker vilka i denna avhandling definieras som evidensbaserade föräldrabetenden som stärker föräldra-barnrelationen. Föräldrategniker kan också vara betenden som används specifikt i matsituationer. Med barnets agerande syftas här framförallt till barnets ätbeteende och dess matintag. Evidensbaserade föräldrategniker innebär att föräldrar är lyhörda för barnets behov samtidigt som det finns regler och struktur i hemmiljön. Tidigare forskning har relaterat dessa föräldrabetenden till en mer gynnsam social och emotionell utveckling hos barn, lägre viktstatus och mer hälsosamma vanor. Tittar man på föräldrabetenden i matsituationer visar forskningen att föräldrar som är kontrollerande i måltidssituationen och till exempel tjarar på barnet att äta upp all mat på tallriken har kunnat relateras till mer ogynnsamma hälsobeteenden och viktstatus hos barn. I denna avhandling studeras barns ätande och fokus är deras ätbeteende (om de tycker om mat eller är kräsna) och intag av livsmedel som har betydelse för ett barns hälsa.

Vi är alla en del av en större kontext och här finns faktorer som är viktiga att ta hänsyn till när man studerar föräldrategniker och barns betenden i relation till barnfetma. Denna kontext beskrivs väl i den socioekologiska modellen för barnfetma. I denna modell placeras barnets betenden i centrum och den illustrerar hur föräldrar påverkar barnet genom sitt föräldraskap, både generellt och specifikt relaterat till mat och ätande. Modellen visar också att andra faktorer utanför familjen, såsom sociodemografiska faktorer också påverkar samspelet mellan barnet och dess föräldrar. Exempelvis så kan en utländsk bakgrund kopplas till både kulturella och strukturella faktorer som påverkar ätande och hälsa. I Sverige är en fjärdedel av invånarna antingen födda

utomlands eller så har de utrikesfödda föräldrar. Utländsk bakgrund är i fokus i avhandlingens två första delarbeten.

Fetma beskrivs som en kronisk sjukdom där kontinuerlig behandling behövs. Behandlingen av barnfetma innebär ofta ett anpassat stöd till föräldrar i hälsosamma levnadsvanor med fokus på mat och rörelse. De behandlingsmetoder som finns saknar dock i allmänhet en stark teoretisk och empirisk grund och det är svårt att utröna vad i behandlingarna som är de viktigaste framgångsfaktorerna. Vidare saknas forskning kring betydelsen av föräldrategniker kopplade till mat och ätande för viktneđgång samt vilket stöd som i behandlingen bör erbjudas för att bemöta barns olika ätbeteenden. Dessutom har tidigare studier främst fokuserat på mammor och forskning som inkluderar pappor samt familjer med olika socioekonomisk bakgrund saknas. Denna avhandling behandlar dessa begränsningar genom att använda data från den randomiserade kontrollerade studien Mer och Mindre (MoM-studien). MoM-studien genomfördes i Stockholms län och syftade till att utvärdera effektiviteten av ett föräldraprogram (med fokus på evidensbaserade föräldrategniker) jämfört med den standardbehandling som vanligtvis erbjuds barn med fetma.

### **Syfte**

Det övergripande syftet för denna avhandling är att undersöka föräldrategniker samt barns matintag och ätbeteenden, i förhållande till utländsk bakgrund och behandling av fetma hos barn i förskoleåldern.

1. Att i förhållande till utländsk bakgrund undersöka barns ätbeteenden och mödrars matrelaterade föräldrategniker (studie I och II)
2. Att undersöka föräldrars användning av evidensbaserade föräldrategniker samt matrelaterade föräldrategniker efter deltagande i en behandling för barnfetma (studie III och IV)
3. Att undersöka barns matintag och ätbeteenden efter deltagande i en behandling för barnfetma (studie III och V)

### **Metod**

Avhandlingen inkluderar fem delstudier. Studie I och II baseras på ett populationsbaserat urval i Malmö och två urval ifrån Stockholm (en skolbaserad och en klinisk population). Det populationsbaserade urvalet ifrån Malmö rekryterades genom svenska befolkningsregistret (876 mammor till 4-åriga barn) och det skolbaserade urvalet rekryterades genom 25 skolor/förskolor i Stockholms län (353 mammor). Det kliniska urvalet är familjer som deltog i MoM-studien för behandling av barnets fetma. Studie III-V baseras på data ifrån MoM-studien. I MoM-studien randomiserades 177 barn och deras föräldrar till ett föräldrastödsprogram, med och utan uppföljande samtal (s.k. booster sessioner) som sedan jämfördes med standardbehandling för barn med fetma. Föräldrastödsprogrammet syftade till att stärka föräldrarna i evidens-

baserade föräldrategniker såsom positivt engagemang, uppmuntran, problemlösning och gränssättning, tillsyn och emotionell reglering, medan standardbehandlingen fokuserade på livsstilsförändringar och representerade den vård som vanligtvis erbjuds på barn och ungdomsmedicinska mottagningar i Stockholms län. Utvärderingen av MoM-studien visade att barnen vars föräldrar deltog i föräldrastödsprogrammet med uppföljande samtal förbättrade sin viktstatus avsevärt mycket mer än barnen som fick standardbehandling.

Studie I och II fokuserar på betydelsen av mödrars utländska bakgrund. Moderns födelseland användes som variabel för att dela in deltagarna i fyra respektive sju grupper. I studie I var grupperna: svenskfödda, nordiska/västeuropeiska, öst/sydeuropeiska samt icke-europeiska. I studie II var indelningen den samma, med undantaget att den icke-europeiska gruppen delades in i fyra grupper (Mellanöstern och Nordafrika, Öst, Syd- och Sydostasien, Subsahariska Afrika samt Central- och Sydamerika). Föräldrarna besvarade enkäter om sig själva och om sitt barn. Enkäten Child Feeding Questionnaire (CFQ) användes för att undersöka föräldrars agerandes i matsituationer med barnet i studie I och enkäten Child Eating Behavior Questionnaire (CEBQ) användes för att undersöka barns ätbeteende i studie II.

Studierna III och IV fokuserar på föräldrategniker (evidensbaserade föräldrategniker och föräldrabetenden i matsituationer). Ett nyutvecklat frågeformulär (Emotions and Communication in Parenting-frågeformulär) användes för att utvärdera föräldrars upplevda förmåga att sätta gränser och att ha kontroll på sina känslor i samspelet med sitt barn medan CFQ användes för att utvärdera föräldrabetenden i matsituationer. Vidare fokuserade studie III och V på barns ätbeteenden, inklusive matintag. Intag av energitäta livsmedel utvärderades genom ett matfrekvensfrågeformulär (FFQ), och CEBQ användes för att bedöma barnens ätbeteende (baserat på resultat från en validering av enkäten med Rasch, en valideringsmetod som tidigare inte har använts på CEBQ).

## **Resultat**

Mödrar födda utanför Västeuropa rapporterade högre nivåer av kontrollerande matrelaterade strategier (begränsning av energitäta mat och truga barnet till att äta upp maten) jämfört med svenskfödda mödrar (studie I). Dessutom upplevde mödrar som var födda i ett annat land än Sverige (Mellanöstern/Nordafrika) att deras barn åt mer (t.ex. hade högre grad av emotionellt överätande och oftare frågade efter något att dricka) men inte att de uppskattade mat mer. Vidare upplevde dessa mödrar till större grad även att deras barn hade ett mer undvikande ätbeteende jämfört med svenskfödda mödrar (studie II). Mammornas oro för barnets övervikt var en betydande faktor för i vilken utsträckning mammorna var mer kontrollerande i matsituationer med sitt barn samt för hur de upplevde sitt barns ätbeteende.

Resultat från MoM-studien (studie III-V) visade att varken mammor eller pappor som deltagit i föräldrastödsprogrammet (med eller utan boosters)

minskade sin nivå av kontrollerande matrelaterade föräldratekniker jämfört med föräldrar som deltog i standardbehandlingen. Det fanns emellertid olika trender för mammors och pappors föräldratekniker efter behandlingen. Mammor ökade i allmänhet sin upplevda förmåga att sätta gränser medan pappor i föräldrastödsprogrammet rapporterade att de inte lika ofta reglerade sina känslor i samspelet med sitt barn jämfört med vad de rapporterat vid studiestart.

Barnen i föräldrastödsprogrammet (med eller utan boosters) minskade inte sitt intag av energität mat mer än barnen i standardbehandlingen. Generellt så minskade barnen de ätbeteenden som har samband med en högre vikt hos barn och ökade ätbeteenden som kan kopplas till en lägre vikt hos barn efter fetma-behandlingen. Förändringarna i beteenden över tid var inte mer uttalade hos barnen i föräldrastödsgruppen.

## **Diskussion**

Resultaten i studie I och II lyfter fram den socioekologiska modellens relevans för att studera betydelsen av familjers socioekonomiska bakgrund för barns viktutveckling. Dessutom bekräftar resultaten tidigare forskning ifrån Europa avseende sambandet mellan utländsk bakgrund och föräldratekniker relaterade till fetma och barns ätbeteende. Sammanfattningsvis visar resultaten att det finns samband mellan barns ätbeteende och kontrollerande föräldratekniker i matsituationer med barnet. Mödrar med icke-västerländsk bakgrund upplevde att deras barn reagerade starkare på matrelaterade stimuli i omgivningen men också att känslor påverkade deras ätbeteende. Därtill upplevde dessa mödrar även att barnets egna fysiologiska hunger- och mättnadssignaler var starkare. Följaktligen använde mammor med icke-västerländsk bakgrund mer kontrollerande strategier i matsituationer med barnet. Dessa resultat diskuteras i relation till mödrarnas rapporterade oro för barnets viktstatus, ätbeteende och matintag. Utländsk bakgrund och migration har ett samband med förändrade kostvanor och högre prevalens av fetma bland barn, vilket i sin tur medför en ökad oro för övervikt och fetmarelaterade beteenden hos barnen. Samtidigt kan föräldrars tidigare upplevelser, brist på mat och kulturella skillnader när det gäller mat öka oro för undervikt och att barnet inte får tillräckligt med mat. Dessutom tycks utrikesfödda mödrar oftare uppleva pressade situationer i vardagslivet, såsom ekonomiska begränsningar, vilket också kan påverka hur de agerar i matsituationer med sitt barn.

Resultat ifrån studie III-V visar att ett föräldrastödsprogram som fokuserar på föräldrabetenden särskilt påverkade pappornas föräldratekniker jämfört med standardbehandling. Hur föräldrarna agerade i matsituationer förändrades däremot inte och inte heller barnets ätbeteende eller matintag efter föräldrastödsprogrammet. Resultaten pekar på betydelsen av pappors roll, och förmodligen även betydelsen av andra vuxna som är involverade i barnets uppfostran, t.ex. mor-och farföräldrar eller föräldrarnas eventuella nya partners. Det är troligt att det finns en ansvarsfördelning mellan föräldrar för vem som gör vad inom familjen. Det är därför möjligt att genom att stärka föräldrarna i

evidensbaserade föräldratekniker så skapas förutsättningar i hemmiljön för att främja en hälsosam viktutveckling hos barnet. Sammantaget ger denna avhandling stöd för att både föräldratekniker som kan kopplas till barns viktstatus och barns beteenden tillsammans med sociodemografiska faktorer såsom utländsk härkomst måste tas hänsyn till för att öka effektiviteten av förebyggande och behandlande åtgärder inom barnfetma. Dessutom betonar avhandlingen att båda föräldrarna är viktiga för att skapa ett sammanhang för livsstilsförändringar som in sin tur kan påverka barnets viktutveckling.

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