Maternal Feeding Strategies and Young Children's Snack Intake

by

Samantha Boots
BBehSci (Hons), GradDipPsych, BEd, DipT

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Table of Contents

Summary

Parents use a variety of feeding strategies in an attempt to encourage their young children to eat healthy foods and to limit the intake of unhealthy foods. Two such strategies are restrictive feeding and covert control. Restrictive feeding involves parents' deliberate attempts to enforce limits that are explicitly communicated to the child, while covert control involves limit-setting through controlling the child's environment. In general, restrictive feeding has been associated with poorer outcomes in children's eating. At the time that this thesis was conceptualised, there was little evidence as to the impact of covert control, particularly on children's snack intake. Thus the overall aim of the thesis was to investigate restrictive and covert control feeding strategies on young children's healthy and unhealthy snack intake, with a view to differentiating beneficial and detrimental effects of parental feeding.

Study 1 was a large cross sectional study of mothers of children aged 2-7 years from diverse socioeconomic backgrounds who completed online questionnaires about their feeding strategies and also reported on their child's snack intake. Factor analysis (Study 1a) showed that the strategies mothers use could be broadly conceptualised into three factors, which we labelled overt (including restriction), covert and parental modeling. Overt control was associated with greater unhealthy and less healthy snack intake in children, whereas covert control showed the opposite pattern. The study (Study 1b) also showed that the use of maternal restriction was associated with a general authoritarian parenting style. Finally, it was shown (Study 1c), that restrictive feeding and covert control translated into specific parental behaviours in response to difficult snack food requests in real life feeding situations. Study 2 was a longitudinal follow-up of the same sample that showed initial parental restrictive feeding predicted increased unhealthy snack intake three years later, while greater initial covert control predicted less unhealthy snack intake three years later.

Study 3 examined the effect of maternal feeding strategy on children's eating behavior using a laboratory-based paradigm. Results showed that maternal restrictive feeding was associated with eating in the absence of hunger for girls, but not boys. Covert control was not associated with

eating in the absence of hunger. Using the same sample, Study 4 examined prospectively (over a two-year period) the effect of maternal feeding strategies on child food preferences collected via interviews with the children themselves. Findings showed that greater initial use of restrictive feeding was associated with increased child preference for sweets and decreased preference for fruit and vegetables two years later, while covert feeding strategies showed the reverse pattern, with decreased preference for sweets and increased preference for fruit and vegetables.

Taken together, the findings of the four studies confirm that the use of restrictive feeding by parents has a detrimental impact on children's eating in both the short and longer term, while covert feeding strategies seem to have a beneficial impact. Accordingly, the results contribute to the conceptual understanding of the two different feeding strategies, as well as offering practical implications which can usefully inform parents of young children.

Declaration

I certify that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person expect where due reference in made in the text.

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Samantha Boots
BBehSc.(Hons.); GradDipPsych; B.Ed; DipT

04/03/19
…….
Date

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CHAPTER 1: General Introduction

Chapter Overview

This general introductory chapter aims to provide a brief background to the parental control of children's snack intake, with a view to setting the studies of the thesis within their conceptual and historical context. First, the general context that influences the child's food environment will be described. Next, an overview of the development of children's eating habits will be presented, followed by an introduction to the role of parents, and specifically general parenting style and parent feeding strategies. The chapter concludes with the aim and outline of the thesis.

Background

Chronic disease is the leading cause of illness, disability and shortened life span in Australia, having a major impact on health and welfare services (AIHW, 2014). The Australian Institute of Health and Welfare (2018) state that chronic disease includes the major disease groups of cardiovascular diseases, cancers, chronic obstructive pulmonary disease (COPD) and diabetes and that more than 50% of Australian adults are affected by least one chronic disease. Poor dietary habits represent a common behavioural risk factor, and improving dietary intake is seen as a modifiable component in chronic disease prevention (Han, Lawlor & Kimm, 2010; World Health Organisation, 2004).

As a consequence, dietary guidelines have been developed and used to promote optimal daily diet quality in order to improve health and well-being, while attempting to reduce the risk of diet related conditions and chronic disease. As dietary guidelines are based on scientific and medical information, and given that nutritional science continues to emerge and evolve, guidelines are updated periodically to reflect both advances in knowledge and changes in the population for whom the guidelines are written (Murphy, Yates, Atkinson, Barr & Dwyer, 2016). For example, the current 2015-2020 Dietary Guidelines for Americans, jointly published by the Departments of Health Services (HSS) and the Agriculture (USDA), are written for the current US population, of whom 60% of adults and 25% of children are overweight or obese, whereas previous iterations of

dietary guidelines were aimed at a less overweight population. These changes reflect an increase in the percentage of Americans who are overweight and obese, and the dietary guidelines consider nutrient adequacy in the context of calorie management and increasing physical activity to a much greater extent than past guidelines (2015-2020 Dietary Guidelines for Americans).

In Australia, the National Health and Medical Research Council (NHMRC) has developed the Australian Dietary Guidelines. These guidelines state that Australians should eat a variety of nutritious foods from five identified food groups: vegetables and legumes, fruit, meat (including poultry, fish, tofu and eggs), cereals and grains, and dairy and dairy substitutes. The guidelines also recommend limiting the consumption of discretionary foods, for example, cakes, sweets, chocolate, salty flavoured crackers, crisps, ice cream. However, more than 58% of Australians' total food spending in 2014 was on discretionary food items, with the most common items purchased being potato chips, soft drinks and chocolates (ABS, 2016). These foods are not necessary for growth or health and are high in saturated fat, added sugar, added salt and low in fibre; in sum, they are high in energy density and low in essential nutrients (NHMRC, 2012; Australian Dietary Guidelines). Discretionary foods are problematic not only because of the high fat, salt and sugar content, but also because they replace other more nutritious foods in people's diets.

The Australian Dietary Guidelines (NHRMC, 2012) also specify that children and adolescents consume food from the five food groups listed above. More specifically, the guidelines suggest that children aged 4-8 years old should eat 4.5 serves of vegetables (equivalent to approximately 350 kilojoules), 1.5 serves of fruit (approx. 350kj), 1.5 serves of meat, fish, poultry, tofu or eggs (approx. 600kj), 4 serves of cereals/grains (approx. 500 kj), 2 serves of dairy or dairy substitutes (600kj), as well as choosing mainly water to drink. They also recommend actively limiting the intake of saturated fats, sodium and sugar by limiting the intake of discretionary foods. These guidelines are important because the micronutrients represented in the five food groups are essential for healthy growth and development (Tulchinsky, 2010). Early childhood is a period of dramatic physical growth and cognitive development that requires optimal dietary intakes of energy

as well as a variety of nutrients (Ogata & Hayes, 2014). However, worldwide there is an increasing prevalence of undernutrition of key essential nutrients in the context of high overall energy overconsumption, indicative of a new phenomenon, malnutrition in the developed world (World Health Organisation: WHO, 2015). Although heterogeneous across regions and countries of the developed world, the 21st century sees an overall state of unhealthy dietary patterns for children on a global scale (AIHW, 2012; WHO, 2015).

Australian data from the 2014-2015 National Nutrition and Physical Activity survey (NNPAS: ABS, 2014) shows that only 34% of children aged from 4-8 years old consume the recommended daily intake of fruit and less than 1% of children in this age range consume the recommended daily intake of vegetables, indicating very low levels of consumption of dietary fibre, necessary for good health. At the same time, the consumption of energy dense, nutrient poor foods has rapidly increased; indeed one third (35%) of children's daily energy intake is from energy dense foods such as cakes, sweet biscuits and salty crackers.

Concerns about the contribution of discretionary foods to excessive energy intake and resulting overweight and obesity have led researchers more recently to examine not only the food consumed but the structure of eating over the day (Potter, Vlassopoulos, & Lehmann, 2018). Attention has turned to snacks, the eating occasions between meals, with evidence showing that 96% of Australian youngsters now eat three-to-five snacks per day as well as three meals, a marked increase from early 1980s when children ate very few snacks between meals (Wang, van der Horst, Jacquier, Afeiche & Eldridge, 2018). The Australian Nutrition Guidelines (NHMRC, 2012) recommend the consumption of snacks if meal portion sizes are small because it enables children (and adults) to consume the recommended daily intakes of essential nutrients (Keast, Nicklas & O'Neil, 2010), as well as having beneficial effects on appetite and satiety regulation (Small, Lane, Vaughan, Melnyk & McBurnett, 2013). However, recent evidence suggests that children are not eating nutrient rich foods on snack occasions, but rather energy dense, nutrient-poor foods that add excessive and 'empty' calories to children's daily intakes (Shriver, Marriage, Bloch, Spees, Ramsey

et al., 2017). For example, the 2014-2015 NNPAS shows that the most frequently consumed foods at snack times for children aged 4-8 years are cakes, biscuits and salty crackers. As a result, Australian children are consuming 60% of the daily-recommended sugar intake and exceed the daily-recommended sodium intake from the consumption of these discretionary foods during snacking occasions (Wong, Mok, Ahmad, Rangan & Louie, 2018). Increased snacking frequency has been associated with increased daily calorie intake (Wang, van der Horst, Jacquier, Afeiche & Eldridge, 2018) and with higher odds of overweight and abdominal obesity in children (Murakami & Livingstone, 2016).

More generally, overweight and obesity are reflected in Australian health data with the Australian population now considered one of the most obese in the world (Hayes, Lung, Bauman & Howard, 2017). Over two-thirds (63%) of Australian adults are categorised as overweight or obese, and over one quarter (26%) of Australian children and adolescents are overweight or obese (AIHW, 2018). Along with increased risk of chronic disease later in life, adverse outcomes associated with overweight and obesity in childhood include social isolation, discrimination (Harrist, Swindle, Hubbs-Tait, Topham, Shriver et al., 2016) and body dissatisfaction (Xanthapoulos, Borradaile, Hayes, Sherman, Vander Veur et al., 2011). Importantly, obesity in childhood tends to persist into adolescence and adulthood, with 67% of obese children growing into obese adolescents (Deshmukh-Taskar, Nicklas, Morales, Yang, Zakeri et al., 2006) and 70% of obese adolescents in turn growing up to become obese adults (Nicklas, Baronowski, Cullen & Berensen, 2011). As a whole, these data may represent what the World Health Organisation describes as the double burden of malnutrition (WHO, 2015), the coexistence of undernutrition along with overweight and obesity.

Development of Children's Eating

A review of the early influences on children's eating by Ventura and Worobey (2013) shows that children's eating involves a complex interplay of biological tendencies and environmental influences. Children's learning about food begins from conception and continues across the lifespan (Birch, 1998). Available data suggest that children are born with an innate preference for sweet,

salty and umami tastes and reject bitter and sour tastes (Menella & Beauchamp, 1996). Infants and young children will therefore readily accept sweet and salty food, making it relatively easy to establish unhealthy dietary patterns (Sullivan & Birch, 1990). This is especially problematic in the current environment, which is characterised by the abundant and ready availability of energy dense, sweet and salty foods that young children will accept and grow to prefer.

In addition to innate taste tendencies, twin studies have shown that other genetic factors contribute to the development of children's eating (Carnell, Haworth, Plomin & Wardle, 2008; Llewellyn, Van Jaarsveld, Johnson, Carnell & Wardle, 2010). Early child eating traits, including fast sucking action in infants (Llewellyn, van Jaarsveld, Boniface, Carnell & Wardle, 2008) and strong food responsiveness in toddlers and young children (Gregory, Paxton & Brozonic, 2010; Kral & Hetherington, 2015; Webber, Cooke, Hill & Wardle, 2010), have been explored as potential mechanisms of genetic transmission that may contribute to poor diet quality and obesity. Another child appetitive trait with a high genetic component shown to influence diet quality is food neophobia, i.e., the predisposition for rejecting novel or unknown foods (Cooke, Haworth & Wardle, 2007). In addition, early epigenetic nutrition memory could contribute to the development of children's eating and risk of obesity due to traits and dietary habits acquired by parents even before having offspring (Huypens, Sass, Wu, Dyckhoff, Tschöp, Theis et al., 2016).

However, it is acknowledged that many genes that potentially influence children's eating may not be expressed without enabling environmental conditions (Carnell & Wardle, 2008). It is evident that a gene-environment interaction can put vulnerable individuals at risk for developing unhealthy eating habits and obesity because of environmental factors that both promote energy dense food intake and discourage physical activity (Ogden, Yanovski, Carroll & Flegal, 2007). The term *obesogenic* has been coined to describe such an environment (Swinburn, Egger & Raza, 1999). Australia has a number of obesogenic characteristics, including a high volume of convenience food outlets filled with energy-dense foods that are relatively cheap in price and heavy promoted (AIHW, 2018). Australians are now eating significantly larger portion sizes (up to 66% more

compared to 17 years ago) of these foods (van der Bend, Bucher, Schumacher, Collins, De Vlieger et al., 2017). With the increase in technology, Australian children are spending about 20% of their waking lives in front of screens on weekdays, and 30% on weekends - watching television, being on computers and hand held devices, and playing electronic games (Australian Institute of Family Studies, 2017). Screen-based activities in young people and adults have been strongly linked to obesity (Banks, Jorm, Rogers, Clements & Bauman, 2011; Boone, Gordon-Larsen, Adair & Popkin, 2007). This increased screen time has also impacted on what children eat through advertising, which has been shown to influence children's food preferences, purchase requests and consumption patterns (WHO, 2015). The average Australian child will be exposed to 35 hours of food advertising on television over the course of a year, over half of which will be for unhealthy foods (King, Hebden, Grunseit, Kelly & Chapman, 2013). There have also been changes in the built environment, with less green spaces and low walkability in neighbourhoods, resulting in less energy expenditure (Allender & Richards, 2012). Finally, Australians' work habits have contributed to the obesogenic environment, with both adults in many families working long hours in paid employment, impacting on time for food preparation, family recreation and physical activity (Australian National Preventative Health Agency, 2014). Meal times are often fragmented, people may eat at different times and in different places (often outside the home) and rely heavily on convenience foods (AIHW, 2018).

The existing obesogenic environment makes early childhood a critical time for establishing dietary habits (Mura Paroche, Caton, Vereijken, Weenen & Houston-Price, 2017) because it is in the early years of life that individual patterns of food preferences and eating behaviours emerge (Birch, 1999). Once these patterns are established, they tend to track into adolescence and adulthood, having a life long influence on overall health (Skinner, Carruth, Bounds, Ziegler & Reidy, 2002; Vereecken, Keukelier & Maes, 2004; Coulthard, Harris & Emmett, 2010). Therefore, establishing healthy dietary patterns early in life may represent a sensitive window of development, laying the foundation for current and future health and wellbeing. In a seminal paper by Birch

(1999), three developmental learning processes were identified as important in the formation of food preferences and eating: familiarization, associative learning and observational learning. Through these processes children learn to eat what is available, accessible and what is eaten by others.

Familiarization describes the process by which foods that the young child is exposed to become familiar, and through familiarity become preferred (Birch & Anzman, 2010). Familiarization with a variety of foods and flavours in early childhood is necessary for a healthy diet as liking is a key determinant of intake and young children tend to eat only preferred foods (Birch, 1999). Availability of and exposure to foods in the children's immediate environment (e.g., home, child care) play a critical role in this process as individuals come to prefer and select those foods that they have repeatedly experienced (Mennella, Jagnow & Beauchamp, 2001). However, foods differ in the amount of exposure required. For example, vegetables that are bitter in taste require multiple taste exposures for acceptance given children's innate taste preferences to reject bitter and sour tastes (Menella & Beauchamp, 1996). Thus, children need frequent experiences with such nutrient rich foods early in life, to promote the acceptance of these foods (Birch & Anzman, 2010). On the other hand, given children's innate preference for sweet and salty tastes, unhealthy foods are readily accepted into children's diets and do not require repeated exposures (Cooke, 2007).

Learning about eating also involves associative learning (Brunstrom, 2005), a process in which associations between two stimuli or between a stimulus and a behaviour are formed (Mura Paroche et al., 2017). Birch (1999) described how these associations may be formed through i) pairing food with a familiar, liked taste; ii) pairing food with energy dense ingredients such as fat; iii) pairing food with a reward or affective experience (e.g., association of a food with praise or being coerced to eat certain food). In this context, children's natural preferences for sweet, salty and fatty foods influence children's intake of other foods that may be bitter or sour (such as vegetables) through pairing. In addition, the emotional valence of the social context in which the

food is consumed may also have positive or negative influence on the relative liking and intake of foods. For example, if children are coerced to finish foods, or rewarded for eating the food, the relative liking and consumption of these foods decreases (Galloway, Fiorito, Lee & Birch, 2005). In contrast, positive social contexts can also lead to counterproductive associative learning. For example, children learn to associate cake and special sweets with birthday parties, increasing the desirability of these foods as they are paired with a salient positive affective experience (Anzman, Rollins & Birch, 2010).

The third learning process through which children learn about food preferences and eating behaviours is observational learning, also termed social learning or modeling, and involves the observation or imitation of the behaviour of others (Bandura & Walters, 1977). Salient models for young children include peers, siblings and parents/caregivers (Brown & Ogden, 2004). For example, experimental research by Birch (1980) showed that after observing peers eating a vegetable (peas versus carrots) during lunch over 4 consecutive days, preschool children's preference for and intake of that particular vegetable increased. A large body of evidence also points to the important role of parents (Brown & Ogden, 2004) in modeling eating behaviours and attitudes that influence their child's beliefs about what to eat, and how much is appropriate to eat (Herman & Polivy, 2005). Experimental data have consistently shown that children readily accept foods that are eaten by their parents (Addessi, Galloway, Visalberghi & Birch, 2005; Jansen & Tenney 2001). Accordingly, learning about eating through observation may have positive or negative effects depending on what and how the models are eating. Thus, if parents themselves eat healthily and show an enjoyment of eating a range of healthy foods, then their children are also more likely to do so (Palfreyman, Haycraft & Meyer, 2014).

Given that parents provide both the genetic potential, as well as the environment in which their child lives and grows, parents are a powerful influence on the development of children's eating. Importantly, the first five years of life have been identified as a period of rapid development when nearly all of the child's experiences are created and shaped by parents and the family

environment (Savage, Fisher & Birch, 2007; Howard, Martin, Berlin & Brooks-Gunn, 2011). In particular, parents of young children play the most critical role in children's learning about food preferences and eating (Birch & Doub, 2014; Kral & Faith, 2007) through determining the foods that are made available, the portion sizes offered and the timing and social context of the meals (Birch & Ventura, 2009).

Parenting Style

Decades of research have shown that the parent-child dyad and the environment of the family, which involves all primary caregivers, are at the foundation of children's well-being and healthy development (Gadsden, Ford & Briener, 2016). The family is the child's first and longest lasting context for development where the child acquires knowledge, habits, skills, attitudes and behaviours through socialization that are required for successful adaptation to a family and a culture (Parke, Buriel & Damon, 1998; Ladd & Pettit, 2002). The socialization process is bidirectional in that parents convey socialization messages to their children but also respond to and behave in response to their children who vary in their level of acceptance, receptivity, and internalization of these messages (Grusec Goodnow & Kuczynski, 2000).

In socializing their children, parents use a complex milieu of parenting behaviours that take place within the context of general parenting style. Parenting behaviours refer to specific strategies that parents engage in when attempting to socialise their children (Patrick, Hennessy, McSpadden & Oh, 2013), whereas general parenting style refers to the approach parents use to raise their child and is a function of parents' attitudes and beliefs, creating a family emotional climate (Darling & Steinberg, 1993). Therefore, general parenting style sets the emotional tone through which specific parenting messages are conveyed to the child.

Historically, the most well known and influential description of general parenting style was by Baumrind (1971) who identified three typologies to distinguish multiple forms of parental authority: Authoritarian (parents who are cold and detached, but have high expressed expectations through rules and orders); Authoritative (parents who are warm and loving, and provide clear

guidance and direction) and Permissive /Indulgent (parents who are warm and loving, but do not provide guidance and direction). Later Maccoby and Martin (1983) added a fourth type they called Neglectful (parents who do not provide warmth and love and who also provide little guidance and direction).

Two influential literature reviews concluded that the parenting styles described above could be distilled into two main dimensions: parental control and parental warmth (Rollins & Thomas, 1979; Maccoby & Martin, 1983). Maccoby and Martin (1983) used the term Demandingness to describe parental control and Responsiveness to describe parental warmth and acceptance. Demandingness refers to the demands parents make on their children to become integrated into the family and the society through exercising control and limit setting. Aspects of parental demandingness include the extent to which parents hold standards for their children, provide supervision, and enact disciplinary efforts when needed (Baumrind, 1991). Responsiveness refers to parental behaviours that intentionally foster individuality, self-regulation, and self-assertion in their children. Aspects of parental responsiveness include the extent to which parents display warmth and are sensitive toward and supportive of their children (Baumrind, 1991). In a recent review of parenting styles and dimensions, Power (2013) noted that after four decades of research, the parenting styles and dimensions identified by Baurmind (1971) and later elaborated on by Maccoby and Martin (1983), are still the only parenting styles in the literature with a strong empirical basis.

General parenting styles have been associated with a number of child outcomes. In particular, Authoritative parenting (high responsiveness, high demandingness) has been frequently and robustly associated with positive child outcomes, e.g., emotional stability (Coplan, Hastings, Lagacé-Séguin & Moulton, 2002), adaptive patterns of coping (Wolfradt, Hempel & Miles, 2003) and life satisfaction (Suldo & Huebner, 2004). Authoritarian parenting (low responsiveness and high demandingness) has been frequently associated with negative child outcomes, e.g., low self-esteem (Hart, Shaver & Goldenberg, 2005), hostility (Nix, Pinderhughes, Dodge, Bates, Pettit & McFadyen-Ketchum, 1999) and high levels of anger and defiance (Thompson, Hollis & Richards,

2003). Both Indulgent (high responsiveness and low demandingness) and Neglectful (low responsiveness and low demandingness) parenting styles have been associated with negative child outcomes such as impulsivity, rebellion and defiance, poor self-control, poor emotional self-regulation and frequent antisocial behaviour (e.g., Aunola, Stattin & Nurmi, 2000; Krudek, Fine & Sinclair 1994; Lamborn, Mounts, Steinberg & Dornbusch, 1991).

In their review of parenting styles, Grolnick and Pomerantz (2009) differentiated parental demandingness in each of the general parenting styles as either control (e.g., critical parental behaviour such as commands, restrictions and negative comments), or structure (e.g., parents providing a consistent, predictable and organised environment for the child). When parents provide structure they highlight the relations between actions and outcomes through clear and consistent guidelines, expectations and rules for children, and provide predictable consequences (Farkas & Grolnick, 2008). In contrast, without structure a chaotic environment is created (Skinner, Johnson & Snyder, 2005). Grolnick and Pomerantz (2009) suggest that parental structure facilitates the development of competence in children as parents convey the standards of competence and also provide children with feedback on their progress in meeting these standards. In addition to structure, Gronlick and colleagues also suggest a separate dimension, autonomy support (e.g., parental encouragement of problem solving, choice making, and participation in decision making). The literature examining autonomy support with school-aged children and adolescents shows that this type of parenting is important in the development of children's self-regulation, impulse control and academic results (e.g., Joussemet, Koestner, Lekes, & Landry, 2005; Grolnick, Ryan, & Deci, 1991; Grolnick, Gurland, Jacob & DeCourcey, 2002).

More recently, researchers have begun to explore the role of parenting style in childhood obesity by examining children's food intake and physical inactivity. In their review of parenting styles and child eating, Patrick et al. (2013) concluded that an authoritative style of parenting is associated with better child outcomes, such as eating more healthy food (Kremers, Brug, de Vries & Engels, 2003; Pearson, Atkin, Biddle, Gorely & Edwardson, 2010), less sugar sweetened beverage

intake (Pearson et al., 2010), less screen use (Jago, Davison & Brockman et al., 2011) and greater physical activity (Hennesey, Hughes, Goldberg et al., 2010). Patrick et al. (2013) note, however, that this research has been conducted largely with older children and adolescents.

While general parenting style is seen as a relatively stable 'trait-like' way in which parents interact with their child, this is also reflected in specific domains. Hughes et al. (2005) have suggested that, similar to general parenting styles, feeding styles can be characterized by a combination of the two underlying dimensions of demandingness and responsiveness. Based on the two dimensions, authoritative (high demandingness, high responsiveness), authoritarian (high demandingness, low responsiveness), indulgent (low demandingness, high responsiveness), and uninvolved (low demandingness, low responsiveness) feeding styles were identified. Within general and feeding styles, parents also use a number of more specific strategies to socialize their child in specific domains. Both general parenting style and feeding strategies may influence children's food preferences and intake.

Parent Feeding Strategies

In an attempt to encourage their children to eat healthy foods and limit the intake of unhealthy foods, parents use a number of strategies that are underpinned by their knowledge, beliefs and attitudes. These feeding strategies include determining the foods and portion sizes that are offered to children, the frequency of eating occasions, and the social context in which eating occurs (Berk, 2010). A recent review has identified nine main feeding strategies used by parents (Yee, Lwin & Ho, 2017). These are: active guidance/education, restrictive guidance/rule making, availability, accessibility, modeling, pressure to eat, rewarding food consumption, rewarding with verbal praise, and using food as a reward.

There have been a large number (> 70: Vaughn, Tabak, Byrant & Ward, 2013) of different measures developed to assess these and other parental feeding strategies. These illustrate some confusion in the way that parental feeding has been conceptualised and measured (Vaughn, Dearth-Wesley, Tabak, Bryant & Ward, 2017), potentially limiting our understanding of the role of parent

feeding in children's eating. For example, scales from different measurement instruments may share similar names, but include items that measure very different parental feeding behaviours. Conversely, other instruments may include similar items, but employ different names for the scales (Vaughn et al., 2013).

Of the measures developed to date, by far the most commonly used is the Child Feeding Questionnaire (CFQ) developed by Birch et al. (2001). This aims to measure parental beliefs, attitudes and strategies regarding child feeding. The CFQ is a 31 item self report measure made up of seven factors. Four of the factors tap parental perceptions and concerns that may prompt the use of controlling child feeding strategies: Concern about Child Weight, Perceived Child Weight, Perceived Parent Weight and Perceived Responsibility. The other three factors are Restriction, Pressure to Eat, and Monitoring. The Restriction subscale consists of 8 items that measure parents' attempts to regulate the type and amount of food eaten by children. For example, a parent may forbid the child to eat sweets (e.g., "I have to be sure that my child does not eat too many sweets"), or may only allow the child to eat a certain amount of sweets and snacks (e.g., "If I did not regulate my child's eating, he/she would eat too many junk foods"). The Pressure to Eat subscale consists of 4 items assessing parents' tendency to pressure their child to eat more food, typically at mealtimes (e.g. "My child should always eat all of the food on her plate."). The Monitoring subscale consists of 3 items that assess the extent to which parents oversee their child's eating (e.g. "How much do you keep track of the high fat foods that your child eats?").

Restriction

By far the most studied form of parental feeding is restrictive feeding, with the Restriction subscale of the CFQ the most widely used measure (Corsini, Danthiir, Kettler & Wilson, 2008). When parents use restrictive feeding they make deliberate attempts to enforce limits to children's access and opportunities to consume certain foods, typically foods high in fat, salt and sugar such as unhealthy snack foods (Fisher & Birch, 2002). Indeed, it has been shown that parents believe that

forbidding or restricting children's eating of sweets is an effective way to discourage eating and liking of sweets and to encourage the consumption of more healthy foods (Casey & Rozin, 1989).

While intuitively restrictive feeding seems a sensible strategy, decades of research have shown that restriction has a paradoxical effect on children's eating. In seminal research by Birch and colleagues beginning in the 1980s, restrictive feeding has been associated with children's increased preferences for and intake of the very foods being restricted. Correlational research has shown that parental restriction is associated with higher overall calorie intake, poorer diet quality and increased child weight (see reviews by Savage, Fisher & Birch, 2007; Ventura & Birch, 2008). Some authors have argued reverse causality in these cross sectional associations, suggesting that child behaviours such as high food responsiveness cause parents to impose restrictive feeding. However, laboratory studies have shown that children's preference for and attention to the experimentally restricted food increases and children eat more of the restricted food when it becomes freely available (see review by Faith & Kerns, 2005). Longitudinal studies have also shown that parental restriction predicted children's eating in the absence of hunger two and four years later (Fisher & Birch, 2002; Birch & Fisher, 2003; Rollins et al., 2014). In addition, parental restriction has been associated with children's emotional over eating one and two years later (Rogers et al., 2013; Steinbekk et al., 2016), as well as disordered eating and weight gain in adolescence (Balantekin, Birch & Savage, 2017). A number of authors have theorised that restrictive feeding results in children failing to learn how to self regulate their own eating in response to internal cues of hunger and satiety (Birch & Fisher, 1998; Constanzo & Woody, 1985, Johnson & Birch, 1994; Fisher & Birch, 1999).

Pressure to Eat

Pressure to eat refers to parental strategies that push children to eat more, especially at meal times. For example, parents might tell their child that they must 'clean their plate' and eat all of the food that is served. Not surprisingly, parents apply pressure to eat more when they perceive that their child is underweight and are worried about their health and eating (Carnell & Wardle, 2008;

Birch, Fisher, Grimm-Thomas, Markey, Sawyer & Johnson, 2001). However, like restriction, this seemingly sensible parental feeding strategy is associated paradoxically with children eating less. Experimental studies (see review by Galloway et al., 2005) have shown that pressuring children to eat is associated with greater negative comments about the food, less liking of the food and less intake overall (Jansen, Mulkens & Jansen, 2007; Keller, Pietrobelli, Johnson & Faith, 2006; Powers, Chamberlain, Van Schaick, Sherman & Whitaker, 2006).

Covert Control

While it appears that restrictive feeding and pressure to eat are not effective feeding strategies, parents may still feel that they need to guide their young children's eating in some way, especially in our current obesogenic environment. Ogden, Brown and Reynolds (2006) distinguished between two forms of parental feeding strategies they termed 'overt' control and 'covert' control. Overt strategies include strategies that are explicitly communicated to the child. In this way, restriction and pressure to eat more are overt strategies because the child is made aware of the strategy via parental comments. In contrast, covert control consists of strategies by which parents manage the child's immediate environment, rather than directly targeting the child. For example, parents may provide mainly healthy foods and avoid buying unhealthy foods and bringing them into the home, or going to eat with the child at restaurants and cafes that sell unhealthy foods. Thus, covert control might provide a more effective way to promote healthy eating and limit the consumption of unhealthy food for children. In support, this feeding strategy has been associated with less unhealthy food consumption in school-aged children (Ogden et al., 2006; Brown, Odgen, Vögele & Gibson, 2008).

Ogden and colleagues' conceptualisation above provides the framework for the present thesis. In particular, I was interested in differentiating parent feeding strategies that may be beneficial to children's eating from strategies that seem to be detrimental. In this, restrictive feeding was chosen as the form of overt control to contrast with covert control. At the time (2010),

there was little research examining the effect of covert control on children's eating in general, and none on preschool aged children's snack intake in particular.

Contemporary Conceptualisations

More recently (and after the studies in the current thesis were conducted), parent feeding strategies as a whole have been conceptualised is either controlling or providing structure (Rollins, Savage, Fisher & Birch, 2015; Savage, Rollins, Kulger, Birch & Marini, 2017). This conceptualisation is based on Grolnick and Pomerantz (2009) model of general parenting style which differentiates control-based parenting, conceptualised as coercive, parent focused and imposed on the child, from structure-based parenting, conceptualised as child focused with parents setting up good structures and routines. Accordingly, restrictive feeding is viewed as a control-based feeding strategy whereas covert control is a structure-based feeding strategy (Rollins et al., 2015). More recently, Savage et al. (2017) have developed a measure entitled Structure and Control in Parent Feeding (SCPF), for toddlers aged 12-18 months old. Their preliminary factor analytic evidence supports the characterization of feeding as either control or structure-based in their sample (Savage et al., 2017).

A similar conceptualisation was developed by a working group of content experts (Vaughn, Ward, Fisher, Faith, Hughes et al., 2015). Their content map of future research postulates that parent feeding is characterised by three higher order constructs (coercive control, structure, and autonomy support) with specific strategies associated with each construct. In this, they make a distinction between overt restriction and covert restriction, where overt restriction is a form of coercive control and covert restriction is a form of structure. In addition to control and structure, they also suggest a third factor. In this conceptualisation, autonomy support maps onto current thinking about general parenting styles (Grolnick & Pomerantz, 2009). In feeding, autonomy support is manifest in parents' endeavors to promote psychological autonomy and encourage their child's independence through involving them in food planning and preparation, nutrition education and encouragement and praise.

Aim of the Thesis

The overarching aim of the present thesis was to examine maternal restriction and covert control on young children's healthy and unhealthy snack intake, with a view to differentiating beneficial and detrimental effects of parental feeding. The research questions of interest that inform this aim are as follows:

1) What is the underlying structure of the existing measures of parent feeding, including restriction and covert control?
2) Does general parenting style influence the use of restriction or covert control?
3) Can maternal behaviours that are restrictive or covert in nature be identified in real life feeding situations?
4) What are the longer term effects of maternal use of restriction and covert control on children's healthy and unhealthy snack consumption?
5) Do restriction and covert control have differential effects on children's eating in the absence of hunger?
6) What is the effect of maternal use of restriction and covert control on the development of children's liking of healthy and unhealthy foods over time?

Research questions 1-3 were addressed in Study 1, which was a large survey study with the mothers of young children from diverse socioeconomic backgrounds who completed online questionnaires about their feeding strategies and also reported on their child's snack food intake. Research question 4 was addressed in Study 2, a longitudinal follow up of a subset of mothers from Study 1. Research question 5 was addressed in Study 3, which examined the effect of maternal restriction and covert control on children's eating in the absence of hunger. Finally, Study 4 examined the effect of maternal restriction and covert control feeding strategies on children's food preferences via interviews with the children themselves (Research question 6).

Thesis Outline

The thesis consists of eight chapters, reporting on four empirical studies. The studies are presented in the order in which they were conceptualised, conducted, and analysed, rather than in the order in which they were accepted for publication. Chapters 2-4 present the results of a large cross-sectional study (Study 1) of mothers that examined child snack intake via parental report. Chapter 2 presents the results of a factor analysis of feeding measures, Chapter 3 is an investigation of general parenting style, and Chapter 4 is an examination of specific food request situations. Chapter 5 then presents the longitudinal follow up, referred to as Study 2, examining the prospective effects of maternal restriction and covert control on children's healthy and unhealthy snack intake two years later. This study allowed for testing whether the maternal feeding strategy is temporally antecedent to (occurs before) child eating behaviours. Chapter 6 (Study 3) presents a different methodology. A laboratory-based paradigm (eating in the absence of hunger) was used to directly measured children's snack intake in a naturalistic setting (an everyday eating occasion in the child's usual preschool setting). Child weight and height were also objectively measured. Chapter 7 presents Study 4, consisting of interviews with children on self-reported preferences for snack foods, as well as for fruit and vegetables, using a longitudinal design over a two year period. Finally, Chapter 8 presents an integrated discussion of findings from the studies within the thesis, including their significance and contribution to the current literature.

All substantive chapters have been formatted as manuscripts for publication. These have resulted in six publications (*Health Education Journal, Journal of Health Psychology, Appetite* x 4), with each written in accord with the individual journal requirements and so formatting may vary slightly. In addition, because the background information is largely similar for each study, there is some repetition in the Introduction and the Discussion sections of the presented studies. Finally, of note is that this PhD thesis has been completed part time over a period of 9 years due to significant care responsibilities, and in some cases the literature has moved beyond the ideas presented in the early chapters, as well as the early chapters having contributed to the literature.

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CHAPTER 2: Study 1a - Factor Analysis and Measures

Three broad parental feeding styles and young children's snack intake

Samantha B. Boots[a], Marika Tiggemann[a] and Nadia Corsini[b]

[a] School of Psychology, Flinders University, Adelaide, Australia

[b] Cancer Council South Australia, Adelaide, Australia

Corresponding author: Samantha B. Boots, School of Psychology, Flinders University, PO Box 2100, Adelaide, SA, 5001 Australia.

Email: samantha.boots@flinders.edu.au

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Abstract

Objective: The aim of this study was to identify broad overarching feeding styles that parents may use and their effect on pre-school aged children's healthy and unhealthy snack intake.

Design: Cross sectional

Methods: Mothers (n = 611) of children aged 2-7 years (mean age 3.9 years) completed an online survey assessing parent feeding strategies and parent-reported child snack intake. Data were analysed in two phases. Firstly, principal components analysis identified three major feeding styles that were labelled overt control, covert control and parent modelling. Then structural equation modelling was used to see if these factors were related differentially to reported child snack intake.

Results: The intake of healthy snack food was associated with higher covert control and parent modelling and lower overt control. The reverse was true for unhealthy snack intake, with the intake of these foods associated with lower covert control and parental modeling, and higher overt control.

Conclusion: Our findings show that parent feeding styles that attempt to control the child's environment seem to have a positive impact on snack intake, while styles aimed at controlling the child (overt control) seem to have a detrimental impact.

Introduction

In Australia, 20-25% of 2-8 year old children are currently overweight or obese (ABS, 2012). The prevalence of obesity in children has been partially attributed to the over consumption of energy dense foods, that is, foods high in fat, salt and sugar, such as most snack foods (Pearson et al., 2011; Reedy and Kerbs-Smith, 2010). Despite the importance of healthy snack eating (e.g., eating fruits, vegetables and dairy snacks) being widely publicised, unhealthy snack consumption by pre-school children has rapidly increased (Piernas and Popkin, 2010; Australian Bureau of Statistics, 2012).

It is widely accepted that parents are instrumental in the development of children's eating behaviours, especially in the early years (Ventura and Birch, 2008). To examine different feeding strategies, researchers have developed a range of measurement tools (Pinard et al., 2012). By far the most widely used measure is the Child Feeding Questionnaire (CFQ) developed by Birch and colleagues (Birch et al., 2001). The measure contains three subscales that assess aspects of control over feeding (Restriction, Monitoring and Pressure to Eat). Of these, Restriction has received the most empirical attention (Corsini et al., 2008). A number of reviews have concluded that parental use of restrictive feeding strategies is somewhat paradoxically associated with poorer child outcomes in terms of the consumption of more unhealthy foods and higher child BMI (Rollins et al., 2016; Ventura and Birch, 2008). In addition, previous validation studies of the CFQ in various populations have identified some psychometric issues within the Restriction scale including low loading items and items loading onto more than one factor (Corsini et al., 2008; Anderson et al., 2005; Boles et al., 2010; Nowicka et al., 2014). A broader limitation of the CFQ as a whole is that it measures highly controlling feeding strategies. Thus, it neglects to examine a range of potentially more positive strategies that parents may use to manage their child's food intake (Clark et al., 2007). Indeed, these may be particularly important when examining children's snack intake, as snack related parent-child interactions potentially involve a wider range of parental behaviours in a wider range of situations than do meals (Brown and Ogden, 2004).

In response, Ogden and colleagues (2006) categorised parental feeding strategies into two types: overt control and covert control. Overt strategies, such as restricting the child's food intake are overtly communicated to the child, e.g., forbidding the child to eat sweets. Thus the strategies measured by the CFQ fall largely into this category. On the other hand, covert control consists of managing diet quality and food intake in a way that is not detected by the child. In particular, covert control refers to the ways in which parents restrict the consumption of unhealthy foods and promote the consumption of healthy foods by managing the child's environment, rather than directly targeting the child. For example, parents (without any comment) may simply avoid having sweets or crisps in the home or avoid visiting restaurants that serve unhealthy food. Indeed, a smaller body of research has found that this form of covert control of the environment is an effective strategy for parents in limiting unhealthy snack intake in older children aged 8-13 years old (Houldcroft et al., 2016; Haycraft et al., 2014) and promoting healthy snack intake (Jarman et al., 2015**;** Rodenberg et al., 2011). In addition, covert control may have a positive benefit on children's diets because children develop good habits, especially around food, without any sense of the deprivation or negative emotions that may be associated with more overt parental feeding strategies (Brown et al., 2008).

In addition to overt and covert control, there may be other factors that are neutral with respect to control. These include parental nutritional knowledge and parental role modelling. Parental modelling describes how behaviour is learned through observation and vicarious reinforcement and much research suggests that parents provide role models for their children (Bandura & Walters, 1963). For example, if parents themselves eat healthily, then their children are more likely to eat healthily. Parents may also use modelling as a deliberate feeding strategy, through actively demonstrating preferred eating strategies for their child (Reinaerts et al., 2007; van der Horst et al., 2007; Palfreyman et al., 2014). One review concluded that parent modelling is positively correlated with their children's fruit and vegetable consumption (Rasmussen et al., 2006).

Existing factor analyses of parental feeding measures have produced varying factor structures (Campbell et al., 2006 [nine]; Rodgers et al., 2013 [nine]; Ek et al., 2015 [five]). However, we argue here that there may be three overarching styles that go across specific measures, distinguished by the kind of control parents use. The first of these is an overt control style, whereby parents directly and overtly manage their child's eating and food intake. The second is covert control, whereby the parent controls the child's immediate environment rather than the child. A third broad style may consist of aspects that are neutral with respect to control, which could include parental modelling of healthy eating.

Thus, the overarching goal of the present study was to investigate parent-feeding strategies and children's snack eating conceptualised in a broad manner in a sample of predominantly pre-school aged children. Although eating habits develop at a young age and seem to remain stable into adolescence and adulthood (Fisk et al., 2011), most of the previous research examining the influence of parent feeding on food intake has been conducted with older school-aged children. The present study will examine the feeding strategies of parents of younger children, as this is a time when parents can exert the most control over what children consume. The first specific aim of the present study was to investigate the existence of broad styles of parental feeding by factor analysing a number of existing parent feeding scales. The second aim was to determine whether the broad feeding styles are differentially related to young children's snack intake. If the styles are indeed related to different outcomes, that would provide evidence of the utility of the conceptualisation of broad feeding styles. More specifically, we predicted that an overt feeding style would be positively related to unhealthy snack intake and negatively related to healthy snack intake. In contrast, a covert style would be positively related to healthy snack intake and negatively related to unhealthy snack intake. A neutral control style was expected to have a positive (albeit weaker) association with healthy snack intake.

Method

Participants

Participants were 611 mothers of children aged 2-7 years recruited through social media, flyers distributed in childcare centres, crèche facilities, preschools, advertisements in local papers and parenting magazines in Adelaide, South Australia. There were no exclusion criteria beyond age and thus the study included children of all weights, diets and special needs. The average age of the mothers was 35.7 years (*SD* = 4.93) and they generally reported on their eldest child (43.0%), with the average age of the child 3.9 years old (*SD* = 1.49). Most of the participants had a higher education with 85% having completed university, TAFE or vocational training. The mothers came from a diverse range of socioeconomic areas (SES), based on postal code of residence (2011 Index of Relative Socioeconomic Disadvantage; Australian Bureau of Statistics, 2013), with 44.5% of participants coming from low to mid SES areas (deciles 1-7) and 47.5% coming from high SES areas (deciles 8-10) (Australian Bureau of Statistics, 2013). Further details of the sample are provided in Boots et al. (2015).

Measures

The questionnaire, entitled "Managing Kids Food", contained some widely used parental feeding measures and reported children's snack food intake. Five sub-scales from three common measures were identified as related to our postulated broad categories of feeding. These were the Restriction scale and the Pressure to Eat scale from the CFQ (Birch et al., 2001), the Covert Control scale (Ogden et al., 2006), and the Modelling scale and the Healthy Environment scale from the CFPQ (Musher-Eizenman and Holub 2007).

Child Feeding Questionnaire: Restriction and Pressure to Eat

The Restriction sub-scale (8 items e.g., "I have to be sure that my child does not eat too many high-fat foods") addresses parents' propensity to control child eating by limiting the amount and portion sizes of certain foods, using food as a reward and by monitoring children's intake of certain foods. The Pressure to Eat sub-scale (4 items e.g., "My child should always eat all of the food on

his/her plate") measures parents' inclination to pressure the child to eat more of some foods. Higher scores indicate greater restrictive feeding and greater parental pressure in feeding. Internal reliability of the original Restriction and Pressure scales was acceptable (α = 0.73 and α = 0.70 respectively) (Birch et al., 2001). In the present sample, internal reliability of the Pressure scale was similar (α = 0.73). However, internal reliability of the Restriction scale was slightly lower (α = 0.67), but similar lower reliabilities have been reported previously (e.g., Powers et al., 2006). Removing specific items did not improve internal reliability.

Covert Control Scale

The Covert Control Scale (5 items e.g., "How often do you avoid buying sweets, crisps, biscuits and cakes and bringing them into the home") addresses strategies that parents use to control the child's consumption of energy dense food through limiting their exposure to these foods in the child's immediate environment. Higher scores on the covert control measure indicate greater control of the child's environment. The original measure had adequate internal reliability (Cronbach's α = 0.79) (Odgen et al., 2006). In the present sample, internal reliability was similar (α = 0.75).

Comprehensive Feeding Practices Questionnaire (CFPQ): Modelling and Healthy Environment

Modelling (4 items e.g., "I try to show enthusiasm about eating healthy foods") and Healthy Environment (4 items e.g., "Most of the food I keep in the house is healthy") assess the extent to which parents model healthy eating and provide a healthy environment. Higher scores indicate greater values for each sub-scale. The original measures for Modelling and Healthy Environment had adequate internal reliability (Cronbach's α = 0.80 and α = 0.75 respectively) (Musher-Eizenman and Holub 2007). In the present sample, internal reliability was similar (α = 0.75 and α = 0.70).

Child Snack Food Intake

Children's usual intake of healthy and unhealthy snack foods was measured with an 11-item food frequency questionnaire that was adapted from the Anti-Cancer Council Dietary Questionnaire

(Ireland et al., 1994). Parents reported how frequently in a week their child consumes 11 different snack foods. The snack foods were subsequently categorised by the first author into 'healthy snacks' (4 items: fruit, vegetable, yoghurt, cheese), and 'unhealthy snacks' (7 items: potato chips or other crisps, salty flavoured or cheesy crackers, sweet biscuits, cakes and pastries, chocolate and lollies, sugar sweetened drinks, hot fried snacks) on the basis of energy density and nutritional quality of the foods. The response categories ranged from 'none' to 'more than once a day'. Snack intake was converted to equivalent daily frequencies, which were then summed together and were used to represent the number of healthy and unhealthy snacks consumed per day.

Statistical Analysis

Statistical analyses were conducted using SPSS v20 (SPSS Inc Chicago). An alpha level of .05 was used for all statistical tests. Initial analyses and screening were conducted to establish the factorability of the data. Principal components analysis was conducted on the items of the feeding scales. As the investigation was focused on identifying broad factors, the scree test (rather than a specified eigenvalue) was used to determine important factors (Cattell 1966). Oblimin rotation, in which factors are allowed to correlate, was selected because parent-feeding scales show inter-correlations (Campbell et al., 2006). Items were retained if they loaded on to the factor at .32 or higher (Tabachnick and Fidel, 2001). Factor scale scores were calculated by summing and averaging items that loaded on the corresponding factor. Bivarate correlations were conducted to assess inter-factor correlations as well as correlations with the demographic variables. Next, structural equation modelling (AMOS, version 20) tested the relationship between the broad feeding styles and parent reported child snack intake. The feeding styles were treated as correlated latent variables, indicated by the items that loaded respectively on each factor. All variables were allowed to co-vary. The adequacy of model fit was assessed by four commonly recommended fit indices: the comparative fit index (CFI), the Tuker-Lewis Index (TLI), the root square error of approximation (RSMEA) and the standardised root mean square residual (SRMR). Good fit is indicated by CFI and TLI values of .95 or higher, RSMEA of .06 or lower and SRMR of .08 or

lower (Hu and Bentler, 1999). Acceptable fit is indicated by values of .90 - .94 for CFI and TLI, .7 - .10 for RMSEA and .09 - .10 for SRMR (Marsh and Hau, 1996).

Results

Sample Characteristics

On average the mothers were 35.7 years old (*SD* = 4.93 years), had two children (56.5%) and mainly lived in two-adult households (92.3%). The mothers reported on 318 boys and 292 girls with an average age of 3.9 years (*SD* = 1.49 years). Most mothers (85%) had some further education (university, TAFE or vocational training). They came from a diverse range of socioeconomic backgrounds: 44.5% came from low to mid SES areas (deciles 1-7) and 47.5% came from high SES areas (deciles 8-10) (Australian Bureau of Statistics, 2013).

Factor Analysis

Inspection of the scree plot showed a clear elbow at the third factor. Interpretability of the factors and the proportion of explained variance showed that most of the items loaded on the three factors. The first factor to emerge, which we labelled "Covert Control", contained all of the items from the Covert Control scale and three (out of four) items from the Environment scale. This factor (eigenvalue = 4.43) accounted for 17.7% of the variance (Table 1, second column). The second factor to emerge (eigenvalue = 3.24, 13.0% of variance) contained nine items comprising overt control of children's eating (Table 1, first column). Five out of the eight items on the Restriction scale, along with the four Pressure to Eat items, loaded on this factor, here named "Overt Control". The final factor to emerge (eigenvalue = 2.28, 9.13% of variance) contained seven items pertaining to parental modelling of healthy eating and so was named "Modelling". It can be seen that all of the items from the Modelling scale and one item from the Environment sub-scale loaded on this factor. No item loaded on more than one factor. Only three items did not load on any factor, all from the Restriction sub-scale (R1, R2, R4). The internal reliabilities for the resulting scales (also presented on Table 1) were all clearly acceptable (>. 7, Nunnally, 1978).

Table 1

Factor loadings for parent feeding sub-scale items

	Overt Control	Covert Control	Modelling
R1: I have to be sure that my child does not eat too much sweets			
R2: I have to be sure that my child does not eat too many high fat foods			
R3: I have to be sure that my child does not eat too much of his/her favourite foods	.38		
R4: I intentionally keep some foods out of my child's reach			
R5: I offer sweets to my child as a reward for good behaviour	.37		
R6: I offer my child his/her favourite foods in exchange for good behaviour	.43		
R7: If I did not guide or regulate my child's eating, s/he would eat too many junk foods	.44		
R8: If I did not guide or regulate my child's eating, s/he would eat too much of his/her favourite foods	.45		
P1: My child should always eat all of the food on his/her plate	.38		
P2: I have to be especially careful to make sure that my child eats enough	.60		
P3: If my child says, "I'm not hungry", I get him/her to eat anyway	.55		
P4: If I did not guide or regulate my child's eating s/he would eat much less than s/he should	.62		
C1: Avoid going to restaurants that sell unhealthy food		.46	
C2: Avoid buying sweets and crisps and bringing them into the house		.78	
C3: Not buy foods that you would like because you don't want your child to have them		.57	
C4: Try not to eat unhealthy foods when your child is around		.40	
C5: Avoid buying biscuits and cakes and bringing them into the house		.67	
M1: I model healthy eating for my child by eating healthy foods myself			.48
M2: I try to eat healthy foods in front of my child, even if they are not my favourite			.53
M3: I try to show enthusiasm about eating healthy foods			.68
M4: I show my child how much I enjoy eating healthy foods			.68
E1: I keep a lot of snack foods (potato chips) in my house		-.56	
E2: Most of the food I keep in the house is healthy		.37	
E3: A variety of healthy foods are available to my child at each meal served at home			.37
E4: I keep a lot of sweets (candy, ice-creams) in my house		-.57	
Internal Reliability	.78	.74	.72

Note: Factor Loadings >.32 listed; R = Restriction, P = Pressure to eat, C = Covert control, M = Modelling, E = Healthy environment

Table 2

Correlations between feeding styles, demographic information and child snack intake

	Overt Control	Covert Control	Modelling
Mean (SD)	2.85 (.68)	3.68 (.51)	3.87 (.40)
Demographics			
Child Age	-.04	-.10*	-.07
Parent age	-.13**	-.10*	-.10*
SES	-.04	.11**	-.03
Education	-.11*	.16**	-.02
Child Snack Intake			
Healthy	-.17**	.23**	.18**
Unhealthy	.24**	-.46**	-.19**
Feeding Style			
Overt Control		-.22**	-.11**
Covert Control			.25**

*p <.05, **p <.01

The relationship between the sample characteristics and broad feeding styles

Table 2 presents the correlations between key demographic variables (child age, parent age, SES and parent education) and the broad feeding styles. In this sample, which includes participants from a diverse range of socioeconomic backgrounds, SES and parental education were significantly related to feeding style. Specifically, parents from higher SES backgrounds and with higher educational attainment used less overt control and more covert control to manage children's snack intake. On the other hand, parents with lower educational attainment used relatively more overt control.

The relationship between broad feeding styles and child snack intake

Table 2 also presents the correlations between the broad feeding styles and children's snack intake. Children's intake of healthy snacks was associated with lower parental overt control and more covert control and modelling. The reverse was true for unhealthy snack foods:

children's intake of unhealthy snacks was associated with greater parental overt control and lower use of covert control and role modelling.

In addition, Table 2 shows that the factors were somewhat inter-correlated and related to one another in theoretically expected ways. Small positive correlations were evident between Covert Control and Modelling (r = .25, p = <.001) and negative correlations were evident between these factors and Overt control (r = -.22, p = <.001 and r = -.11, p = <.001 respectively).

Structural model predicting parent reported child snack intake

In order to integrate all of the elements of the study, a structural equation model (Figure 1) examined the association between the broad feeding factors (overt control, covert control and modelling) with child healthy and unhealthy snack intake. The final model produced an acceptable-to-good fit: χ^2[173] = 303.3, p <.001; TLI = .906 (acceptable); CFI = .955 (good); RMSEA =.049 (good); SRMR =.04 (good). The model shows that covert control significantly predicted higher healthy snack intake and strongly predicted lower unhealthy snack intake. Overt control significantly predicted lower healthy snack intake and greater unhealthy snack intake. With all variables in the model, modelling did not offer independent prediction of child snack intake.

Discussion

The first aim of the present study was to examine items from a number of parent feeding scales to see whether they could be meaningfully conceptualised as broad feeding styles. The second aim was to examine whether these broad styles are associated with preschool children's snack intake. The major findings are clear. We were able to identify three broad feeding styles that differed in the nature of control displayed**,** here termed overt control, covert control, and modelling (neutral). These findings support Ogden and colleagues (2006) overall

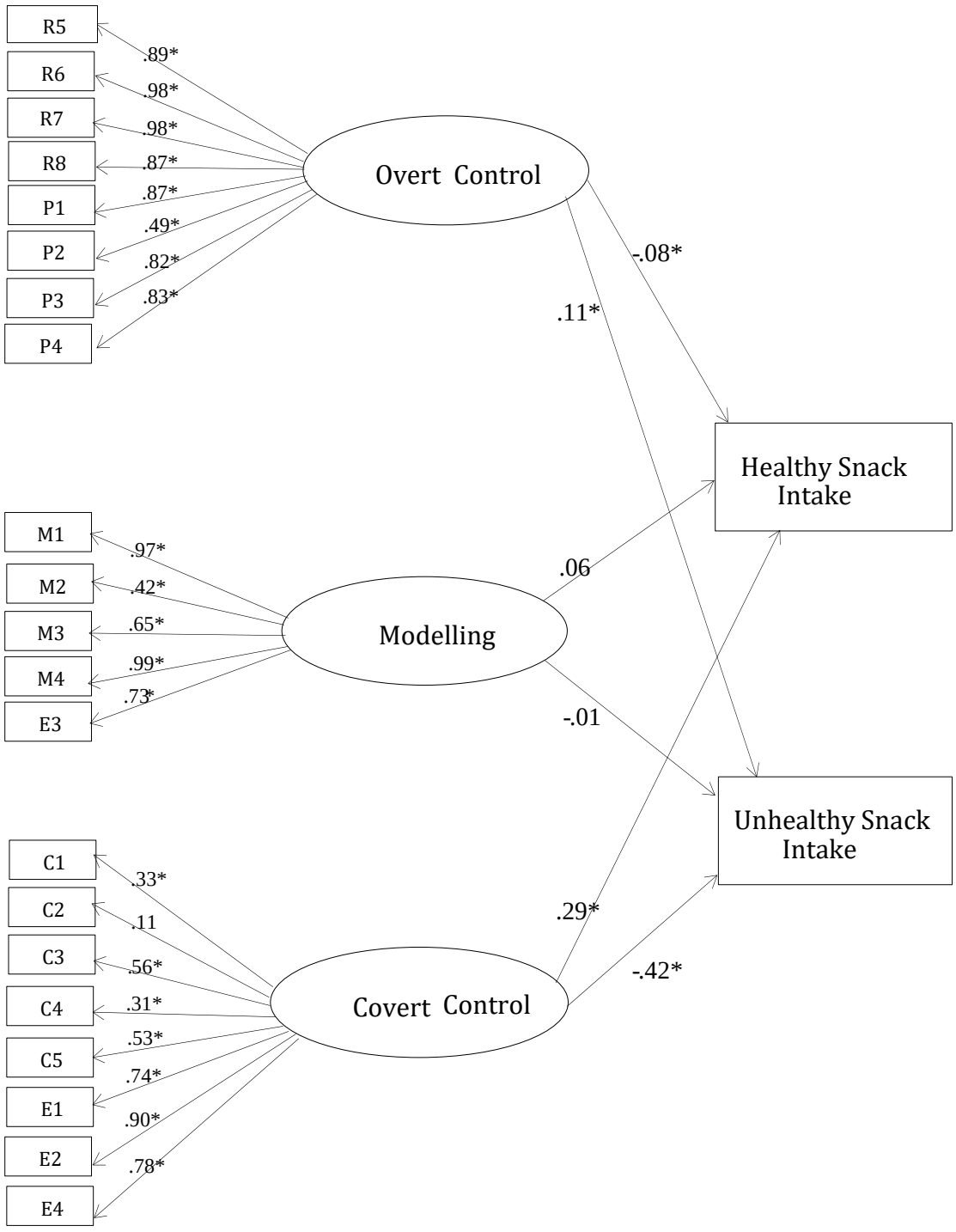

Figure1. Structural equation model showing standardised path coefficients.
Note: * p <.05

conceptualisation of feeding styles as overt or covert and extend the empirical support to young children. In extending previous literature, the findings identify a third feeding style that is neutral in terms of control. These broad styles were associated with demographic background. In our reasonably diverse sample, more highly educated parents coming from higher SES backgrounds used more covert control strategies, whereas parents with less formal education used more overt control. Importantly, these broad styles were also differentially associated with children's snack intake. As predicted, a covert control style was associated with greater healthy and less unhealthy snack intake, while the reverse was true for an overt feeding style. The modelling feeding style operated similarly to the covert control style (albeit with weaker associations). When parent modelling was examined within the entire model, this factor did not uniquely predict children's snack intake.

With respect to the measurement of parent feeding, the broad styles identified in this study seem quite coherent. In the main, items on the established scales held together as expected, with the exception of the Restriction scale. Several items on this scale did not load onto the identified construct of overt control; nor did the items load on any of the factors which likely accounts for the low internal reliability (alpha) of the Restriction scale in our sample. These results are similar to previous studies examining the Restriction scale, in which items were excluded from analyses due to low factor loadings or loading on other factors (Anderson et al, 2005; Boles et al., 2010; Corsini et al., 2008; Nowicka et al., 2014; Vaughn et al., 2016). Our results indicate that additional conceptual clarification of the restrictive feeding construct in the CFQ may be warranted.

The first broad feeding style identified by the principal components analysis was covert control, which describes parental control of the child's feeding environment rather than the child. This feeding style was associated with children consuming more healthy snacks and less unhealthy snacks. Here, the covert control style incorporated all of the items (five) from the Covert control scale and three items from the Environmental control scale (CFPQ). Previous

literature examining Covert control has found that this is an effective strategy in promoting healthy eating in older children (Ogden et al., 2006; Brown et al., 2008; Rodenburg et al., 2011). Our results show a covert control style represents a type of parental control that is also beneficial for younger children. Indeed, this feeding style may constitute an effective way for parents to manage children's nutritional intake, without any sense of deprivation or conflict that may be associated with other control strategies that are directed towards the child.

The second broad feeding style identified was overt control. This feeding style comprised five of the eight items from the Restriction scale and all of the items from the Pressure to Eat scale**.** Of interest here is the finding that both the strategies of restrictive feeding and of pressure to eat load on to the same factor. In restrictive feeding, parents attempt to limit the amount of food their child eats, whereas in pressure parents attempt to encourage their child to eat more. Thus, these parent-feeding strategies seem to be working in opposite directions in terms of what parents are trying to achieve. Yet they share the same underlying factor structure. Previous research shows restrictive feeding is associated with poorer child eating outcomes (Birch et al., 2003; Jansen et al., 2007; Rodgers et al., 2013; Ogden et al., 2013; Loth, 2016; Steinsbekk et al., 2016). Previous research also shows that pressuring children to eat more is associated with poorer child eating outcomes (Galloway et al., 2006; Loth, 2016; Steinsbekk et al., 2016). Our results suggest that what unites these two seemingly opposing strategies is that they are both aspects of overt control, in which parental strategies are overtly communicated to, and thus readily detectable by, the child. Here we show that the overt control style was associated with poorer child eating, with children consuming less healthy snacks and more unhealthy snacks. The results indicate that attempting to either limit the intake of unhealthy foods or promote the intake of healthy foods through an overt feeding style is counterproductive; in fact, children consumed more of the foods parents were trying to limit and less of the foods they were trying to encourage.

Results from the present study have important practical implications. In particular, they can usefully inform advice given to parents about the most effective strategies to manage their young child's snack intake. Broadly categorising feeding styles into three types as we have done here may be useful in providing parents with a simpler message about feeding their child. Importantly, this information may give parents alternative strategies that may create a more positive feeding environment for both the parent and child**.** Indeed, using such strategies could eliminate the feeding battlefield that can consume both parent and child. This is especially important given the increased awareness of the risks of obesity, where parents may be concerned about their child's present and future weight. The most obvious action for parents is to place their child on a diet or restrict their intake of energy dense (unhealthy) food. However, while this seems a very logical response, the present results indicate that **t**his response is one that well-meaning parents should be dissuaded from using. Rather, parents should be educated about and encouraged to use greater covert control, such as limiting the availability of unhealthy snacks in the child's immediate environment.

Like all studies, the findings of the current study need to be interpreted in light of some limitations. First, although we measured frequency of snack intake per day, we did not measure snack portion size and therefore cannot determine the total amount consumed or associated nutritional value. In addition, information gathered was through parental reports and so may be open to some degree of social desirability bias. Second, the participants were mothers who volunteered to participate in a study on child feeding and may have had a higher interest in the health of their child**.** They were also more highly educated, suggesting the possibility of some self selection bias. Third, we investigated only five commonly used subscales of published measures of parental feeding, a small portion of the many scales available to measure parent-feeding strategies. Future research could usefully determine whether other sub-scales fall into the broad conceptual categories identified here. Fourth, the study recruited only mothers, and did not recruit fathers or other caregivers. Further, it did not examine other variables such as

mothers' eating habits, and thus may give a limited perspective of the total family-eating environment. Finally, as with all correlational studies, causal conclusions cannot be drawn. It is possible that the observed relationships between parent feeding styles and child eating may be bidirectional. Parents may indeed use specific feeding strategies that influence their children's eating behaviour (as posited here), but it is also plausible that parents may adopt specific feeding strategies in response to their child's eating. Longitudinal research that tracks both parental and child behaviours over some time is needed to come to more definite causal conclusions about factors that influence the development of snacking behaviour in young children.

Despite these limitations, the findings of the present study clearly show that broad maternal feeding styles are associated with parent-reported child snack intake. In particular, results from this study indicate that a covert feeding style is associated with healthier eating than an overt feeding style. At a theoretical level, the identification of broad feeding styles contributes to our understanding of the effect of parent feeding strategies on children's snack intake. At a more practical level, findings offer potential scope for interventions with parents of pre-school-aged children that focus on covert control strategies to manage their children's snack intake.

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CHAPTER 3: Study 1b - Parenting Style

Managing young children's snack food intake: The role of parenting style and feeding strategies

Samantha B. Boots[a], Marika Tiggemann[a], Nadia Corsini[b] and Julie Mattiske[a]

[a] School of Psychology, Flinders University, Adelaide, Australia

[b] Cancer Council South Australia, Adelaide, Australia

Corresponding author: Samantha B. Boots, School of Psychology, Flinders University, PO Box 2100, Adelaide, SA, 5001 Australia.

Email: samantha.boots@flinders.edu.au

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Abstract

One major contributor to the problem of childhood overweight and obesity is the over-consumption of foods high in fat, salt and sugar, such as snack foods. The current study aimed to examine young children's snack intake and the influence of feeding strategies used by parents in the context of general parenting style. Participants were 611 mothers of children aged 2-7 years who completed an online questionnaire containing measures of general parenting domains and two particular feeding strategies, restriction and covert control. It was found that greater unhealthy snack intake was associated with higher restriction and lower covert control, while greater healthy snack intake was associated with lower restriction and higher covert control. Further, the feeding strategies mediated the association between parental demandingness and responsiveness and child snack intake. These findings provide evidence for the differential impact of controlling and positive parental feeding strategies on young children's snack intake in the context of general parenting.

Introduction

Childhood overweight and obesity is an important public health issue. In Australia, 20-25% of 2-8 year olds are currently overweight or obese (ABS, 2012). Adverse outcomes associated with childhood overweight and obesity include poorer health (Must & Strauss, 1999), slower cognitive and social development (Tremblay, Inman & Willms, 2000; Hesketh, Wake & Waters, 2004) and social isolation and discrimination (Stunkard & Wadden, 1992). Importantly, obesity in childhood tends to persist into adolescence and adulthood, with 67% of obese children growing up to be obese adolescents (Deshmukh-Taskar, Nicklas, Morales, Yang, Zakeri & Berenson, 2006), and 70% of obese adolescents in turn growing up to become obese adults (Nicklas, Baranowski, Cullen & Berensen, 2001).

While the causes of childhood obesity are complex, one of the contributing factors is the over-consumption of energy dense foods, that is, foods high in fat, salt and sugar, such as most snack foods (Pearson, Salmon, Campbell & Timperio, 2011). Over the past three years, Australian children's daily consumption of snack foods has increased markedly and now these foods make up about one third of their daily energy intake. As reported in the National Health Survey (2012), on the day of the survey, cakes, biscuits, potato chips and sweetened drinks made up 30.2% of daily energy intake for children aged 2-3 years old and 37.5% of daily energy intake for children aged 4-8 years old (ABS, 2012).

Parents are mainly responsible for determining the foods that children of this age eat. In young children, parents determine which foods are offered, the portion sizes and the frequency of eating occasions (Birch & Ventura, 2008). In particular, parents are largely responsible for young children's snack food consumption. For example, 61% of young children's snack intake occurs within the family home, with an additional 11% consumed in the family car (CSIRO, 2012). Identifying and understanding the way in which parents manage children's consumption of snack foods is therefore one important element in combating childhood obesity.

Parent Feeding Strategies

Parents are influential in shaping children's eating behaviours, including food preferences, food consumption, general diet quality and ultimately weight status (Pinard, Yaroch, Hart et al 2012; Kral & Rauh 2010; Golan & Crow, 2004). Parental influence can be through modeling of food consumed (Brown & Ogden, 2004) and the availability and accessibility of food in the home (Cullen et al. 2003). Parents can also influence children's eating behaviours by using deliberate feeding strategies, such as encouraging their children to eat more of some foods, keeping track of what their child eats and controlling the consumption of certain foods by restricting access to these foods (Birch & Fisher, 1998).

Previous reviews have demonstrated a relationship between particular parent feeding strategies and child eating (Faith, Scalon, Birch, Francis & Sherry, 2004; Ventura & Birch, 2008). Most commonly, parental feeding has been measured by the Child Feeding Questionnaire (CFQ) developed by Fisher and Birch (2001). The CFQ produces measures of restrictive feeding, monitoring child food intake and pressuring the child to eat more of some foods. The studies reviewed consistently showed that higher restrictive feeding strategies were associated with poorer child eating outcomes (e.g., the consumption of more unhealthy foods) than the other parent feeding strategies (Johnson & Birch, 1994; Fisher & Birch, 1999; Fisher & Birch, 2002; Spruijt-Metz, Lindquist, Birch, Fisher & Goran, 2002). As a whole, the reviews provide evidence of a negative effect of parental restrictive feeding strategies on child eating. However, one limitation to generalisation is that most samples consisted of Caucasian children living in middle-to-high socioeconomic areas in the United States.

Another different kind of limitation lies in the use of the CFQ. This measures highly controlling feeding strategies such as restricting the type and amount of certain food, using food as a reward and monitoring the intake of certain foods. Thus it neglects to examine a wider range of potential strategies that parents may use to control their child's food intake (Clark, Goyder, Bissell, Blank & Peters, 2007). As such, it has been recommended that an expanded focus, which includes

more positive strategies such as modeling healthy eating and providing healthy food in the home, be used when examining the relationship between parent feeding strategies and child food intake (Hennessy, Hughes, Goldberg, Hyatt & Economos, 2010). This is particularly necessary when examining snack intake, as snack-related parent-child interactions are likely to involve a wider range of parental behaviours across a range of situations than do meals (Brown & Ogden, 2004).

In response to the above concern, Ogden, Reynolds and Smith (2006) categorised the different potential forms of parental control into what they termed 'overt' and 'covert' control strategies. Overt strategies include monitoring and restricting the child's food intake and are explicitly communicated between the parent and child, e.g., forbidding the child to eat sweets. As such, overt strategies are strategies that the child can easily detect. Thus, the strategies measured by the CFQ, particularly restriction, fall into this category. On the other hand, covert control consists of managing diet quality and food intake in a way that is not detected by the child. In particular, covert control taps the ways in which parents restrict the consumption of unhealthy foods and promote the consumption of healthy food by managing their child's environment, rather than directly targeting the child. For example, parents may avoid buying or having sweets or crisps in the home and avoid visiting restaurants and cafes that serve unhealthy foods.

When Ogden and colleagues investigated the associations between this form of control and the snack food intake of British children (mean age = 7.4 years), they found that covert control was associated with lower intake of unhealthy snack foods. This finding has been replicated by Brown et al. (2008) in a larger British sample. More recently, Rodenburg, Kremers, Oenema and van de Mheen (2013), in a somewhat older sample of 9 year-old Dutch children using a modified and shorter measure of covert control, found that the children of parents who used more covert strategies ate more fruit snacks and fewer unhealthy snacks. Thus, covert control may be a positive practice whereby parents take control over the kinds and quantities of foods available to their children which results in healthier food choices (Ogden, Reynolds & Smith, 2006; Wardle et al., 2005). In addition, covert control may have a beneficial influence on children's diets and eating

habits because children develop good habits, specifically around food, without any sense of deprivation or the emotional angst associated with more overt parental feeding strategies (Brown et al., 2008).

In sum, a sizable body of research documents the negative influence of overtly controlling parental feeding strategies, in particular restrictive feeding, in shaping children's eating habits. More recently research has turned to a broader conceptualisation of parent feeding strategies and this smaller body of research indicates that covert control may be a positive feeding strategy that helps to shape healthier eating habits in older children. However, the impact of this type of parental control has not yet been investigated with younger children aged 2-7 years. Yet this is the time in children's lives when parents have the most control over what they consume and when early habits that carry on into later life are likely to be formed (Skinner, Carruth, Bounds, Ziegler & Reidy, 2003).

General Parenting Style

Like other parental behaviours, feeding strategies take place in the context of general parenting strategies. As such, another body of research has emerged examining the role of general parenting styles and child health outcomes. General parenting style refers to the approach parents use to raise their child and is a function of a parent's attitudes and beliefs, creating a family emotional climate (Darling & Steinberg, 1993). The most common description of parenting style, originally described by Baumrind (1971) and later modified by Maccoby and Martin (1983), conceptualises types of parenting based on two dimensions of parental behaviour: demandingness of and responsiveness to the child. Demandingness refers to setting and enforcing clear standards of behaviour, actively monitoring and supervising child activities, maintaining structure and regimen in the child's daily life, and making demands consistent with the child's level of development. Responsiveness is characterised by the parent's acceptance and affection, providing comfort and support to the child and by their involvement in the child's academic and social development, as well as recognising the child's achievements (Jackson, Henriksen & Foshee, 1998). Historically,

general parenting style research has focused on broad child outcomes including school achievement, social adjustment, and alcohol and drug use in adolescents (Jackson et al, 1998). It is suggested that the combination of high demandingness and high responsiveness, referred to as authoritative parenting (Maccoby & Martin, 1983), is associated with better child outcomes (Cullen et al, 2003; Gable & Lutz, 2000, Steinberg, Dornbusch & Brown, 1997).

More recently, general parenting style research has begun to investigate eating behaviours in older children and adolescents with mixed results. On the one hand, it has been found that adolescents whose parents were highly responsiveness ate more fruit (Kremers, Brug, de Vreis & Engels, 2003), and adolescents whose parents were both highly responsive and highly demanding ate more healthy food (Kremers, et al., 2003; Pearson, Atkin, Biddle, Gorely & Edwardson, 2010). On the other hand, other studies have found no such association (De Bourdeaudhuij et al., 2009; Veerecken, Rovner & Maes, 2010; Taylor, Wilson, Slater & Mohr, 2011). These latter studies concluded that parenting style is not sufficient to determine the dietary behaviour of school aged children and adolescents.

General Parenting, Parent Feeding Strategies and Child Snack Intake

To our knowledge, only one previous study has investigated the relationships between general parenting style, parent feeding strategies and young children's snack intake. In a survey of 269 parents of Australian children aged 2-5 years old, Peters, Dollman, Petkov and Parletta (2013) found parental restrictive feeding strategies predicted lower consumption of fruit and vegetables among children. In addition, parental demandingness and responsiveness predicted healthy snack consumption. Neither general parenting nor parent feeding strategy predicted unhealthy snack intake. However, the study did not investigate the relationship between general parenting and feeding strategies. More importantly, they included only overt controlling strategies (restriction); they did not include any broader potentially positive feeding strategies such as covert control. Indeed, the authors attributed their lack of significant findings to the use of tools that did not measure important aspects of parent feeding strategies.

The Present Study

Given the rapid increase in young children's snack food consumption and the influence of energy dense foods on their diet quality and ultimately weight status, it is important to examine more thoroughly the predictors of snack intake, both healthy and unhealthy. To our knowledge, no previous study has examined general parenting style and both restrictive and covert feeding strategies, as predictors of young children's snack intake. Thus, the present study extends previous research by investigating the parenting dimensions of demandingness and responsiveness, along with restrictive and covert feeding strategies, as predictors of young preschool age children's healthy and unhealthy snack intake. Further, unlike previous studies, we aimed to recruit a large and socioeconomically diverse sample. We predicted that restrictive feeding strategies would be positively related to unhealthy snack intake and negatively related to healthy snack intake, while covert strategies would show the opposite pattern. Finally, we predicted that these feeding strategies would mediate the influence of general parenting style on children's snack intake.

Method

Participants

Participants were 660 mothers of children aged 2-7 years recruited through social media, flyers distributed in childcare centres, crèche facilities, preschools, advertisements in local papers and parenting magazines in Adelaide, South Australia. The study included children of all weights, diets and special needs. Of the 660 participants recruited, 18 participants were excluded from analysis because their children fell outside the targeted 2-7-year age range and 31 participants were excluded due to insufficient data collected, resulting in a final sample size of 611 participants. Participants were directed to a secure web link and completed the questionnaire on line. As a small thank you, they were offered the opportunity to enter a raffle to win one of four $70 supermarket store vouchers. Approval for the study was obtained from the Social and Behavioural Research Ethics Committee at Flinders University.

Measures

The questionnaire, entitled "Managing Kids Food", contained measures of general parenting style, parent feeding strategies, and children's snack food intake as outlined below. Demographic information was also obtained. If participants had more than one child in the target age range, they were asked to respond about only one of their children.

Demographics/Family Environment

Residential postcodes, employment status, occupation and educational attainment were collected. Mothers also reported their current age and the age and gender of their child. Relative socioeconomic disadvantage of area (RSDA) was assigned according to postal code of residence using the area-based deciles (1- 10) from the 2011 Index of Relative Socioeconomic Disadvantage from the Australian Bureau of Statistics census-based Socio-Economic Indexes for Areas (SEIFA) (ABS, 2013). A low decile score on the SEIFA indicates greater socioeconomic disadvantage in the area of residence: participants live in an area where many households have low incomes and many people are without educational qualifications or work in low skilled jobs.

General Parenting style

Mothers reported on their parenting style using the parent report version (Taylor, Wilson, Slater & Mohr, 2011) of the Authoritative Parenting Index (API: Jackson, Henriksen & Foshee, 1998). This measure consists of two scales: *Demandingness* and *Responsiveness*. The Demandingness scale contains nine items measuring indicators of parental supervision, assertive control, monitoring and permissiveness. The Responsiveness scale contains six items measuring indicators of parental warmth, acceptance, involvement, and intrusiveness. The API was originally designed to be reported by children and adolescents and has been validated for use with children from the age of 8 years (Jackson et al., 1998). The API has now been successfully adapted for parental report with minor word changes (e.g. "He/She comforts me when I am upset" to "I comfort my child when he/she is upset) with children aged 7-11 years (Taylor et al., 2011). Internal reliability for the revised parental-report API was adequate for both demandingness ($\alpha = 0.69$) and responsiveness ($\alpha = 0.73$). For the present study, additional minor wording changes were made to

suit younger children (e.g. “I know where my child is after school” to “I know where my child is all of the time”). In the present sample, internal reliability was adequate for both parental reported demandingness (α = 0.75) and parental reported responsiveness (α = 0.73).

Restrictive Feeding

Restrictive feeding strategies were assessed by the restriction subscale of the Child Feeding Questionnaire (CFQ: Fisher & Birch, 2001), by far the most commonly used measure of parental feeding. This scale contains 8 items addressing parents’ propensity to control child eating by limiting the amount and portion sizes of certain foods, using food as a reward and by monitoring children’s intake of certain foods. Exemplar items are, “I have to be sure that my child does not eat too many high-fat foods” and “If I did not guide or regulate my child’s eating s/he would eat too many junk foods”. Responses are made on a 5-point Likert scale (1 = *disagree*, 5 = *agree*) and summed and averaged to produce a score ranging from 1 to 5, with higher scores indicating greater restrictive feeding. Internal reliability of the original restriction scale was acceptable (α = 0.73) (Birch, Fisher, Grimm-Thomas, et al 2001). In the present sample, internal reliability was slightly lower (α = 0.67), but similar reliabilities have been reported previously (e.g., Powers, Chamberlin, van Schaick, Sherman, & Whitaker, 2006). Removing specific items did not improve internal reliability.

Covert Control

Covert control was measured by the covert control scale developed by Odgen et al. (2006). This 5-item scale addresses strategies that parents use to control the child’s consumption of energy dense food through limiting their exposure to these foods in the child’s immediate environment. Items include “How often do you avoid taking your child to places that sell unhealthy food”, and “How often do you avoid buying sweets, crisps, biscuits and cakes and bringing them into the home”. Higher scores on the covert control measure indicate greater control of the child’s environment. The original measure had adequate internal reliability (Cronbach’s α = 0.79). In the present sample, internal reliability was similar (α = 0.75).

Child Snack Food Intake

Children's usual intake of healthy and unhealthy snack foods was measured with an 11-item food frequency questionnaire that was adapted from the Anti-Cancer Council Dietary Questionnaire (Giles & Ireland, 1996). Parents were asked to indicate how frequently in a week their child consumes 11 different snack foods, four of which were subsequently categorized as healthy (fruit, vegetable, yoghurt, cheese) while seven were considered unhealthy (energy dense / nutrient poor) snack foods (potato chips or other crisps, salty flavoured or cheesy crackers, sweet biscuits, cakes and pastries, chocolate and lollies, sugar sweetened drinks, hot fried snacks). The response categories ranged from 'none' to 'more than once a day'. Snack intake was converted to equivalent daily frequencies, which were then summed together and were used to represent the number of healthy and unhealthy snacks consumed per day.

Statistical Analysis

Statistical analyses were conducted using SPSS v20 (SPSS Inc Chicago). An alpha level of .05 was used for all statistical tests. Pearson bivariate correlations were used to identify relationships among background variables and the general parenting domains, feeding strategies and child snack intake. Multiple regression models were used to examine the extent to which 1) general parenting domains predicted the use of particular feeding strategies, 2) general parenting predicted children's unhealthy and healthy snack intake, and 3) the feeding strategies of restriction and covert control predicted children's healthy and unhealthy snack intake, while controlling for covariates (child age, parent age, RSDA and parent education). In these analyses, the covariates were added in the first step, and the predictor variables added in the second step. Finally, the mediation of the relationship between general parenting dimensions of demandingness and responsiveness and child snack intake via parental feeding strategies was tested by the PROCESS procedure using the parallel multiple mediator model based on 10 000 bootstrapped samples (Hayes, 2013). In these analyses, mediation is significant if the 95% bias-corrected confidence interval (CI) of the indirect path does not contain zero. The covariates of child age, parent age,

socioeconomic area and parent education were controlled for and separate analyses were conducted for unhealthy and healthy snack intake.

Results

Sample characteristics

Participants were 611 mothers and their children (318 boys and 292 girls). The available demographic characteristics are presented in Table 1. The average age of the participants was 35.7 years (*SD* = 4.93) with the majority living in two-adult households (92.3%) with two children (56.5%). The participants generally reported on their eldest child (43.0%), with the average age of the child 3.9 years old (*SD* = 1.49). Of the sample, 15.7 % were in full time work, 54.1% in part time or causal employment, and 30.2% were not in the paid workforce. As a group, participants were more educated than national comparison figures with 85% (c.f. 67.2%) having completed university, TAFE or vocational training (ABS, 2013). Nevertheless, they came from a diverse range of socioeconomic backgrounds, with 44.5% of participants coming from low to mid SEIFA areas (deciles 1-7) and 47.5% coming from high SEIFA areas (deciles 8-10) (ABS, 2013).

Table 2 presents means and SDs for parenting styles, feeding strategies and snack intake. Mothers of 2-7 year old children reported significantly higher levels of responsiveness (*M* = 30.0 *SD* =3.36) compared to demandingness (*M* = 20.2, *SD* = 2.99), $t(571) = 59.92$, $p < .01$. Mean scores for restriction (*M* = 3.4, *SD* = 0.69) were similar to those reported previously (*M* = 3.5, *SD* = 0.08; Hennessy et al., 2010). Likewise, mean scores for covert control (*M* = 3.3, *SD* = 0.72) were similar to those reported previously (*M* = 3.0, *SD* = 0.70; Rodenberg et al., 2011). Finally, on average children consumed healthy snacks 4.75 (*SD* = 1.49) times per day and unhealthy snacks close to once a day (*M* = 0.94, *SD* = 0.69).

Table 1

Descriptive characteristics for parents and children

Characteristics	*N* (or %)
Parent	
Age (years), mean (*SD)*	35.7 *(4.93)*
Number of Children mean *(SD)*	1.9 *(.82)*
Education	
Some university/completed university	63%
Technical or vocational school	22%
Some high school/completed high school	9%
Occupation	
Home duties	30%
Casual employment	10%
Part-time employment	44%
Full-time employment	15%
Number of adults in the home	
One	7%
Two	84%
SEIFA	
Low (1-4)	23.4%
Mid (5-7)	21.1%
High (8-10)	47.5%
Child	
Gender	
Male	318
Female	292
Child's position in the family	
Only	24%
Eldest	43%
Middle	6%
Youngest	19%

Table 2

Bivariate correlations between parenting dimensions, feeding strategies and parent reported child snack intake

	Demanding-ness	Responsive-ness	Restriction	Covert Control	Healthy Snacks	Unhealthy Snacks
Mean (SD)	20.20 (2.99)	30.02 (3.36)	3.40 (.69)	3.30 (.72)	4.75 (1.49)	.94 (.69)
Demographics						
Child Age	.04	-.10*	-.11**	-.10*	.06	.15**
Parent age	-.02	-.01	-.10*	-.11**	.02	.02
RSDA[a]	.01	.05	-.05	.04	.12**	-.10*
Education	-.05	.01	-.09*	.11*	.11**	-.11*
Parenting Style						
Demandingness	-	.24**	.06	.14**	.17**	-.17**
Responsiveness	.24**	-	-.26**	.01	.09*	-.17**
Child Eating						
Unhealthy	-.17**	-.17**	.24**	-.33**	-	-
Healthy	.17**	.09*	-.14**	.13**	-	-

*p <.05, **p <.01

[a]RSDA = Relative Socioeconomic Disadvantage of Area from SIEFA index based on residential postcodes

Relationships between key demographic variables and general parenting, parent feeding strategies and child snack intake

Table 2 also presents the correlations between key demographic variables (child age, parent age, relative socioeconomic disadvantage of area [RSDA] and parent education) and parental demandingness and responsiveness, restriction and covert control and children's unhealthy and healthy snack intake. It can be seen that there were significant, albeit small negative correlations between parent age and child age with the use of restriction and covert control. In this sample, which includes participants from a diverse range of socioeconomic areas, RSDA was not significantly related to parenting style or feeding strategies, but was related to snack intake. Specifically, living in a higher socioeconomic area was associated with greater healthy snack intake

and lower unhealthy snack intake. Likewise, higher parental education was related to child snack intake, as well as greater use of covert strategies, and less restrictive feeding. No significant associations were found between child gender, the number of children in the family or family structure and either parent feeding strategies or general parenting style (data not reported in the table).

Table 3

Regression analyses predicting parent feeding strategies from general parenting domains

	Feeding Strategy							
	Restriction				Covert Control			
	B	±SE	Beta	*p*	*B*	±SE	Beta	*p*
Step 1	R^2 (4, 551) =.02, *p* = <.01				R^2 (4, 551) =. 04, *p* = <.001			
Child Age	-.06	.02	-.14	.00	-.04	.02	-.07	.10
Parent Age	-.01	.01	-.05	.30	-.02	.01	-.12	.01
Education	-.07	.04	-.07	.11	.13	.05	.13	.00
RSDA	-.00	.01	-.00	.93	.01	.01	.04	.37
Step 2								
	ΔR^2 (2, 549) =.09, *p* = <.001				ΔR^2 (2, 549) =.02, *p* = <.001			
Demandingness	.30	.01	.13	.00	.04	.01	.34	.00
Responsiveness	-.06	.01	-.31	.00	-.01	.01	-.04	.39

Relationships between general parenting styles and feeding strategies

Regression analyses, presented in Table 3, demonstrate that after controlling for the covariates in Step 1, general parenting domains were significantly associated with feeding strategies. Specifically, higher parental demandingness (β = .13, *p* =. 002) and lower responsiveness (β = -.31, *p* =. 000) independently predicted use of restrictive feeding, R^2_{Change} (2, 549) = .09 *p* = .001, while higher parental demandingness (but not responsiveness) was positively associated with the use of covert strategies (β = .34, *p* =. 000), R^2_{Change} (2, 549) = .02, *p* =. 001.

Table 4

Regression analyses predicting child snack intake from general parenting domains

	Snack Intake							
	Unhealthy				Healthy			
	B	±SE	Beta	*p*	*B*	±SE	Beta	*p*
Step 1								
	R^2 (4, 539) =.04, *p* = <.001				R^2 (4, 551) =. 02, *p* = <.01			
Child Age	.07	.04	.14	.00	.07	.04	.07	.14
Parent Age	.00	.01	.02	.70	-.01	.01	-.04	.40
Education	-.10	.05	-.10	.03	.23	.10	.10	.02
RSDA	-.02	.01	-.07	.09	.05	.02	.09	.04
Step 2								
	ΔR^2 (2, 527) =.05, *p* = <.001				ΔR^2 (2, 549) =.03, *p* = <.001			
Demandingness	-.04	.01	-.16	.00	.08	.02	.16	.00
Responsiveness	-.02	.01	-.11	.01	.02	.02	.05	.23

General parenting predicting parent reported child snack intake

The regression results (Table 4) show that lower parental demandingness (β = -.16, *p* =. 001) and lower parental responsiveness (β = -.11, *p* =. 007) were associated with unhealthy snack intake, R^2_{Change} (2, 527) = .05, *p* =. 001, while higher parental demandingness (β = .16, *p* =. 000) was associated with healthy snack intake, R^2_{Change} (2, 549) = .03, *p* =. 001).

Feeding strategies predicting parent reported child snack intake

As can be seen in Table 5, the regression analyses show that unhealthy snack intake was predicted by higher parental restrictive feeding (β = .29, *p* =. 001) and lower use of covert control (β = -.34, *p* =. 001). The reverse was true for healthy snack intake: children's intake of healthy snacks was predicted by less parental restrictive feeding (β = -.30, *p* =. 001) and more covert control (β = .28, *p* =. 001).

Table 5

Regression analyses predicting child snack intake from parent feeding strategies

	Snack Intake							
	Unhealthy				Healthy			
	B	±SE	Beta	*p*	*B*	±SE	Beta	*p*
Step 1	R^2 (4, 539) =.04, *p* = <.001				R^2 (4, 551) =. 02, *p* = <.01			
Child Age	.07	.02	.15	.00	.06	.04	.06	.16
Parent Age	-.01	.01	-.01	.85	-.01	.01	-.03	.48
Education	-.03	.04	-.03	.50	.15	.10	.07	.12
RSDA	-.02	.01	-.07	.11	.05	.03	.09	.05
Step 2	ΔR^2 (2, 537) =.17, *p* = <.001				ΔR^2 (2, 549) =.03, *p* = <.001			
Restriction	.29	.04	.29	.00	-.30	.09	-.14	.00
Covert Control	-.33	.04	-.34	.00	.28	.09	.13	.00

The mediating role of feeding strategies, general parenting style and parent reported child snack intake

The regression coefficients from the PROCESS analyses are displayed in Figure 1. For unhealthy snack intake, Figure 1(a) shows that there is a direct effect from parental demandingness and indirect effects through both restrictive feeding strategies and covert strategies. It can also be seen that parental responsiveness directly affects children's unhealthy snack intake, with the only indirect effect through restrictive feeding. For healthy snack intake (Figure 1b), a direct effect from parental demandingness, and indirect effects through restrictive feeding and covert strategies can be seen. However, for parental responsiveness, there is no direct effect on healthy snack intake, nor indirect effect through covert strategies; only an indirect effect through restrictive feeding is evident. Tests of the significance of indirect effects, which are presented in Table 6, show that the indirect effects described above are all statistically significant (CI does not contain zero).

Figure 1(a). Unhealthy snack intake

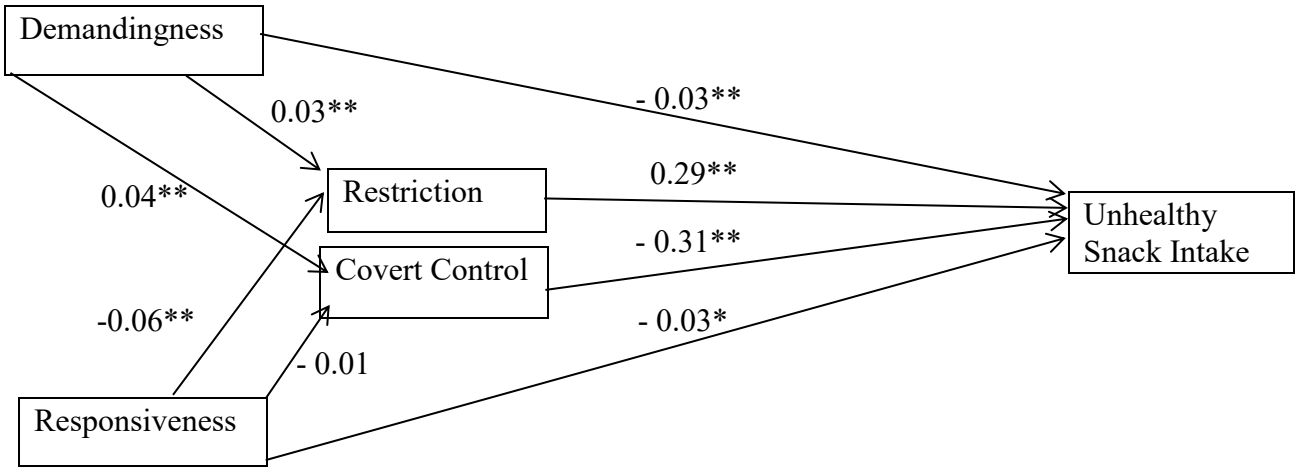

Figure 1(b). Healthy snack intake

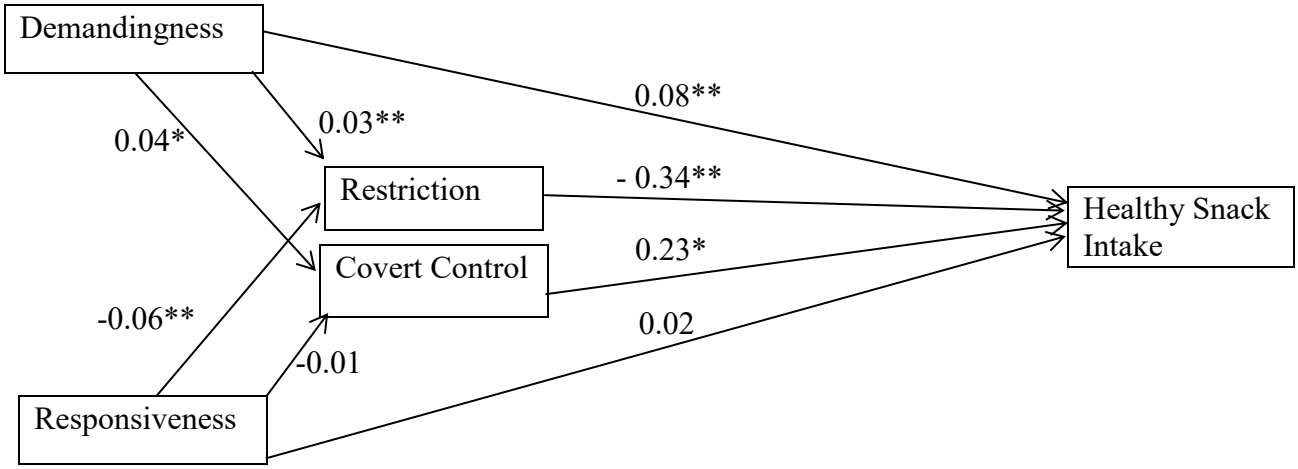

Figure 1. Mediation pathways from general parenting dimensions of demandingness and responsiveness to child snack intake. Note: * $p < .05$ ** $p < .001$

Table 6

Bootstrapped path coefficients and 95% CI of indirect effects from general parenting to child snack intake

		Unstandardised, *B*		
		Estimate (SE)	95% CI	Significant Indirect Effects
Dependent Variable: Healthy				
Predictor	*Mediator*			
Demandingness	Restriction	-.011 (.005)	[-.023 -.003]	*
Demandingness	Covert	.009 (.005)	[.002 .021]	*
Responsiveness	Restriction	.021 (.007)	[.009 .036]	*
Responsiveness	Covert	-.001 (.002)	[-.007 .003]	
Dependent Variable: Unhealthy				
Predictor	*Mediator*			
Demandingness	Restriction	.009 (.003)	[.004 .016]	*
Demandingness	Covert	-.012 (.004)	[-.020 -.005]	*
Responsiveness	Restriction	-.017 (.004)	[-.025 -.011]	*
Responsiveness	Covert	.001 (.003)	[-.005 .007]	

Note: These process analyses were based on 10 000 bootstrapped samples. CI = confidence interval

Discussion

To our knowledge the present study is the first to examine the influence of both restrictive and covert feeding strategies on pre-school children's snack intake. Further, this was done in the context of general parenting. The major findings of the study are clear. As predicted, restrictive feeding was associated with greater unhealthy and less healthy snack intake, while the reverse was true for covert strategies. In addition, for both unhealthy and healthy snack intake, the effect of parental demandingness operated through restrictive feeding and covert strategies, while the effect of parental responsiveness operated only through restrictive feeding.

Here, restrictive parent feeding strategies were associated with excessive unhealthy snack intake. While parents may use this strategy in an attempt to limit young children's intake of unhealthy snack foods, children seem to consume more of these foods when parents use more

restrictive feeding. These findings support the results of previous studies indicating that this type of overtly controlling strategy has a paradoxical effect on older children's intake of unhealthy foods (Fisher & Birch, 1999 (a); Birch, Fisher & Davison, 2003; Jansen, Mulkens & Jansen, 2007). The cross sectional design of the study means that the causal direction is not clear, and thus it is not possible to disentangle whether children's increased intake of unhealthy snacks causes alarm for parents, resulting in them more frequently restricting their child's snacks, or if these feeding strategies result in children's greater attraction to and intake of unhealthy snacks. While a few experimental studies have suggested the latter (Fisher & Birch 1999 (a); Fisher & Birch 1999 (b); Jansen et al., 2007), here it is unclear whether this relationship starts with the parent or the child. Most likely, parent-feeding strategies and child eating behaviours reinforce each other in an ongoing reciprocal process. Our research also shows a moderately strong negative relationship between restrictive feeding strategies and young children's intake of healthy snacks, thus showing that restrictive feeding strategies may further serve to inhibit the eating of healthy snacks. This finding supports the one other study that examined the effect of parental restriction on young children's fruit and vegetable consumption (rather than healthy snack intake), where parental use of restriction was associated with lower fruit and vegetable consumption (Coulthard and Blissett, 2009). As a whole, these results indicate that overtly controlling parental feeding strategies like restrictive feeding are associated with poorer child dietary outcomes.

Extending the previous literature, our study also examined parental use of potentially more positive covert feeding strategies with pre-school children (mean age = 3.9 years). The finding that the use of covert strategies was associated with more healthy and less unhealthy snack food intake clearly indicates that this is a more effective strategy for parents when managing their young child's snack intake. This finding extends the few studies that have been conducted with older children (Ogden et al., 2006: Brown et al., 2008; Rodenburg et al., 2013). Together, these findings suggest that covert feeding strategies, in which parents manage the environment rather than the child, represent a type of parental control that is beneficial for children. Thus covert strategies constitute a

positive and effective way to manage children's nutritional intake and allow children to develop good eating habits, without any sense of deprivation or conflict that may be associated with more overtly controlling strategies. Importantly, the differential effects on snack intake also clearly show that covert control and restrictive feeding (overt control) should be treated as theoretically different constructs.

When examining the influence of general parenting behaviours, greater demandingness was associated with greater healthy snack intake and lower unhealthy snack intake. Parental demandingness (characterised by setting and enforcing clear standards of behaviour and maintaining structure in the child's daily life) is considered a stable characteristic of parenting that characterises parents' overall approach to parenting (Jackson et al, 1998). We also found that parental responsiveness (characterised by being affectionate and accepting, and providing comfort and support) was associated with lower unhealthy snack food. Put differently, the children who consumed the most unhealthy snack food were those who had parents low on both demandingness and responsiveness and, conversely, the children who consumed the least unhealthy snack food were those with parents high on both parenting dimensions.

To our knowledge, the present study is the first to test the influence of parent feeding strategies as mediators of the relationship between general parenting style and young children's snack intake. Our findings clearly show that the association between parenting style and child snack intake is mediated by restrictive feeding and covert feeding strategies. Thus general parenting styles lead to the use of particular feeding strategies that, in turn, are associated with children's consumption of particular snacks. In addition, these associations remained when additional factors such as parent age, child age, parent education and socioeconomic area of residence were controlled for. Previous research has indicated that general parenting style has far reaching implications in many domains of child development. Our results add to this body of research that shows high levels of demandingness and responsiveness to be related to a host of beneficial outcomes (Cullen

et al, 2003; Gable & Lutz, 2000, Steinberg, Dornbusch & Brown, 1997), and extends these benefits into healthy eating behaviours.

A notable strength of the present study is the age of children investigated. Our study examined the parenting strategies of parents of younger children, a time when parents can exert the most control over children's eating habits. Although eating habits develop at a young age and seem to remain stable into adolescence and adulthood (Fisk, Crozier, Inskip, Godfrey, Cooper & Robinson, 2011), most of the previous research examining the influence of general parenting or feeding strategies on food intake has been conducted with older school-aged children. The findings of the present study indicate that the use of both restrictive feeding and covert strategies are reduced for older parents and children, supporting the suggestion that parents have more control when children are younger. In addition, and perhaps unsurprisingly, as children become older, their consumption of unhealthy snacks increases. This suggests that there may be only one limited window of opportunity for parents to exert much influence over children's eating habits. A further notable contribution of the present study is that participants came from more diverse socioeconomic areas than in previous research. This is particularly important given that diet quality and associated risk factors of obesity have been socioeconomically patterned (Ball & Crawford, 2005; McNaughton, Ball, Crawford & Mishra, 2008). Indeed, our results show that living in a lower socioeconomic area was related to unhealthy snack intake. However, where participants lived had little effect on parenting style or feeding strategies. Put differently, socioeconomic area of residence was not relevant to what style or strategies parents used, but was relevant to the type of snacks children ate. It is possible that place of residence operates on snack intake via other variables such as family eating habits or environmental features such as vicinity to and volume of fast food restaurants (Abbott, Backholer, Peeters, Thornton, Crawford & Bell, 2013).

The results presented here may have important practical implications. In particular, they could usefully inform the advice given to parents about effective strategies to use when attempting to manage their young children's snack intake. Given the increased public awareness of the risks of

obesity, parents may be concerned about their child's present and future weight. The most obvious action for parents to take would be to place their child on a diet or restrict their intake of unhealthy (energy dense) food. However, while this seems a very logical response, the present results indicate that this may not be the most useful strategy and one that well-meaning parents should be dissuaded from using. Rather, parents could be educated about and encouraged to use more covert strategies, such as limiting the availability of unhealthy snacks in the child's immediate environment in a way that is not experienced by the child as deprivation. In addition, given that general parenting style is thought to be stable over time (and not a response to children's eating behaviours), training parents in the skills and behaviours associated with parental demandingness and responsiveness may be beneficial. These behaviours include the setting and enforcing of clear boundaries and maintaining structure in the child's daily life, along with being affectionate, accepting, supportive and involved in the child's academic and social development. Such training might not only contribute to the child's consumption of healthier snacks, but also ultimately have a wide range of additional benefits (Lazelere, Morris & Harrist, 2013)

Like all studies, the findings of the current study need to be interpreted in light of some limitations. First, the participants were mothers who volunteered to participate in a study on child feeding and as such may have had a higher interest in healthy child diet (they were more highly educated), resulting in some degree of self-selection bias. On the other hand, the study had a large sample from a wider range of socioeconomic areas than previous studies. Second, participation was via a parental self-report questionnaire, which is open to some degree of social desirability bias. Third, the study only recruited mothers, and did not recruit fathers or other caregivers. Further, it did not examine other variables such as mothers' eating habits, thus giving a limited perspective of the total family-eating environment. Fourth, the Authoritative Parenting Index used needs further psychometric validation for younger children. Finally, as with all correlational studies, causal conclusions cannot be drawn. Longitudinal research that tracks both parental and child behaviours

over some time is needed to more fully understand the factors that influence the development of young children's snacking behaviours.

Despite the above limitations, the findings of the present study clearly show that general parenting style predicts the use of specific parental feeding strategies, and that these feeding strategies, in turn, influence child snack intake. Results from this study indicate that the use of covert feeding strategies is far more beneficial than restrictive strategies in encouraging young children's consumption of healthy snacks and discouraging the consumption of unhealthy snacks. At a theoretical level, identification of covert control in the context of general parenting style contributes to a more complex understanding of the effect of parent feeding strategies on children's snack intake. At a practical level, findings offer potential scope for interventions with parents of pre-school-aged children that focus on both general parenting style and specific feeding strategies to help manage their children's snack food intake.

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CHAPTER 4: Study 1c - Difficult Feeding Situations

Maternal responses to difficult food request scenarios: Relationships with feeding style and child unhealthy snack intake

Samantha B. Boots[a], Marika Tiggemann[a] and Nadia Corsini[b]

[a] School of Psychology, Flinders University, Adelaide, Australia

[b] Cancer Council South Australia, Adelaide, Australia

Corresponding author: Samantha B. Boots, School of Psychology, Flinders University, PO Box 2100, Adelaide, SA, 5001 Australia.

Email: samantha.boots@flinders.edu.au

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Abstract

This study sought to identify parent-feeding behaviours in real-life difficult feeding situations through the use of a set of scenarios. These were then used to examine links between parent feeding and child snack intake. Mothers of children age 2-7 years (n = 611) completed an online survey containing five snack food request scenarios, two commonly used parent-feeding scales (Restriction or Covert Control), and reported on their child's snack intake. Results showed that parent-feeding styles (restrictive or covert) translated into specific behaviours in response to the scenarios. These parent behaviours predicted children's intake of unhealthy snack food over and above the feeding style.

Introduction

Childhood obesity is well documented and may have serious adverse psychological, social and health consequences in childhood and in later life (Monasta, Batty, Catteneo, Lutje, Ronfani et al., 2010). Currently, 20-25% of 2-8 year old children in Australia are overweight or obese (ABS, 2012). While a number of factors contribute to childhood overweight, the over-consumption of energy dense foods (foods high in fat, salt and sugar), such as most snack foods, is clearly a significant contributor (Pearson, Salmon, Campbell, Crawford & Timperio, 2011). Of particular concern is the rapid increase in unhealthy snack consumption among pre-school aged children (ABS, 2012; Piernas & Popkin, 2010), with unhealthy snack foods making up close to one third of Australian preschool children's daily food intake (ABS, 2011). Furthermore, 61% of young children's snack intake occurs within the family home, with an additional 11% consumed in the family car (CSIRO, 2012), indicating that parents play a major role. In light of these trends, understanding how parents manage young children's unhealthy snack consumption may be one important element in addressing childhood obesity.

Parents may use a range of feeding strategies to manage their child's snack intake. For example, parents may attempt to restrict the consumption of energy dense (unhealthy) snacks by not allowing the child to eat sweets, or only allowing the child to eat a certain amount of sweets and snacks (Fisher & Birch, 1999a). Restrictive feeding involves deliberate attempts to limit unhealthy snack food consumption through explicit communication from the parent to the child, and thus is overt in nature. Restrictive feeding is by far the most widely studied parent feeding strategy (Stang & Loth, 2011) and is most commonly measured by the Restriction subscale of the Child Feeding Questionnaire (CFQ: Birch, Fisher, Grimm-Thomas, Markey, Sawyer et al., 2001). However, somewhat paradoxically, previous research has consistently shown that restrictive feeding is associated with poorer child eating outcomes (e.g., consumption of more unhealthy foods) and higher child BMI (Fisher & Birch, 1999a, 1999b; Birch et al., 2002; Johnson & Birch, 1994;

Spruijt-Metz, Lindquist, Birch, Fisher & Goran, 2002; Faith, Scanlon, Birch, Francis & Sherry, 2013; Rodgers, Paxton, Massey, Campbell, Wertheim et al., 2013).

Ogden and colleagues (2006) have identified a very different style of parental feeding that they termed covert control. In contrast to restrictive feeding, covert control refers to ways in which parents manage the child's eating by targeting the child's *environment*, rather than targeting the child, and thus is not detected by the child. For example, parents (without any comment) may avoid having snack foods in the home or avoid visiting cafés or restaurants that sell unhealthy food. A smaller body of research has shown that covert strategies as measured by the Covert Control Scale (Odgen, Reynolds & Smith, 2006) result in healthier food choices and intake for the child (Rodenburg, Kremers, Oenema & van de Mheen, 2011; Brown, Ogden, Vogele & Gibson, 2008). Indeed, covert strategies may have longer-term benefit because children can develop good eating habits without any sense of the deprivation potentially associated with more overt restrictive feeding strategies (Cullen, Baranowski, Owens, Marsh, Rittenberry et al., 2003).

The existing measures of parent feeding styles, including the Restriction and Covert Control Scales, attempt to capture broad feeding attitudes, e.g. '*I have to be sure that my child does not eat too many high fat foods'* (Restriction). As a result, relatively little is known about what parents actually do in specific situations when managing their child's snack food consumption (Fisher, Wright, Herman, Malhotra, Serrano et al., 2015). While some observational studies have described the behaviour of small samples of mothers of pre-school aged children during mealtimes (for a review see Bergmeier, Skouteris & Hertherington, 2015), there is limited research on how snack foods are managed outside of mealtimes. Two recent interview studies have begun the investigation of parental perceptions of non-meal foods in the home. Blake, Fisher, Ganter, Younginer, Orloski, et al. (2015) interviewed 60 parents of preschool aged children about their strategies surrounding children's snack food portion size. Fisher, Wright, Herman, Malhotra, Serrano et al. (2015) interviewed 32 mothers of preschool children about their perceptions of snack foods. Two key themes emerged: snack foods were quick and convenient and did not constitute

'real' food; and snacks held great hedonic value for both the mother and children. As yet, research has not addressed parental behaviours in specific situations, such as at the supermarket or at a birthday party, situations that can be highly public and stressful for parents. Parental behaviour in these situations may have important implications for understanding how parents manage young children's snack intake and may inform the advice given to parents about strategies to promote healthy eating habits.

The first aim of the present study was to develop a set of scenarios depicting real life challenging situations involving pre-school aged children's snack food requests, and to document parental responses of a large and diverse sample of mothers. The second aim was to examine whether these parental responses reflect broader feeding styles as measured by the Restriction and Covert Control feeding scales. The third aim was to determine whether parent reported behaviours offer additional unique prediction of child unhealthy snack intake, over and above the measured feeding styles.

Method

Participants

Participants were 611 mothers of children aged 2-7 years (318 boys and 292 girls) recruited through social media, flyers distributed in childcare centres, crèche facilities, preschools, advertisements in local papers and parenting magazines in Adelaide, South Australia. The average age of the mothers was 35.7 years (*SD* = 4.93) and they generally reported on their eldest child (43.0%), with the average age of the child 3.9 years old (*SD* = 1.49). Most of the participants had a higher education with 85% having completed university, TAFE or vocational training. The mothers came from a diverse range of socioeconomic areas (SES), based on postal code of residence (2011 Index of Relative Socioeconomic Disadvantage; ABS, 2013), with 44.5% of participants coming from low to mid SEIFA areas (deciles 1-7) and 47.5% coming from high SEIFA areas (deciles 8-10) (ABS, 2013). Further details of the sample are provided in Boots, Tiggemann, Corsini & Mattiske (2015).

Measures

The questionnaire, entitled "Managing Kids Food", presented mothers with a set of five food scenarios involving child snack food requests with behavioural responses. These were completed first in order not to be primed by responses on the subsequent measures of feeding attitudes. Next, mothers completed the Restriction Scale from the CFQ (Birch et al., 2001) and the Covert Control Scale (Ogden et al., 2006), and finally reported on their child's snack intake.

Snack Food Request Scenarios

There were five food request scenarios that depicted challenging situations for parents: at the supermarket, visiting friends or relatives, at a birthday party, packing a lunch box, and after viewing an advertisement for a food on television. The mothers were asked, "*What would you usually do*?" and were asked to select one response from a list of 4 to 6 options for each scenario.

The scenarios and behavioural responses were developed through an extensive series of pilot interviews with 22 mothers (aged 30-39 years old) of children aged 2-7 years. The pilot test group of 22 mothers identified everyday difficult situations where they were under pressure to response to their child's snack food request. During the first phase of scenario development, we asked mothers to respond to open ended questions about situations in which they felt challenged in how to deal with their child's request for unhealthy food. A list of all of the situations was developed and circulated to the pilot group participants. The situations were then rank ordered by mothers and the top five were selected for inclusion in the study. In the next phase of development, mothers were presented with the scenarios and asked "*What would you usually do*?" in order to develop realistic behavioural responses. Again, the most common responses were collated and sent to the pilot group for further comment. In the final phase of development, we sent the resulting scenarios and behavioural responses to a new smaller group of mothers ($n = 6$) for their comment. No further revisions were necessary based on this feedback.

Restriction Scale (CFQ)

The Restriction Scale (8 items, e.g., "I have to be sure that my child does not eat too many high-fat foods") of the CFQ (Birch et al, 2001) addresses parents' propensity to control child eating by limiting the amount and portion sizes of certain foods, using food as a reward and by monitoring children's intake of certain foods. Higher scores indicate greater restrictive feeding. Internal reliability of the original Restriction Scale was acceptable ($\alpha = 0.73$) (Birch et al., 2002). In the present sample, internal reliability of the Restriction Scale was slightly lower ($\alpha = 0.67$), but similar lower reliabilities have been reported previously (e.g., Powers, Chamberlin, van Schaick, Sherman, & Whitaker, 2006).

Covert Control Scale

The Covert Control Scale (5 items, e.g., "How often do you avoid buying sweets, crisps, biscuits and cakes and bringing them into the home") addresses strategies that parents use to control their child's consumption of energy dense food through limiting their exposure to these foods in the child's immediate environment (Odgen et al., 2006). Higher scores on the Covert Control scale indicate greater control of the child's environment. The original measure had adequate internal reliability (Cronbach's $\alpha = 0.79$). In the present sample, internal reliability was similar ($\alpha = 0.75$).

Child Snack Food Intake

Children's habitual intake of snack foods was measured with an 11-item food frequency questionnaire that was adapted from the Anti-Cancer Council Dietary Questionnaire (Giles & Ireland, 1996). Of these, seven items referred to unhealthy (energy dense / nutrient poor) foods. In particular, parents reported how frequently in a week their child consumes potato chips or other crisps, salty flavoured or cheesy crackers, sweet biscuits, cakes and pastries, chocolate and lollies, sugar sweetened drinks, hot fried snacks. The response categories ranged from 'none' to 'more than once a day'. Unhealthy snack intake was converted to equivalent daily frequencies, which were then summed to represent the number of unhealthy snacks consumed per day.

Statistical Analysis

Statistical analyses were conducted using SPSS v20 (SPSS Inc Chicago). An alpha level of .05 was used for all statistical tests. Descriptive statistics were used to describe the distribution of maternal responses to the scenarios. A series of one-way ANOVAs was conducted to test whether particular scenario responses were associated with the Restriction and Covert Feeding Scale scores. Separate restrictive and covert scenario behavioural response scores were then calculated by summing the responses that were reflective of the particular style. Pearson bivariate correlations were used to examine relationships between scenario behavioural responses and children's unhealthy snack intake. The difference between the size of the correlations for scenario and scale scores was tested with Steiger's (1980) test for non-independent correlations. Finally, to examine the incremental utility of the scenarios, a regression analysis was conducted to explicitly determine whether scenario responses offered additional unique prediction of child unhealthy snack intake over and above that offered by feeding style, while controlling for covariates (child age, parent age, SES and parent education). In this analysis, the covariates were added in the Step 1, the feeding scale scores (Restriction Scale and Covert Control Scale) were entered in Step 2, and the scenario responses (restrictive and covert) were added in Step 3.

Results

Maternal responses to the snack request scenarios

Table 1 provides the text of the snack request scenarios, the maternal response options and the frequency of mothers who chose each response. It can be seen that there was a spread of responses for each snack request scenario. For Scenario 1, *At the supermarket,* the most common behavioural responses were Response 2 (*bring food from home and offer that*) and Response 5 (*say 'no'*). For Scenario 2, *At a birthday party,* most parents chose Response 4 (*keep track of what your child eats and tell them to stop when you think they have had enough*). For Scenario 3, *Packing a lunch box,* Response 4 (*offer a healthier alternative*) was the most commonly chosen response. By far the most common response to Scenario 4, *Visiting a friend or relative,* was Response 1 (*you*

allow your child to have a small amount of the food and then say to your child you don't want them to have anymore). Finally, for Scenario 5, *viewing a food advertisement on television,* Response 3 (*you point out that its not good for them and refuse*) or Response 4 (*remind them of a healthy treat that they like and offer to buy that*) were the most commonly reported responses.

The association between snack request scenario responses and feeding style

Table 1 also shows the means (and standard deviations) for the general feeding scale scores of mothers for each particular response option chosen. The ANOVA showed that the restriction and covert control scale scores differed by response in Scenario 1, *At the supermarket*. Mothers with a restrictive style chose Response 1 (*allow the child to have the sweet*) and 4 (*offer the sweet as a reward for good behaviour*). For Scenario 2, *At a birth party,* covert control was associated with Response 5 (*bring food from home*). In Scenario 3, *Packing a lunch box,* mothers with a restrictive feeding style chose Response 2 (*child can choose a snack, parent chooses a snack*) or Response 5 (*defer to kindy rules*), while mothers with a covert style chose Response 1 (*we don't have those kinds of snacks in the house).* For Scenario 4 (*visiting a friend or relative),* restrictive mothers chose Response 2 (*allow your child to eat the sweets*) and Response 5 (*say to your child they can't have anymore*). Finally, for Scenario 5, *viewing a food advertisement on television,* restrictive mothers responded with either Response 1 (*tell them you will buy it if they are good*) or Response 2 (*agree to buy it as a treat*), while mothers higher in a covert style responded with Response 3 (*you point out that its not good for them and refuse*) or Response 4 (*remind them of a healthy treat that they like and offer to buy that*).

Table 1
Means (and standard deviations) of behavioural responses by feeding style.

Scenario 1: At the supermarket. You are at the supermarket: you may be feeling pressured for time and want to get the shopping done quickly so that you can get home. Your child asks you for a sweet or snack food. What would you normally do?

1. You allow your child to have the snack or sweet as you do not want to have a scene and it means you can get the shopping done quickly.
2. You bring food from home and offer that.
3. You offer your child a healthier alternative than what the wanted (e.g. sultanas, dried fruit).
4. You offer the sweet or snack as a reward for good behaviour (e.g. 'If you are good through the whole shopping, you can pick out a lolly before we leave').
5. You say 'no' to your child's request.
6. You typically avoid taking your child to the supermarket.

Response	1 (n = 17)	2 (n = 154)	3 (n = 131)	4 (n = 99)	5 (n = 139)	6 (n = 59)	F	η^2
Restriction Scale	**3.78$_a$ (.61)**	3.39$_b$ (.64)	3.21$_b$ (.66)	**3.80$_a$ (.63)**	3.26$_b$ (.70)	3.42$_b$ (.64)	11.65**	.08
Covert Control Scale	2.88 (.53)	3.35 (.72)	3.33 (.73)	3.22 (.65)	3.31 (.73)	3.38 (.78)	1.70	.13

Scenario 2: At a birthday party. You and your child are at a birthday party. Your child wants to eat the sweets and snack foods that are there. What would you normally do?

1. You allow your child to eat the foods on offer – after all it is a birthday party, you figure your child can eat what they want.
2. You only allow your child to eat a few sweets and snacks by getting the food for your child (you do not allow your child to self-serve).
3. You allow your child to choose two things to eat and then you choose the rest of what they will eat.
4. You keep track of what your child eats, and tell then to stop when you think they have had enough.
5. You bring food from home for your child to eat at the birthday party, that way you know that there will be food there that your child can eat.

Response	1 (n = 217)	2 (n = 68)	3 (n = 44)	4 (n = 256)	5 (n = 14)	F	η^2
Restriction Scale	3.41 (.71)	3.47 (.53)	3.26 (.72)	3.42 (.69)	3.01 (.63)	1.86	.01
Covert Control Scale	3.20$_a$ (.72)	3.46 (.71)	3.26 (.74)	3.35 (.69)	**3.80$_b$ (.74)**	3.91*	.03

Scenario 3: Packing the lunch box. You and your child are packing their school or kindy or preschool snack box. Your child wants to put in a snack or sweet. What would you normally do?

1. You do not keep snacks and sweets in the cupboard at home, so you say to your child, 'We don't have any of those kinds of foods to put into your snack box'.
2. You say that your child can choose one type of snack or sweet and you also include a healthy alternative.
3. Your child packs their own snack box, so they can choose to eat what they like.
4. You have snack foods that you know your child likes to eat that are healthy, so you offer that instead.
5. You say to your child that the school or kindy or preschool rules about food mean that they are not allowed to have those foods in their snack box.

(Continued)

Table 1. (Continued)

Response	1 (n = 82)	2 (n = 98)	4 (n = 282)	5 (n = 132)	F	η^2
Restriction Scale	3.16_a (.66)	**3.51_b (.69)**	3.38 (.67)	**3.51_b (.67)**	5.65*	.03
Covert Control Scale	**3.72_a (.70)**	3.09_b (.68)	3.29 (.65)	3.29 (.65)	12.82**	06

Scenario 4: Visiting. You and your child are visiting a friend or relative. They offer your child a sweet or snack that you would prefer they did not have. What would you normally do?

1. You allow your child to have a small amount of the food that is offered and then say to your child you do not want them to have any more.
2. You allow your child to eat the offered sweets or snack foods to be polite.
3. You tell your child before you get to your friend or relative's house that they must say no to any offers of snacks or sweets because they are bad for you.
4. You tell your friend or relative not to offer your child snacks or sweets as you do not want them to eat those types of foods.
5. You say to your child that they cannot have the sweets and snacks that have been offered in front of your friend or relative.

Response	1 (n = 340)	2 (n = 103)	4 (n = 103)	5 (n = 30)	F	η^2
Restriction Scale	3.40 (.68)	**3.51_a (.68)**	3.24_b (.71)	**3.50_a (.60)**	3.21*	.02
Covert Control Scale	3.28 (.72)	3.28 (.65)	3.46 (.71)	3.33 (.80)	1.69	.01

Scenario 5: TV ad. Your child has seen an ad for a new sweet, snack or fast food item and then asks for it – what would you normally do?

1. You tell them that you will buy it for them if they are good (you know that you could use this to encourage them to behave).
2. You generally agree that you will buy it at some point in the future as a treat.
3. You point out to your child that the food is not good for them and refuse to buy it.
4. You remind them about another healthy treat that you know they like and offer to buy that for them instead.

Response	1 (n = 19)	2 (n = 169)	3 (n = 216)	4 (n = 189)	F	η^2
Restriction Scale	**3.54_a (.89)**	**3.54_a (.65)**	3.39 (.63)	3.26_b (.73)	5.48*	.03
Covert Control Scale	2.99_a (.75)	3.08_a (.70)	**3.41_b (.70)**	**3.31_b (.68)**	11.43**	.06

HSD: honest significant difference.A total of 0 participants indicated response 3 in scenarios 3 and 4. Standard deviations appear in parentheses.

Means with differing subscripts within rows are significantly differ- ent at $p < .05$ based on Tukey HSD post hoc test.

*p <.05, **p <.01

Relationship between behaviour responses and scale scores

The means that are reflective of either a restrictive feeding style or a covert feeding style are presented in bold on Table 1. When examining the correlations between the summed behavioural responses reflective of a style and the scale score, restrictive behavioural responses were positively correlated with Restriction Scale scores (r = .28, p <. 01) and negatively correlated with Covert Control Scale scores (r = -.22, p <. 01). Likewise, covert behavioural responses were positively correlated with Covert Control Scale scores (r = .30, p <. 01) and negatively correlated with Restriction Scale scores (r = -.30, p <. 01).

Table 2

Correlations between scenario response scores, child feeding scale scores and children's snack intake

	Scenario Response	Feeding Scale Scores	*t*
Restriction	.42**	.24**	4.01**
Covert	-.41**	-.33**	2.02*

* p <.01, ** p <.001

Relationship between food scenario responses and unhealthy snack intake

Table 2 presents the correlations between the scenario responses and children's unhealthy snack intake. Restrictive scenario responses were associated with more unhealthy snack consumption by children (r = .42, p <. 001). In contrast, covert scenario responses were related to lower consumption of unhealthy snack foods (r = -.41, p <. 001). When the difference between the size of the correlations for scenario and scale scores was tested, Steiger's (1980) test for non-independent correlations showed that restrictive scenario responses were a significantly stronger predictor of unhealthy snack intake than Restriction Scale scores, $t(608) = 4.01$, $p < .001$. Likewise,

covert scenario responses were a stronger predictor of unhealthy snack intake than Covert Control Scale scores, $t(608) = 2.02$, $p < .01$.

Table 3

Regression analyses predicting child snack intake from parent feeding responses

	B	±SE	Beta	*p*
Step 1	R^2 (4, 531) =. 04, $p <$. 001			
Child Age	.07	.02	.15	.00
Parent Age	.01	.01	.02	.96
Education	.02	.04	.02	.69
SES	-.02	.01	-.06	.15
Step 2 *(measure scale)*	ΔR^2 (2, 529) =. 17, $p <$. 001			
Restriction	.20	.04	.19	.00
Covert Control	-.23	.04	-.24	.00
Step 3 *(scenario response)*	ΔR^2 (2, 527) =. 09, $p <$. 001			
Restrictive Responses	.16	.04	.23	.00
Covert Responses	-.14	.05	-.13	.00

Results for the final regression analysis are presented in Table 3. As can be seen, after controlling for the covariates in Step 1, Restriction and Covert Control scale scores significantly predicted child unhealthy snack intake. Of more importance, Step 3 showed that the scenario responses offered significant additional prediction in unhealthy snack intake, R^2_{Change} (2, 531) =. 09, $F_{Change} = 34.33$, $p <$. 001. The resulting betas indicate that higher restrictive ($\beta = .23$, $p < .001$) and lower covert scenario responses ($\beta = -.13$ $p < .001$) offered unique independent prediction of unhealthy snack intake.

Discussion

The present study sought to add to the small number of studies that have investigating parental behaviours in relation to young children's snack intake. While much attention in recent years has focused on examining the influence of maternal feeding style on child eating, to our knowledge the present study is the first to examine parental responses to difficult everyday child snack food requests, and then to examine their relationship with child unhealthy snack intake. As

eating habits established early in childhood are likely to carry on into later life (Fisk, Crozier, Inskip, Godfrey, Cooper et al., 2011), understanding how parents manage children's snack intake during the pre-school years is particularly important. The preschool years also represent a time when parents are able to exert more control over what their child eats than at later developmental stages.

The major findings of the study are clear. We were able to develop a set of snack food request scenarios and 'real life' maternal responses through extensive pilot testing. When these scenarios and responses were presented to a large and diverse sample of mothers of preschool aged children, results presented here indicated that their responses to the snack food requests reflected the general feeding styles of Restrictive Feeding and Covert Control. Most importantly, our results show that mothers' behavioural responses were more strongly correlated with their child's consumption of unhealthy snacks than general feeding style. Further, scenario responses offered unique prediction of child unhealthy snack intake.

The results show that specific restrictive feeding responses (e.g., Scenario 4, *Visiting a friend or relative*: telling the child that they are not allowed to eat any sweets or snacks offered) were associated with children consuming more unhealthy snacks. Accordingly, our research is consistent with a large body of previous research that has shown general restrictive feeding scale scores to be associated with poorer child eating outcomes (e.g., Birch et al., 2002). Paradoxically, while parents use restrictive feeding in an attempt to limit young children's intake of unhealthy snacks, children seem to actually consume more of these very foods under these conditions. The present study extends the previous work from the general and largely attitudinal restrictive feeding scale to reported responses to specific situations and shows that restrictive behavioural responses are a stronger predictor of children's unhealthy snack intake than scores on the Restriction feeding scale. Our study also found that the use of covert responses, which was associated with *lower* consumption of unhealthy snack foods, was a stronger predictor of snack intake over and above the Covert Control scale. Together, the results show that a covert feeding strategy is more effective than

a restrictive strategy when managing children's snack intake. Thus parent feeding strategies, in which parents manage the environment rather than the child (covert control), appear to offer a health benefit for children.

One major contribution of the present study was the development of a set of food request scenarios, based on everyday but challenging situations, such as visiting the supermarket or packing a snack box. The scenarios and responses were developed through extensive consultation with mothers of young children to identify real parent feeding behaviours. Theoretically, the scenario responses provide concrete examples of what is meant by restrictive feeding and covert control strategies. Practically, the scenarios and behavioural responses can usefully inform advice given to parents. While parents can be encouraged to use covert feeding strategies in general, the scenarios give specific examples of what to do in difficult, often highly public situations, such as at the supermarket, in which parents have to make decisions about snack requests quickly and sometimes under pressure. Here we have provided some specific actions that parents can think about beforehand in order to know how to respond in common situations. By providing parents with this information, a more positive feeding environment for both the parent and child may be created with the intended outcome of curbing children's unhealthy snack food intake.

Like all studies, the findings of the current study need to be interpreted in light of some limitations. First, the participants were mothers who volunteered to participate in a study on child feeding and may have had a higher interest in the health of their child. On the other hand, the sample covered a diverse range of socioeconomic status. Second, the study recruited only mothers, and did not recruit fathers or other caregivers. Third, while observational studies of mothers responding to snack requests would provide a more objective insight into parental behaviours, the self-reported behavioural responses to the scenarios developed here are able to efficiently offer significant information across a range of situations and from a large sample of mothers. Finally, as with all correlational studies, firm causal conclusions cannot be drawn. Longitudinal research that

tracks both parental and child behaviours over some time is needed to more fully understand the factors that influence the development of snacking behaviour in young children.

Despite the above limitations, the findings of the present study clearly show that parental responses to challenging food scenarios which parents may find themselves in on an everyday basis were associated with child snack intake. The current study adds to the very few that have examined young pre-school aged children's intake of unhealthy snack foods by extending our knowledge of parental feeding responses to children's snack food requests. In doing so, the study has addressed a significant knowledge gap. Such knowledge may be particularly important because young children's consumption of energy dense snack foods now contributes a sizable proportion of their daily energy intake. Importantly, the present study identified specific parent feeding behaviours around the management of energy dense snack foods and thus contributes to our understanding of what parents actually do to manage their child's snack intake. In particular, the results indicate that covert parental feeding behaviours are far more beneficial than restrictive behaviours. At a practical level, the findings offer potential scope for interventions with parents of pre-school-aged children that aim to limit children's consumption of unhealthy snack foods.

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CHAPTER 5: Study 2 - Longitudinal Follow Up

"That's enough now!": A prospective study of the effects of maternal control on children's snack intake

Samantha B. Boots[a], Marika Tiggemann[a] and Nadia Corsini[b]

[a] School of Psychology, Flinders University, Adelaide, Australia

[b] Rosemary Bryant AO Research Centre, University of South Australia, Adelaide, Australia

Corresponding author: Samantha B. Boots, School of Psychology, Flinders University, PO Box 2100, Adelaide, SA, 5001 Australia.

Email: samantha.boots@flinders.edu.au

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Abstract

The aim of this study was to investigate maternal feeding strategies as prospective predictors of young children's snack intake. Participants were 252 mothers of children aged 3 – 11 years old who completed questionnaire measures of parent feeding strategies (Restriction and Covert Control) and reported on their child's healthy and unhealthy snack intake at two time points separated by three years. Longitudinal regression models showed no prediction of healthy snack food intake. However, Time 1 parental restrictive feeding predicted greater unhealthy snack intake at Time 2, while Time 1 covert feeding strategies predicted lower unhealthy snack intake at Time 2. Structural equation modeling showed that these associations were independent of known covariates that influence children's snack intake (child and parent weight, education level and SES). The results provide longitudinal evidence for the negative impact of restrictive parent feeding strategies on children's snack intake and highlight the importance of dissuading parents from using this type of feeding control. Instead, parents should be encouraged to use more covert feeding strategies that are associated with less unhealthy snack intake over the longer term.

Introduction

Childhood obesity has been well established as a public health concern. Obesity in children has been associated with adverse health (Russell-Mayhew et al., 2012) and social outcomes (Harrist et al., 2016). While childhood obesity may be influenced by many factors, one proposed contributing factor is the overconsumption of foods high in fat, salt and sugar, such as most snack foods (Larson & Story, 2013).

Recent data show that young children are now eating three meals and three snacks per day (Piernas & Popkin, 2010), with large portion sizes of energy dense snack foods (Piernas & Popkin, 2011). Indeed, snack foods now represent over one third of young children's daily energy intake (ABS, 2017). Although parental influence on children's overall eating behaviours and weight status has been studied extensively (Vaughn, Tabak, Bryant & Ward, 2013; Vollmer, Mobley, 2013), less attention has been given to how parental feeding strategies may influence the snack intake of children (Blaine et al., 2017). Given the growing contribution of snack foods to children's dietary intake (Larson & Story, 2013), this study will focus on understanding the impact over time of two feeding strategies that parents may use to manage children's snack consumption.

Parent feeding strategies are specific behaviours that parents employ to manage what, when and how much their child eats (Ventura & Birch, 2008). The vast majority of the existing research on parent feeding strategies has focused on parental restrictive feeding, most commonly measured by the Restriction scale of the Child Feeding Questionnaire (CFQ: Birch et al., 2001). This scale assesses parents' propensity to regulate the type and amount of food eaten by children. For example, a parent may forbid the child to eat sweets or may only allow the child to eat a certain amount of sweets or snacks, or use sweets and snacks as a reward for finishing portions of other (healthier) food. In cross-sectional studies, Restriction has been associated with a number of negative outcomes including overall calorie consumption (Fisher & Birch, 1999a; Fisher & Birch 1999b, Jansen et al., 2007, Webber et al., 2010a, Corsini et al., 2017), eating in the absence of hunger (Birch & Fisher, 2000), negative self-evaluations in young girls (Fisher & Birch, 2000),

poorer diet quality in terms of higher fat intake (Lee, Mitchell, Smiciklas-Wright & Birch, 2001), greater intake of unhealthy snacks (Boots, Tiggemann & Corsini, 2015) and greater child weight in some studies (Joyce & Zimmer-Beck 2009; Musher-Eizenman et al., 2009). Longitudinal studies have shown that parental restriction predicted child weight one year (Rodgers et al., 2013) and two years later (Faith et al., 2004) and eating in the absence of hunger two years (Fisher & Birch, 2002; Rollins et al., 2014; Rodgers et al., 2013) and four years later (Birch et al., 2003). In addition, parental restrictive feeding has been associated with children's food responsiveness and emotional overeating one year (Rodgers, Paxton, Massey, Campbell, Wertheim et al., 2013) and two years later (Steinbekk, Belsky, Wichstrom, 2016), as well as disordered eating and weight gain in adolescence (Balantekin, Birch & Savage, 2017). Reviews of the existing literature have concluded that restriction simultaneously increases children's preference for the restricted foods and promotes overeating when the restricted foods are made more freely available (Loth, 2016; Ventura & Birch, 2008).

It has been suggested that the association between parental restrictive feeding and children's eating is likely bidirectional and influenced by multiple factors, such as parental concern for the child's weight (Bergmeier, Skouteris & Hetherington, 2015) and early child traits such as strong food responsiveness (Gregory, Paxton & Brozovic, 2010; Kral & Hetherington, 2015; Webber, Cooke, Hill & Wardle, 2010b). While twin studies have shown that both genetic and environmental influences may contribute to the development of child eating traits (Carnell, Haworth, Plomin & Wardle, 2008; Llewellyn et al., 2010), it is also acknowledged that without certain environmental conditions, including parent feeding strategies, many genes that potentially influence children's eating traits may not be expressed (Carnell & Wardle, 2008). Although bidirectional relationships have been investigated between parental feeding strategies and child eating traits, the relationship between parental feeding and children's naturalistic snack intake has not been examined in this way.

In expanding the concept of parental control over feeding, Ogden and Brown (2006) conceptualised a different type of feeding strategy they termed 'Covert Control'. Covert feeding strategies tap the ways in which parents promote the consumption of healthy food by managing the child's environment. For example, parents may simply not have unhealthy foods within the home environment and avoid places that serve primarily unhealthy foods when eating out (Ogden, Reynolds & Smith, 2006). A small number of cross-sectional studies have shown that covert feeding strategies are associated with greater healthy snack intake and less unhealthy snack intake in older children aged 9-13 years (Brown et al., 2008; Ogden et al., 2006; Rodenberg et al., 2011) and in younger children aged 2-7 years (Boots, Tiggemann & Corsini, 2017). To our knowledge, there has only been one longitudinal study of the effects of parental covert control. Jarman et al. (2015) found that British mothers of young children (mean age = 3.4 years) who used more covert control strategies had children with better quality diets concurrently and two years later (although they did not explicitly test whether covert feeding strategies were temporally antecedent to child eating outcomes). In addition, mothers who increased their use of covert control over the two-year period had children whose diet quality also improved over the two years. Jarmen et al.'s (2015) focus group discussions identified unhealthy snack consumption as the most salient component of diet quality.

In sum, while there is a large body of literature on the influence of parent feeding strategies on children's eating behaviour, traits and weight, less is known about the influence of parent feeding on children's naturalistic snack food consumption, an increasingly important component of children's diet. As has been suggested in other contexts (Kral & Hetherington, 2015), while it is possible that parental feeding strategies determine children's intake of snack foods, the converse causal assumption is equally plausible. That is, children's eating may lead parents to adopt particular feeding strategies in response. A minimum requirement for causality is temporal precedence (Menard, 1991). Only a longitudinal design allows for testing whether a proposed

cause (parent feeding strategy) is temporally antecedent to (occurs before) the proposed effect (child eating behaviours).

Thus the aim of the present study was to examine the effect of two different maternal feeding strategies on young children's snack intake using a longitudinal research design. Specifically, maternal use of restrictive and covert feeding strategies and young children's healthy and unhealthy snack consumption were examined at two time points separated by approximately three years. On the basis of previous literature with other eating outcomes, we predicted that restrictive feeding would be associated with children's greater unhealthy snack intake over time. In addition, we predicted that covert feeding strategies would be associated with children eating more healthy and less unhealthy snacks over time.

Method

Participants

Participants were 252 mothers of children (127 boys and 125 girls) recruited through social media, flyers distributed through child care centres, crèche facilities, preschools, advertisements in local papers and parenting magazines in Adelaide, South Australia. The mothers were a subset of a larger sample (n = 611; Boots et al., 2015) who were followed up approximately three years later. Interested participants were directed to a secure web link and completed the questionnaire online. Approval for the study protocol was obtained from the Social and Behavioural Research Ethics Committee at Flinders University, South Australia.

The participants came from diverse socioeconomic backgrounds (SES), ranging from low SES (decile 1) to high SES (decile 10), as designated by the Australia Bureau of Statistics (ABS: 2013), with fuller details of the sample at Time 1 previously reported (Boots et al., 2015). The retention rate at Time 2 was 43%. At Time 2, the mothers were aged 28-50 years old (M = 38.00 years, SD = 4.68). The average age of the child at Time 2 was 6.2 years old (SD = 1.49).

Measures

The mothers completed a questionnaire at Time 1 and again approximately three years later (Time 2). The questionnaire, entitled "Managing Kids Food", contained measures of parent feeding strategies and children's snack food intake as outlined below. Demographic information was also obtained.

Parental Restriction

The Restriction subscale of the Child Feeding Questionnaire (CFQ: Birch et al., 2001) contains 8 items addressing parents' propensity to control child eating by limiting the amount and portion sizes of certain foods, using food as a reward and by monitoring children's intake of certain foods. Exemplar items are, "I have to be sure that my child does not eat too many high-fat foods" and "If I did not guide or regulate my child's eating s/he would eat too many junk foods." Responses are made on a 5-point Likert scale (1 = *disagree*, 5 = *agree*) and summed and averaged to produce a score ranging from 1 to 5, with higher scores indicating greater restrictive feeding. Birch et al. (2001) reported the internal reliability of the original Restriction scale was acceptable ($\alpha = 0.73$). In the present sample, internal reliability of the Restriction scales was slightly lower at Time 1($\alpha = 0.69$), and acceptable at Time 2 ($\alpha = 0.79$).

Covert Control

Covert control was measured by the Covert Control Scale developed by Odgen et al. (2006). This 5-item scale addresses strategies that parents use to control the child's consumption of energy dense food through limiting their exposure to these foods in the child's immediate environment. Items include "How often do you avoid taking your child to places that sell unhealthy food", and "How often do you avoid buying sweets, crisps, biscuits and cakes and bringing them into the home". Higher scores on the covert control measure indicate greater control of the child's environment. Ogden et al. (2006) reported the original measure had adequate internal reliability ($\alpha = 0.79$). In the present sample, internal reliability at both Time 1 and Time 2 was acceptable ($\alpha = 0.72$).

Child Snack Food Intake

Children's usual intake of healthy and unhealthy snack foods was measured with an 11-item food frequency questionnaire that was adapted from the Anti-Cancer Council Dietary Questionnaire (Giles & Ireland, 1996). Parents were asked to indicate how frequently their child consumes 11 different snack foods in a week. Based on energy density classifications provided by the World Cancer Research Fund UK (WCRF-UK, 2007), four of these were subsequently categorized as healthy (low energy dense: < 150kcal/100g - fruit, vegetable, yoghurt, cheese) while seven were considered unhealthy (high energy dense: 225-275kcal/100g - potato chips or other crisps, salty flavoured or cheesy crackers, sweet biscuits, cakes and pastries, chocolate and lollies, sugar sweetened drinks, hot fried snacks). The six response categories ranged from 'none' to 'more than once a day'. Snack intake was converted to equivalent daily frequencies, which were then summed together and were used to represent the number of healthy and unhealthy snacks consumed per day.

Covariates

A number of demographic variables previously found to be related to parent feeding strategies and children's snack intake (Boots et al., 2015) were collected. Mothers reported on their own age and the age and gender of their child. Residential postcode, employment status and educational attainment were also collected. The index of relative socioeconomic disadvantage (IRSD: ABS, 2013) was assigned based on postcode of residence using area-based deciles (1-10) with lower deciles indicating greater socioeconomic disadvantage. Parents were also asked to report on their own weight and their child's weight ("*How would you describe your weight at present?*" and "*How would you describe your child's weight at present?*" respectively). Response options were: very underweight, slightly underweight, normal weight, slightly overweight, very overweight.

Statistical analysis

Statistical analyses were conducted using SPSS v21 (SPSS Inc Chicago). An alpha level of .05 was used for all statistical tests. Correlational analyses were conducted to assess the bivariate

cross-sectional and cross-lagged associations between the parental feeding strategies and children's snack intake at both time points.

Across time correlations do not of themselves indicate temporal precedence. Two hierarchical multiple regressions were undertaken to examine whether Time 1 parent feeding strategies temporally preceded children's snack intake three years later. In each regression, Time 1 child snack intake was entered in Step 1, with Time 1 parent feeding strategy (Restriction, Covert Control) entered in Step 2. Time 2 child snack intake was the outcome variable.

Structural equation modelling (AMOS, version 23) was then used to test an integrated model that simultaneously tested the relationships between all the variables at both time points while controlling for covariates **(**child age, child weight category, parent age, parent weight category, parent education level and SES**)**. The adequacy of model fit was assessed by four commonly recommended fit indices: the comparative fit index (CFI), the Tuker-Lewis Index (TLI), the root square error of approximation (RSMEA) and the standardised root mean square residual (SRMR). Good fit is indicated by CFI and TLI values of .95 or higher, RSMEA of .06 or lower and SRMR of .08 or lower (Hu & Bentler, 1999). Acceptable fit is indicated by values of .90 - .94 for CFI and TLI, .7 - .10 for RMSEA and .09 - .10 for SRMR (Marsh & Hau, 1996).

Results

Changes over time

Table 1 displays the means for parent feeding strategies and child snack intake at Time 1 and Time 2. It can be seen that there was no significant change over time in parental restrictive feeding or parental covert control. In regards to snack intake, children's healthy snack intake significantly increased over time, $t(232) = 6.20$, $p < .001$, while there was no significant change in children's unhealthy snack intake. All correlations between respective Time 1 and Time 2 variables were moderate.

Table 1

Means (SDs), t, and correlations for parental feeding strategies and child snack intake at Time 1 and Time 2

	Time 1	Time 2	*t*	Correlation
Parent Feeding Strategies				
Restriction	3.40 (.68)	3.34 (.80)	1.36	.53**
Covert Control	3.30 (.67)	3.29 (.66)	0.24	.46**
Child Snack Intake				
Healthy	4.70 (1.48)	5.25 (1.15)	6.20**	.42*
Unhealthy	1.36 (.93)	1.01 (.73)	1.11	.48*

* $p < .05$ ** $p < .001$

Associations between parent feeding and child snack intake

Table 2 displays the correlations between restrictive and covert feeding strategies and children's healthy snack and unhealthy intake. Within Time 1, more frequent use of restrictive feeding was associated with children's greater unhealthy snack intake, while covert feeding strategies were associated with more healthy snack intake. Within Time 2, parental restrictive feeding strategies were again associated with greater unhealthy snack intake, while covert feeding strategies were associated with less unhealthy snack intake by children.

Table 2 also shows cross-lagged (across time) correlations. Time 1 parent feeding strategies were not associated with children's healthy snack intake at Time 2. However, restrictive feeding at Time 1 was positively associated, and covert control was negatively associated, with children's unhealthy snack intake at Time 2.

Table 2

Cross-sectional and cross-lagged correlations between parent feeding strategies and child snack intake

		Time 1		Time 2	
		Healthy	Unhealthy	Healthy	Unhealthy
Time 1					
	Restriction	-.12	.12*	-.01	.19**
	Covert Control	.14*	-.09	.09	-.26**
Time 2					
	Restriction	.01	-.05	-.04	.17**
	Covert Control	.15*	-.02	.09	-.35**

* p <.05 ** p <.001

Longitudinal tests of parent feeding and child snack intake

Table 3 displays the results for Step 2 of the individual regression analyses, predicting Time 2 child snack intake from Time 1 parent feeding strategies. As can be seen, neither restrictive feeding nor convert control significantly predicted increased healthy snack intake at Time 2. However, Time 1 parental restrictive feeding (β = .18, p = .004) predicted increased unhealthy snack intake in children at Time 2, R^2_{change} (1,232) = .03, p = .004, and Time 1 parental covert feeding (β = -.31, p = .000) predicted decreased unhealthy snack intake at Time 2, R^2_{change} (1, 232) = .09, p <.001.

To examine the reverse relationships, that is whether children's eating predicts parental feeding strategies, two further hierarchical regressions were conducted. Time 1 parent feeding strategy (Restriction, Covert Control) was entered in Step 1. Time 1 child snack intake was entered in Step 2, with Time 2 parent feeding strategy (Restriction, Covert Control) as the outcome variable. Neither healthy nor unhealthy child snack intake at Time 1 significantly predicted the subsequent use of restrictive (healthy: R^2_{change} (1, 232) = .01, p = .178; unhealthy: R^2_{change} (1, 232) = .00, p = .879) or covert feeding strategies (healthy: R^2_{change} (1, 232) = .03, p = .443; unhealthy: R^2_{change} (1, 232) = .00, p = .819).

Table 3

Regression results predicting Time 2 child snack intake from Time 1 parent feeding strategies

Variable	B	SE	β	ΔR^2	ΔF
Healthy Snack Intake T2					
Restriction T1	.05	.10	.03	.00	.20
Covert Control T1	-.02	.15	-.01	.00	.01
Unhealthy Snack Intake T2					
Restriction T1	.19	.07	.18	.04	8.34*
Covert Control T1	-.34	.10	-.31	.09	12.45**

* p <.05 ** p <.001

Integrated Model

In order to integrate all of the elements investigated, a structural equation model with reciprocal pathways across time was constructed. In addition, the covariates of child and parent weight category, child and parent age, parental education level and SES were controlled. The final model produced an acceptable-to-good fit: χ^2 [231] = 35.40, p <.05; TLI = .906 (acceptable); CFI = .954 (good); RMSEA =.059 (good); SRMR =.05(good). As can be seen in Table 4, which presents the standardised pathway coefficients for all pathways in the structural equation model, parent-feeding strategies showed no relationship over time with children's healthy snack intake, but did show associations with unhealthy snack intake. In addition, in no case did child snack intake significantly predict parent-feeding strategies.

The significant pathways are represented graphically in Figure 1. For clarity the pathways to healthy and unhealthy snack intake have been presented separately. Figure 1(a) illustrates that parent feeding strategies did not significantly predict children's healthy snack intake. In contrast, Figure 1(b) shows that both restrictive and covert parental feeding strategies independently predicted children's subsequent intake of unhealthy snacks.

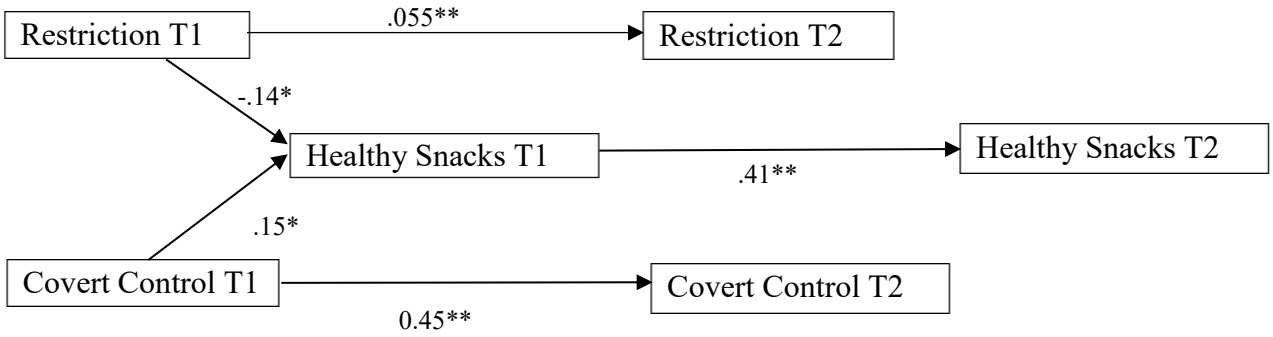
Table 4

Standardised path coefficients (β) for all pathways in the structural equation model.

	β	*p* value
Within Time Pathways		
T1 Restriction ➔T1 Healthy	-.14	.030
T1 Restriction ➔T1 Unhealthy	.13	.038
T1 Covert Control ➔T1 Healthy	.15	.016
T1 Covert Control➔T1 Unhealthy	-.11	.094
T2 Restriction ➔T2 Healthy	-.09	.204
T2 Restriction ➔T2 Unhealthy	.16	.014
T2 Covert Control ➔T2 Healthy	.04	.558
T2 Covert Control➔T2 Unhealthy	-.33	.000
Between Time Pathways		
T1 Restriction ➔T2 Restriction	.55	.000
T1 Covert Control ➔T2 Covert Control	.45	.000
T1 Healthy ➔T2 Healthy	.41	.000
T1 Unhealthy ➔T2 Unhealthy	.07	.216
T1 Parent Feeding to T2 Child Snack Intake Pathways		
T1 Restriction➔T2 Healthy	.08	.296
T1 Restriction➔T2 Unhealthy	.14	.030
T1 Covert Control➔T2 Healthy	.01	.826
T1 Covert Control➔T2 Unhealthy	-.12	.041
T1 Child Snack Intake to T2 Parent Feeding Pathways		
T1 Healthy➔T2 Restriction	.05	.316
T1 Healthy➔T2 Covert Control	.10	.081
T1 Unhealthy➔T2 Restriction	-.10	.069
T1 Unhealthy➔T2 Covert Control	.03	.568

Note: T1 = Time 1, T2 = Time 2

(a)



(b)

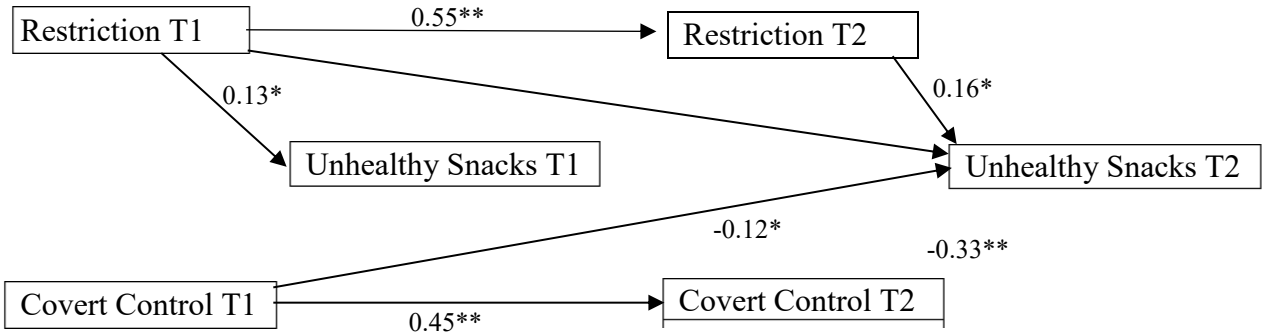


Figure. 1. Significant prospective paths (β) predicting child snack intake, adjusted for child age, child weight category, parent age, parent weight category, parent education and SES for (a) healthy snack intake, and (b) unhealthy snack intake.
Note: * p <.05, ** p <.001

Discussion

To our knowledge the present study is the first to examine prospectively the influence of both restrictive and covert parental feeding strategies on young children's snack intake. Further, our sample was socioeconomically diverse. The major findings from the study are clear. As predicted, we found that greater initial use of restrictive feeding by parents predicted increased unhealthy snack intake in children three years later. In addition, we found that greater initial parental covert control predicted decreased unhealthy snack intake three years later. There was no evidence for reverse causation, with no significant prediction of parent feeding strategies from child snack intake.

Our results showed that while parental feeding strategies were relatively stable over time, there was a differential influence of feeding strategies on child snack consumption. Here, consistent with our postulated model we found that restrictive parental feeding strategies at approximately age 3 were associated with relatively greater unhealthy snack intake at approximately age 6 years. The relationship was evident even after adjusting for the relationships between all variables and accounting for covariates known to affect child eating outcomes, such as child weight, parent weight, parent education and socioeconomic status. Our longitudinal finding adds to the results of previous cross-sectional (Fisher & Birch, 1999a; Fisher & Birch, 1999b; Gregory et al., 2010; Webber et al., 2010a), longitudinal (Bergmeier et al., 2015; Rodgers et al., 2013) and laboratory studies (Fisher & Birch, 2002; Jansen et al., 2007; Rollins et al., 2014) that show that parental restrictive feeding has a detrimental effect on a range of children's eating outcomes and extends these findings to children's naturalistic snack intake. Here we show that while well-meaning parents may use restrictive feeding to limit the consumption of unhealthy snacks in their youngsters, over time children actually consume relatively more of these very foods. Our findings are consistent with the suggestion that such parental control over feeding actively inhibits children's learning to self-regulate their own eating, while simultaneously increasing the desirability of and preference for the restricted foods (Rollins et al., 2016). As a consequence, we might expect the

effects to become larger as children get older and become more responsible for their own dietary intake.

An alternative strategy to restrictive feeding is provided by covert control. When parents manage the child's environment by providing primarily healthy foods, they do not need to make any direct comment or fuss around the child's eating. In contrast to more overt forms of control such as restrictive feeding, this approach may allow room for the child to develop the necessary self-regulatory skills in order to appropriately deal with exposure to unhealthy snack foods, resulting in the child consuming relatively less of these foods. In addition, the limited availability of energy dense snack foods in the home likely has a direct impact on children's consumption of these foods. Here we have extended the previous literature on short term beneficial outcomes of covert control (Boots et al., 2015; Ogden et al., 2006; Rodenberg et al., 2011) to show that these benefits extend over the longer term. Our finding is consistent with the one previous longitudinal study that found greater covert control to be associated with children's improved diet quality over a two-year period (Jarmen et al., 2015). Our result shows this association for specifically snack food consumption. Together, the studies provide convincing evidence for the longer-term benefits of parents using covert control strategies to shape their young child's eating through shaping their environment.

One strength of the present study is that our research design allowed parental feeding strategies to be examined together in a single model that showed that they offered unique prediction of children's snack intake. Importantly, we were able to explicitly rule out the reverse temporal direction. Our findings showed that children's snack intake at this age did not predict parental feeding. Thus the observed link between parent feeding strategies and child eating at this time comes about because the strategies parents use affect children's eating, and not because children's unhealthy snack consumption causes alarm for parents, who react by applying restrictions. In our study parents are not responding to children's eating behaviours, but rather are shaping them. This disentangling of the temporality of the relationship between parent feeding strategies and child

eating would not have been possible without a longitudinal research design. It is important to note, however, that longitudinal studies are always limited to the portion of the life span examined, and thus relationships may not hold at other time points. For example, it is possible that maternal feeding strategies prior to Time 1 (age 3) are shaped by children's eating behaviours.

The findings from the present study have some important practical implications. In an environment saturated with unhealthy snack food cues and varied options, a challenge for conscientious parents of young children is to establish healthy eating patterns in their child. The findings presented here can inform advice given to parents about the most effective feeding strategies to use for managing their young child's snack intake. While intuitively it may make sense for parents to tell their child not to eat certain foods and when to stop, our findings show that this type of (restrictive) parenting around food is counterproductive in the longer term. Thus, this is a strategy that parents should be dissuaded from using. Fortunately, the present study offers an alternative strategy in the form of covert control, which is about limiting children's unhealthy snack consumption by managing the child's immediate environment. The present study indicates that covert feeding is something that parents can confidently engage in, knowing that this strategy has longer term benefits for children's eating. One difficulty that needs to be acknowledged is that the use of covert control techniques may require a level of planning and preparation on the part of parents. Hence existing parenting programs could usefully include education about feeding strategies for promoting healthy eating in children, including teaching parents appropriate responses to specific (and often difficult) snack situations that they may face on an everyday basis (Boots et al., 2016). This type of parental feeding strategy may constitute a particular form of proactive parenting, which has been shown to facilitate child learning in other domains (Chang et al., 2015).

As with all research, the current study contains some limitations that need to be acknowledged. First, the participants were all mothers, and not fathers or other salient care givers, who volunteered to participate and as such may have had some particular interest in healthy child diet, resulting in a degree of self-selection bias. In addition, we did not gather data from other

settings where children may spend time, such as with grandparents, or early childhood educators. Second, participation was via a parental self-report questionnaire, which is open to some degree of social desirability bias. Observational methods would provide a more accurate assessment of parent feeding strategies, as some previous research has shown that maternal reports may not always reflect the strategies actually used (Bergmeier et al., 2015). Relatedly, because the questionnaire was completed online, participant and child weight could not be objectively measured. Previous research has shown that a substantial proportion of parents perceive their overweight children as normal weight (Robinson & Sutin, 2016; Lundahl, Kidwell & Nelson, 2014). Therefore, future studies should investigate measured child BMI, as well as gaining more objective measures of children's snack consumption. Third, we used only two well established measures of parental feeding. Future research might include a greater range of parental feeding measures, for example, the Comprehensive Feeding Practices Questionnaire (CFPQ: Musher-Eizenman & Holub, 2007), which differentiates between restriction for weight control and restriction for health. In our study, we were able to predict unhealthy but not healthy snack intake. It is possible that other feeding strategies might offer better prediction of healthy snack consumption. Finally, our study focused on children's snack intake as the outcome, and did not examine any potential linking mechanisms such as child eating traits or appetite.

Despite the above limitations, the current study has contributed to our understanding of the role of parental restrictive feeding and covert control strategies in children's snack food intake over time. The findings clearly show that the strategies parents use to manage their young children's eating do matter over the longer term.

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CHAPTER 6: Study 3 - Eating in the Absence of Hunger

Eating in the absence of hunger in young children: The role of maternal feeding strategies

Samantha B. Boots[a], Marika Tiggemann[a] and Nadia Corsini[b]

[a] School of Psychology, Flinders University, Adelaide, Australia

[b] Rosemary Bryant AO Research Centre, University of South Australia, Adelaide, Australia

Corresponding author: Samantha B. Boots, School of Psychology, Flinders University, PO Box 2100, Adelaide, SA, 5001 Australia.

Email: samantha.boots@flinders.edu.au

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Abstract

Restrictive feeding strategies have been associated with increased eating in the absence of hunger in a small number of studies of young girls. The aim of the present study was to examine a broader range of maternal feeding styles and eating in the absence of hunger in both girls and boys aged 3 - 5 years old. Participants were 184 mother-child dyads. Mothers completed a questionnaire containing measures of feeding strategies (Restriction, Pressure to Eat and Covert Control). Children consumed a lunch meal and then completed the Eating in the Absence of Hunger protocol. For girls, restrictive feeding was associated with increased eating in the absence of hunger. For boys, pressure to eat more was negatively associated with eating in the absence of hunger. Covert control was not associated with eating in the absence of hunger. Overall, the findings suggest that maternal feeding strategies have a differential effect on the eating behaviours of girls and boys. In addition, results from this study indicate that controlling maternal feeding strategies, such as restrictive feeding, have a detrimental impact on young children's eating behaviours and may interfere with their ability to self-regulate eating.

Introduction

National data indicate that 20-25% of Australian preschool aged children between ages 3 and 5 years old are overweight or obese (ABS, 2012). Adverse outcomes associated with childhood overweight and obesity are wide ranging and include poorer health (Must & Strauss, 1999), body dissatisfaction (Xanthopoulos et al., 2011), social isolation and discrimination (Stunkard & Wadden, 1992). One identified behavioural pathway to obesity in children is disinhibited eating (Birch, Fisher & Davison, 2003; Faith et al., 2006). Disinhibited eating refers to a reduced ability to self regulate intake leading to the over consumption of foods in the absence of hunger (Wardle et al., 2001). The Eating in the Absence of Hunger (EAH) protocol developed by Fisher and Birch (1999) has become the gold standard for assessing children's disinhibited eating (Soltero, Ledoux & Lee, 2015**).** The protocol consists of two major phases: preload and free access (Langisan, Emond & Gilbert-Diamond, 2015). In the preload phase, children are given an ad libitum meal followed by a hunger assessment whereby the children self-report if they are full. After a 20-minute time period, children are provided with the opportunity to play with toys and eat snack food for ten minutes. Some studies have also included a disinhibitor (taste test) between the two major phases (e.g., Fisher & Birch, 1999a; Birch, Fisher & Davison, 2003). Eating in the absence of hunger is calculated as the number of calories consumed during the free access phase.

A small number of studies have examined the influence of restrictive maternal feeding strategies on children's eating in the absence of hunger using the EAH protocol (Fisher & Birch, 2002; Francis & Birch, 2005; Bauer, Haines, Miller, Rosenblum, Appugliese et al., 2017; Remy, Issanchou, Chabanet, Boggio & Nicklaus, 2015) with mixed results. Restrictive feeding strategies include maternal attempts to restrict the consumption of energy dense (unhealthy) snacks by not allowing the child to eat sweets, or only allowing the child to eat a certain amount of sweets and snacks (Fisher & Birch, 1999a). While appealing to many parents as a logical means of controlling food intake, restrictive feeding has in fact been found to be counterproductive. In a recent systematic review of EAH (Lansigan, Emond & Gilbert-Diamond, 2015), three studies found

restrictive feeding was associated with increased EAH for young girls aged 3 years to 9 years old (Fisher & Birch, 1999; Birch & Fisher, 2000; Fisher & Birch, 2002). In addition, maternal reports of restrictive feeding when their daughter was age 5 predicted their daughter's increased EAH at ages 7 and 9 (Birch et al., 2003). Only one of these studies (Fisher & Birch, 1999) included boys in the sample, for whom maternal self-reports of restrictive feeding were not associated with EAH. Two other studies (Faith et al., 2006; Blissett et al., 2010) found no effect. The systematic review concluded that maternal restriction of palatable foods results in greater EAH for girls when foods become freely available (Lansigan, Emond & Gilbert-Diamond, 2015). In addition, maternal restrictive feeding may lead to objective future weight gain (Fisher & Birch, 2002; Francis & Birch, 2005) and disordered eating behaviours (Balantekin, Birch & Savage, 2017). In a study of 2231 adolescents, Loth et al. (2013) found that girls who reported maternal restrictive feeding were more likely to engage in extreme weight control behaviours such as using diet pills, vomiting after eating and using laxatives. Birch and colleagues have suggested that exposure to maternal restrictive feeding results in girls losing the ability to self-regulate food intake, leading to disinhibited eating when foods become freely available (Fisher & Birch 1999).

With the exception of Fisher and Birch (1999), the literature is silent on the effects of restrictive feeding in young boys. Birch and colleagues have theorised that restrictive feeding leads girls, more so than boys, to internalise feelings regarding the 'goodness' and 'badness' of foods (Birch et al., 2001). The imposed maternal restriction also serves as a trigger for the loss of control around food or binge eating, particularly for girls (Birch, Fisher & Davison, 2003). In addition, it has been suggested that the parents of girls are likely responding to sociocultural pressure for girls (and women) to be thin and are therefore more concerned about their daughters', than their sons', weight (Musher-Eizenman et al., 2003; Salci & Paxton, 2015; Harriger, Calogero, Witherington & Smith, 2010; Puhl & Latner, 2007), with parents particularly wanting to protect their daughters from becoming overweight (Birch, Fisher & Davison, 2003). Accordingly, we predicted that

maternal restrictive feeding would be positively associated with eating in the absence of hunger in girls, but not in boys.

Lansigan et al. (2015) noted that only one study in their review had investigated parent feeding strategies other than restriction. Specifically, Moens and Braet (2007) found no association between maternal pressure to eat or monitoring of child intake and EAH in girls and boys aged 7-12 years. A more recent small Australian study of children aged 3-4 years old (Harris et al., 2015) found that for boys only (n = 16), maternal pressure to eat was associated with increased EAH. Restrictive feeding and monitoring of intake were not associated with EAH for either gender. In contrast, a study of Latino children aged 4-6 years old (Galindo, Power, Beck, Fisher, O'Connor & Hughes, 2018) showed that maternal pressure to eat was associated with decreased EAH (boys and girls were not analysed separately). In sum, research investigating the role of pressure to eat on child dietary intake using the EAH protocol is limited, with inconsistent findings.

To our knowledge, no studies have explored EAH with potentially more positive parent feeding strategies such as covert control. Covert control feeding strategies manage child diet quality and food intake in a way that is not detected by the child. In particular, covert control taps the ways in which parents restrict the consumption of unhealthy foods and promote the consumption of healthy food by managing their child's environment, rather than directly managing the child. For example, parents may avoid buying or having sweets or crisps in the home and avoid visiting restaurants and cafes that serve unhealthy foods. Previous research has shown that the use of covert strategies is associated with the consumption of more healthy and less unhealthy snack foods in young children aged 2-7 years (Boots et al., 2015) and in older children age 9-13 years (Brown et al., 2008; Ogden et al., 2006; Rodenberg et al., 2011). However, the association between the use of covert control and children's eating in the absence of hunger has yet to be investigated. It has, however, been suggested that covert control influences children's diets in a healthy way because it allows children to develop the necessary self-regulation around eating, including behaviours such as eating to satiety and only when hungry (Ogden, Reynolds & Smith, 2006). Consequently, we

predicted that covert control would be negatively associated with eating in the absence of hunger for both boys and girls.

Thus the present study aimed to extend the existing literature by examining the influence of a broader range of maternal feeding strategies on young children's disinhibited eating using the EAH protocol. Specifically, restrictive feeding, pressure to eat and covert control were investigated and assessed for gender specific effects. We predicted that restrictive feeding would be positively associated with eating in the absence of hunger for girls but not boys. In addition, we predicted that pressure to eat would not be associated with eating in the absence of hunger for boys or girls. Finally, we predicted that covert control would be negatively associated with eating in the absence of hunger for both boys and girls.

Method

Participants

Participants were 213 children (104 boys) aged 3 to 5 years (M = 4.80 years, SD = .43) and their mothers recruited from 12 preschools in South Australia, Australia. Participants came from diverse socioeconomic backgrounds (SES), ranging from low SES to high SES (decile 1 – 10 respectively, with a mean decile of 5.4 [SD = 3.6]) as designated by the Australia Bureau of Statistics (ABS: 2013). Mothers were aged 22 - 57 years old (M = 35. 28 years, SD = 6.55), with the majority living in two-adult households (84.2%) with two children (55.4%).

Maternal Survey

The questionnaire, entitled "Kids Eating Project", was completed by mothers and returned to their child's kindergarten prior to the child's participation in the EAH protocol. The questionnaire contained measures of maternal feeding strategies as outlined below.

Maternal Restriction, Pressure to Eat and Weight Concern (Child Feeding Questionnaire: CFQ)

The Restriction subscale of the Child Feeding Questionnaire (CFQ: Birch et al., 2001) contains 8 items addressing maternal propensity to control child eating by limiting the amount and portion sizes of certain foods, using food as a reward and by monitoring children's intake of certain

foods. Exemplar items are, "I have to be sure that my child does not eat too many high-fat foods" and "If I did not guide or regulate my child's eating s/he would eat too many junk foods." The Pressure to Eat subscale consists of 4 items and measures mothers' inclination to pressure the child to eat more of some foods. Exemplar items include "My child should always eat all of the food on his/her plate" and "If I did not guide or regulated my child's eating, s/he would eat much less than s/he should." Maternal concern about child weight was measured using one item from the CFQ that measured maternal concern about their child's risk of being overweight, *"How concerned about you about your child becoming overweight"*. Responses are made on a 5-point Likert scale (1 = *disagree*, 5 = *agree*) and are averaged to produce a score ranging from 1 to 5, with higher scores indicating greater restrictive feeding and greater maternal pressure in feeding. Internal reliability of the original Restriction and Pressure scales was acceptable ($\alpha = 0.73$ and $\alpha = 0.70$ respectively) (Birch et al., 2001). In the present sample, internal reliabilities of the Restriction and Pressure scales were similar ($\alpha = 0.73$ and $\alpha = 0.80$ respectively).

Covert Control

Covert control was measured by the Covert Control Scale developed by Ogden et al. (2006). This 5-item scale addresses strategies that parents use to control the child's consumption of energy dense food through limiting their exposure to these foods in the child's immediate environment. Items include "How often do you avoid taking your child to places that sell unhealthy food", and "How often do you avoid buying sweets, crisps, biscuits and cakes and bringing them into the home". Responses are made on a 5-point Likert scale (1 = *never*, 5 = *always*) and are averaged to produce a score ranging from 1 to 5. Higher scores on the covert control measure indicate greater control of the child's environment. The original measure had adequate internal reliability (Cronbach's $\alpha = 0.79$). In the present sample, internal reliability was the same ($\alpha = 0.79$).

EAH Protocol

The EAH protocol was conducted in the child's regular preschool classroom, an adaptation recently used successfully (Soltero, Ledoux & Lee, 2015). Children were provided with generous

portions of food in buffet style, which consisted of sandwiches, muffins and fruit salad. A sandwich consisted of two slices of bread (42 g/slice), plus sandwich meat (2 slices, 25 g/slice), cheese (2 slices, 21 g/slice), tomatoes (5 slices, 27 grams), or vegemite (3 g /serve) equivalent to approximately 360 calories. Muffins were banana, blueberry or apple (30g/each) equivalent to approximately 150 calories. Sliced assorted fruit, for example, watermelon, pineapple, oranges was also provided and was equivalent to approximately 75 calories (approx. 150 g) per cup. The total food provided was sufficient for each child to eat approximately 4 sandwiches, 3 muffins and 3 cups of fruit. Children were able to eat the food ad libitum until they reported that they were finished. They ate at the time and where they would normally eat their lunch, with up to 20 children eating lunch in the room. Each child was observed by trained research assistants (ratio 1:5) to confirm that a meal was consumed prior to participating in the EAH protocol. In addition, a subjective measure of hunger was obtained from each participant immediately after lunch with the use of 3 figures depicting hungry, half full, full. All children responded to the satiety scale indicating that they were full following lunch.

Consistent with the original protocol, after a 20-minute period, the children were shown into a separate room that contained various novel toys. In addition, each child had a named placemat with three bowls of pre weighed snack food: 30g plain crisps (Smith's Potato Chips, 156 cal/per serve), 60g of bite size biscuits (Arnott's Tiny Teddy Honey Biscuits, 267 cal/per serve), and 60g of sultanas (Sunbeam Sultanas, 185 cal/per serve). These snack foods were selected, as they are the three most commonly consumed snack foods by this age group (National Nutrition and Physical Activity Survey 2011- 2013; ABS 2014). The children were instructed that there were toys to play with and that they could eat some food if they wanted to. Trained research assistants remained in the room and discretely observed the children to ensure that they only ate snack foods from their own bowls. To determine energy intake for each child, each of the food items was weighed before and after the session. Manufacturers data were used in conjunction with calorie information to

calculate each child's total energy intake during the 10 minute EAH procedure. Almost all (89.2%) of the children ate some of the available snack foods.

A trained research assistant measured the children's height and weight at the end of the EAH protocol. The children's BMI was then calculated from height and weight measures. Because BMI during childhood is age and sex specific, BMI was calculated using gender specific growth charts (Kuczmarski et al., 2000).

Statistical Analysis

Statistical analyses were conducted using SPSS v20 (SPSS Inc Chicago). An alpha level of .05 was used for all statistical tests. Descriptive statistics were used to describe the sample characteristics. A series of t-tests was conducted to test gender difference in maternal feeding strategies and children's EAH. In order to examine gender differences in the relationship between maternal feeding strategies and child eating in the absence of hunger, hierarchical regression analysis was conducted to test for the interaction between gender and maternal feeding. Separate regression analyses for boys and girls were then conducted.

Results

Gender Differences

Boys and girls did not differ on objectively measured BMI, t (185) = 1.34, p = .19. Boys mean BMI was 15.89 (SD = 1.87) and girls mean BMI was 16.31 (2.38). According to International Obesity Task Force cut offs (IOTF: Cole et al., 2007), 10.1% of the boys and 7.5% of girls were underweight, 60.6% of boys and 60.4% of girls were normal weight, 15.2 % of boys and 15.1% of girls were overweight and 6.1% of boys and 7.5% of girls were obese.

Table 1 shows the mean scores for maternal concern about child weight. Mothers reported greater weight concern for girls (M = 1.62, SD = 0.80) than for boys (M = 1.39, SD = 0.71), t (202) = 2.61, p = .03, η^2 = .02.

Table 1 also displays the means for maternal feeding strategies and child snack intake during the EAH protocol. As can be seen, there was no significant gender difference in any maternal feeding strategy for boys or girls (all Fs < 1, ps >.25). EAH intake ranged from 0 calories

to 508 calories, with an average mean intake during the ten minute procedure representing close to 10% of the children's estimated daily energy requirements (EER: Institute of Medicine, 2005). The t-test showed that boys (M = 127.92 SD = 106.50) ate significantly more than girls (M = 84.28, SD = 80.95) in the EAH protocol, t (198) = 3.22, p = .001, η^2 = .04.

Table 1

Means (and standard deviations) of maternal feeding style for boys and girls

	Range	Boys (n = 98)	Girls (n = 104)	
Maternal Measures				
Weight Concern	1.0 – 4.0	1.39 (0.71)	1.62 (0.80)	*
Restriction	1.0 - 5.0	3.57 (0.79)	3.51 (0.74)	
Pressure to Eat	1.0 - 5.0	2.86 (1.11)	2.94 (1.12)	
Covert Control	1.0 - 4.4	3.07 (0.72)	3.16 (0.72)	
Child EAH				
Snack Intake (cals)	0 – 508	127.92 (106.5)	84.28 (80.95)	*

* p <.05

The relationship between maternal feeding strategies and EAH for boys and girls

To investigate gender differences in the relationship between maternal feeding strategies and eating in the absence of hunger, a series of hierarchical regression analyses was conducted. The maternal feeding strategy (restriction, pressure to eat, covert control) was entered in Step 1, gender in Step 2, and the product term (restriction x gender, pressure to eat x gender, covert control x gender) was entered in Step 3, with EAH as the outcome variable. Step 1 offered significant (negative) prediction only for pressure to eat, F (1,179) = 12.35, p = .001. More importantly, the interaction with gender (Step 3) was significant for restriction, F (1,179) = 7.95, p = .005, and for pressure to eat, F (1,179) = 5.87, p = .003, but not for covert control, F (1,178) = .203, p = .593.

Table 2

Associations between feeding strategies and EAH for boys and girls

	Eating in the Absence of Hunger (total calories)			
	Boys		Girls	
	r	β	*r*	β
Restriction	-.19	-.11	.21*	.21*
Pressure to Eat	-.45**	-.43**	-.08	-.17
Covert Control	.07	.10	.18	.14

* $p < .05$ ** $p < .001$

Given that the relationships varied with gender, regression analyses were then conducted for boys and girls separately. Table 2 provides the zero order correlations as well as the resulting betas. Maternal feeding strategies significantly predicted eating in the absence of hunger for both boys, R^2 (3,92) = .23, p = .000, and girls, R^2 (3,96) = .09, p = .04, but with different variables offering prediction. For boys, pressure to eat was the only unique predictor (β = -.42, p = .00), while for girls restrictive feeding offered unique prediction (β = .21, p = .05).

Discussion

To our knowledge the present study is the first to examine the influence of a range of feeding strategies, in particular restrictive feeding, pressure to eat and covert feeding, on pre-school children's disinhibited eating using the EAH protocol. In addition, the study examined these separately for boys and girls. The major findings of the study are clear. As predicted, maternal restrictive feeding was associated with increased eating in the absence of hunger for girls only. In contrast to our prediction, maternal pressure to eat more was negatively associated with eating in

the absence of hunger for boys. In addition, maternal covert control was not associated with less eating in the absence of hunger in boys or girls.

Our findings show that restrictive feeding was associated with increased EAH for girls, and not for boys. While mothers may use restrictive feeding in an attempt to limit their daughters' intake of snack foods, girls respond to restrictive feeding by consuming relatively more snack foods when they become freely available. Our research adds one more result in a more socioeconomically diverse sample to the body of work reviewed by Lansigan et al. (2015) showing that this type of feeding strategy has a paradoxical effect on girls' eating, with girls eating more of the foods when they are readily available. The finding that maternal restrictive feeding was associated with disinhibited eating in girls but not boys is consistent with the one previous study that has examined EAH in both girls and boys (Fisher & Birch, 1999). Although there was no gender difference in maternal reports of restrictive feeding, girls responded to the imposed restriction differently. In the context of societal thin ideals for girls, perhaps as Birch, Fisher and Davison (2003) suggest, restrictive feeding messages transmitted by mothers may be internalised more readily by girls and manifest as a trigger for binge eating when foods become freely available. In contrast, restrictive feeding messages are not similarly internalised by boys and are therefore not responded to in the same way.

Our study further extended previous research by examining other feeding styles, including maternal use of pressure to eat more. In contrast to Harris et al. (2014) and Moens and Braet (2007), but in accord with Galindo et al. (2018), the use of pressure to eat was associated with less eating in the absence of hunger for boys. This finding is consistent with previous research using a variety of other methodologies showing that children who are pressured to eat tend to make more negative comments about food (Vereecken, Rovner & Maes, 2010) and to eat less (Boots et al., 2017; Galloway et al., 2006; Lee et al., 2010). We have now shown that the latter finding extends to the EAH protocol for boys. Again, although there was no gender difference in the amount of pressure exerted by mothers, it appears to have different implications for boys and girls. It is possible,

however, that child eating behaviour may influence mothers' feeding strategies in that mothers may exert relatively more pressure on their sons than their daughters with small appetites (who may also eat less in the EAH protocol). As a whole, we interpret the findings to show that what parents do in regards to feeding their children influences the actual eating of girls and boys differently. Our regression analyses indicate that restrictive feeding is more salient for girls, while pressure to eat is more salient for boys.

Finally, although we predicted that the use of covert control strategies would be associated with less eating in the absence of hunger, here covert control was not associated with eating in the absence of hunger. Covert feeding strategies, whereby the mother manages the child's environment rather than the child, are not readily detected by the child and therefore not interpreted by them as deprivation of certain foods. Although no relationship was observed in the behavioural setting here, survey studies suggest that covert control is associated with more healthy and less unhealthy snack food intake in both young and older children in naturalistic settings (Boots et al., 2015; Brown et al., 2006). Our results show that while covert control did not have the predicted effect, in contrast to restrictive feeding, covert control had no negative effect on children's eating.

As in all studies, the present study contained some limitations. First, participants were mothers and children recruited from 12 specific preschools in metropolitan Adelaide, South Australia. However, the sample was larger than in most previous EAH studies. Second, only mothers were recruited, and not fathers or other salient caregivers. Third, data regarding the amount children consumed during the ad libitum buffet lunch was not gathered and therefore could not be taken into account. Nevertheless, all children reported that they were full. Fourth, as with all correlational studies, causal conclusions cannot be made. It is important to note the possibility of bidirectional relationships between parent feeding strategies and child eating. Mothers may be responding to child eating behaviour as well as determining child eating behaviour patterns. Longitudinal research that examines both parent and child behaviours over some time is needed to more fully understand the influences on the development of young children's eating behaviours.

Despite the above limitations, the study clearly shows that there is a relationship between maternal feeding strategies and child eating behaviours as determined by the EAH protocol, with marked variability among sons and daughters. In particular, results indicate that the use of restrictive feeding by mothers may have a detrimental effect on their daughters' development of self-regulation of eating in a way that covert feeding strategies do not.

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CHAPTER 7: Study 4 - Longitudinal Study of Food Preferences

Pumpkin is "yucky"!: A prospective study of overt and covert restriction in the development of young children's food preferences

Samantha B. Boots[a], Marika Tiggemann[a] and Nadia Corsini[b]

[a] School of Psychology, Flinders University, Adelaide, Australia

[b] Rosemary Bryant AO Research Centre, University of South Australia, Adelaide, Australia

Corresponding author: Samantha B. Boots, School of Psychology, Flinders University, PO Box 2100, Adelaide, SA, 5001 Australia.

Email: samantha.boots@flinders.edu.au

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Abstract

The aim of the study was to investigate maternal feeding strategies as prospective predictors of young children's food preferences. Participants were 106 mother – child dyads with data collected when children were aged 4 (Time 1) and then again at 6 years old (Time 2). Mothers completed an initial questionnaire at Time 1 which contained measures of restrictive and covert feeding strategies. Children were interviewed concerning their food preferences and had their height and weight measured at Time 1 and again two years later (Time 2). Longitudinal regression results showed that Time 1 parental restrictive feeding predicted decreased child-reported preferences for fruit and vegetables and increased preferences for salty food and sweets at Time 2. Conversely, Time 1 parental covert control predicted greater child-reported preferences for fruit and vegetables over time. The results provide longitudinal evidence of the negative impact of restrictive feeding, and of the positive impact of covert control, on the development of young children's food preferences.

Introduction

Childhood obesity presents a significant health risk (Wang & Lobstein, 2006). Although the causes of obesity are complex, a major contributing factor is the overconsumption of food high in fat, salt and sugar, such as most snack foods (Larsen & Story, 2013). Recent data show many young Australian children do not meet the recommended daily intakes of fruits and vegetables (ABS, 2012). Instead, energy dense snack foods make up close to one third of their daily energy intake (ABS, 2012). Children's food preferences, in terms of their food likes and dislikes, are one of the most powerful predictors of their intake (Birch, 1979; Gibson, Wardle & Watts, 1998; Skinner, Carruth, Bounds & Ziegler, 2002; Jaramillo, Yang, Hughes, Fisher, Morales & Nicklas, 2006). These food preferences develop in early childhood and remain relatively stable through later childhood (Skinner et al., 2002), and into adolescence (Northstone & Emmett, 2008) and adulthood (Nicklaus, Boggio, Chabanet & Issanchou, 2004; Mikkilä, Räsänen, Raitakari, Pietinen & Viikari, 2005). In addition, once developed, food preferences are resistant to change (Hawkes, Smith, Jewell, Wardle, Hammond, et al., 2015). Therefore early childhood may represent a sensitive window for establishing preferences for foods that could potentially impact an individual's lifelong health.

Particularly for young children, parents are a critical influence in the development of food preferences and eating patterns (Gregory, Paxton, Brozovic, 2011). Parents use a variety of feeding strategies in order to encourage their children to eat healthily and to restrict their intake of unhealthy foods. Such feeding strategies have been be conceptualised as either 'overt' or 'covert' control (Ogden, Reynolds & Smith, 2006). Overt control strategies include monitoring and restricting the child's food intake and are explicitly communicated between the parent and the child. As such, overt strategies can be easily detected by the child. Many of the existing measures of parent feeding strategies (e.g., Child Feeding Questionnaire: Birch, Fisher, Grimm-Thomas, Markey, Sawyer & Johnson, 2001; Comprehensive Feeding Practices Questionnaire: Musher-

Eizenman & Holub, 2007) are parent reported and address aspects of overt control. The most widely examined parent feeding strategy is restrictive feeding, which involves parents' deliberate attempts to limit the consumption of unhealthy foods, e.g., by forbidding the child to eat sweets (Ogden et al., 2006). Restrictive feeding is most commonly measured by the Restriction Subscale of the Child Feeding Questionnaire (CFQ: Birch et al., 2001). While this has largely been conceptualised as a form of overt control (Yee, Lwin & Ho, 2017), it needs to be acknowledged that some of the items of the Restriction subscale are somewhat ambiguous and may include aspects of control that are covert, as well as overt. Indeed, some factor analyses including the Restriction Subscale have shown that the items do not always hang together well (Boots, Tiggemann & Corsini, 2017; Corsini, Danthiir, Kettler & Wilson, 2008), perhaps reflecting different aspects of parental control.

Nevertheless, in cross-sectional studies, parental restrictive feeding (as measured by the CFQ) has been associated with a number of negative outcomes, including eating in the absence of hunger (Birch & Fisher, 2000), poorer diet quality in terms of higher fat intake (Lee, Mitchell, Smiciklas-Wright & Birch, 2001), greater intake of unhealthy snacks (Boots, Tiggemann & Corsini, 2015), increased preferences for high fat and high sugar foods (Vollmer & Baietto, 2017) and greater child weight in some studies (Joyce & Zimmer-Beck 2009; Musher-Eizenman et al., 2009). Longitudinal studies have shown that parental restriction predicted child weight one year (Rodgers, Paxton, Massey, Campbell, Wertheim et al., 2013) and two years later (Faith, Scanlon, Birch, Francis & Sherry, 2004) and eating in the absence of hunger two years (Fisher & Birch, 2002; Rollins, Loken, Savage & Birch, 2014; Rodgers et al., 2013) and four years later (Birch, Fisher & Davison, 2003). In addition, parental restrictive feeding has been associated with children's food responsiveness and emotional overeating one year (Rodgers et al., 2013) and two years later (Steinbekk, Belsky, Wichstrom, 2016), as well as disordered eating and weight gain in adolescence (Balantekin, Birch & Savage, 2017). Reviews of existing literature with children aged 4 - 9 years old have concluded that restriction simultaneously promotes overeating when the restricted foods

are made more freely available and increases children's preference for the restricted foods, although they also point out that more well designed longitudinal research is needed to fully understand these relationships (Loth, 2016; Ventura & Birch, 2008).

In contrast to global restrictive strategies, covert feeding strategies aim to reduce the intake of unhealthy foods through means that are not communicated directly to the child and therefore remain un-detected by the child (Ogden et al., 2006). In other words, the parent manages the child's food environment, rather than the child directly, by providing primarily healthy foods in the home and avoiding restaurants and cafes that serve unhealthy foods when eating out. A small number of cross sectional studies of school-aged children have shown that covert control is associated with parent reports of lower intake of unhealthy snack foods (Brown & Ogden, 2004; Brown, Ogden, Vögele & Gibson, 2008) and greater fruit consumption (Rodenburg, Kremers, Oenema & van de Mheen, 2013). Two longitudinal studies with pre-school aged children (mean age = 4 years) have shown that covert feeding strategies are associated with parental reports of less unhealthy snack intake (Boots, Tiggemann & Corsini, 2018) and improved diet quality (Jarman, Ogden, Inskip, Lawerence, Baird et al., 2015).

More recently, parental feeding strategies have been conceptualised more broadly to reflect control versus structure in feeding children (Savage, Rollins, Kugler, Birch & Marini, 2017; Rollins, Savage, Fisher & Birch, 2016). Similarly, feeding strategies have been mapped to identify three overarching constructs: coercive control, structure, and autonomy support (Vaughn, Ward, Fisher, Faith, Hughes et al., 2015). Restrictive feeding (as measured by the CFQ) is seen as a form of coercive control, whereas covert control is a form of structure whereby parents limit access and create predictable routines to organise the child's environment (Rollins et al., 2016). It is argued that structure has a beneficial influence on children's eating because it promotes the development of self regulation resulting in improved overall diet quality (Savage et al., 2017), without any sense of deprivation or emotional angst that may be associated with more coercive feeding strategies.

However, the relationship between parental use of structure and the development of children's food preferences has yet to be tested.

More generally, while there is a large amount of research on the effects of restrictive feeding on children's food consumption, there is little on the development of food likes or preferences. Most of this existing research has consisted of short-term experimental studies that have restricted children's access to a specific food (e.g., chocolate Easter eggs) and shown that children's attention toward the restricted food and desire to obtain and consume the restricted food increased (Fisher & Birch, 1999a; Fisher & Birch, 1999b; Jansen, Mulkens & Jansen, 2007; Ogden, Cordey, Culter & Thomas, 2013; Rollins et al., 2014). These studies offer an experimental analogue to the effect of restriction on children's eating behaviour. A broader review of experimental studies of children's eating concluded that restriction serves to increase children's attraction to and preferences for the restricted foods, while simultaneously decreasing preferences for other (healthier) foods (DeCosta, Møller, Bom Frøst, Olsen, 2017). However, none of above studies speaks to the role of parent feeding in the *development* of children's food preferences, which necessarily takes place over time. To our knowledge, there are no longitudinal studies that have investigated the impact of restrictive feeding strategies on children's food preferences.

Thus, the purpose of the present study was to examine two conceptually different parent-feeding strategies in the development of children's food preferences using a longitudinal research design. Importantly, instead of using a parent-reported measure of children's food preferences (e.g., Fildes, van Jaarsveld, Llewellyn, Fisher, Cooke & Wardle, 2014), we wanted to ask children about their own food preferences. To this end, maternal use of restrictive and covert feeding strategies and children's reported preferences for fruit, vegetables, salty snacks and sweets were examined at two time points separated by approximately two years. Australian statistics show that 41% of young Australian children do not eat the recommended daily amount of fruit, 98% do not eat the recommended daily amount of vegetables, 50% consume sweets daily and 41% eat salty fatty foods daily (Australian National Health Survey: ABS, 2012). As children's acceptance and intake of

fruits, vegetables and non-core foods such as salty snacks and sweets are at least in part determined by their food preferences (Mallan, Fildes, Magarey & Daniels, 2016), we chose to examine preferences for these foods. Based on the findings of the previous experimental and cross-sectional studies, we predicted that restrictive feeding would be associated with an increase in children's preferences for salty snacks and sweets and a decrease in preference for fruit and vegetables over time. We predicted the opposite pattern for covert control. We also investigated changes in children's BMI.

Method

Participants

Participants were 106 children (57 girls and 49 boys) and their mothers. They were a subset of an initial sample recruited through 12 kindergartens in South Australia, Australia (n = 213; Boots et al., 2018) who had indicated willingness for their child to be followed up two years later when their child was at school. There were no exclusion criteria deployed. Interested mothers were contacted via email two years after the initial study, which was conducted in early 2016. Time 2 data were collected in early 2018. The retention rate at Time 2 was 51%. Attrition analyses showed that mothers who consented for their child to participate in the follow-up were older (M = 36.1, SD = 6.1 vs M = 34.27, SD = 6.5), $t(102)$ =2.15, p = .03, and more likely to have a tertiary education (M = 3.33, SD = .75 vs M = 3.1, SD = .86), $t(102)$ =1.96, p =.05, than those who did not consent. They did not differ on socioeconomic status or BMI (ps > .34).

Parent Survey

The mothers completed a questionnaire at Time 1, entitled "Kids Eating Project". The questionnaire contained measures of parent feeding strategies as outlined below. Demographic information was also obtained. Mothers reported on their own age and the age and gender of their child. Residential postcode and educational attainment were also collected. Socioeconomic status was assigned based on postcode of residence (Australian Bureau of Statistics [ABS]: 2013). Mothers also reported their own height and weight which were used to calculate maternal BMI.

Parental Restriction

The Restriction subscale of the Child Feeding Questionnaire (CFQ: Birch et al., 2001) contains 8 items addressing parents' propensity to control child eating by limiting the amount and portion sizes of certain foods, using food as a reward and by monitoring children's intake of certain foods. Exemplar items are, "I have to be sure that my child does not eat too many high-fat foods" and "If I did not guide or regulate my child's eating s/he would eat too many junk foods." Responses are made on a 5-point Likert scale (1 = *disagree*, 5 = *agree*) and summed and averaged to produce a score ranging from 1 to 5, with higher scores indicating greater restrictive feeding. Birch et al. (2001) reported the internal reliability of the original Restriction scale as acceptable (α = 0.73). In the present sample, internal reliability of the Restriction scales was similar (α = 0.71).

Covert Control

Covert control was measured by the Covert Control Scale developed by Ogden et al. (2006). This 5-item scale addresses strategies that parents use to control the child's consumption of energy dense food through limiting their exposure to these foods in the child's immediate environment. Items include "How often do you avoid taking your child to places that sell unhealthy food", and "How often do you avoid buying sweets, crisps, biscuits and cakes and bringing them into the home". Higher scores on the covert control measure indicate greater control of the child's environment. The original measure had adequate internal reliability (Cronbach's α = 0.79). In the present sample, internal reliability was similar (α = 0.74).

Child Measures

Food Preference Interview

Children's food preferences at Time 1 and Time 2 were measured by the same researcher (first author) by interviewing each child individually in their usual educational setting (Time 1: Kindergarten, Time 2: Primary School). Commonly children's food preferences have been assessed by parent report on their child's food likes and dislikes (Fildes et al., 2014; Howard, Mallan, Bryne, Magarey & Daniels, 2012; Wardle, Guthrie, Sanderson, Birch & Plomin, 2001; Wardle, Sanderson,

Gibson, Rapoport, 2001). An alternative technique that allows children to report on their own food preferences (irrespective of reading ability) is by the use of food photographs (e.g., Jaramillo, Yang, Hughes, Fisher, Morales & Nicklas, 2015; Olsen, Kildegaard, Gabrielsen, Thybo & Møller, 2012). Ratings of food photographs have been shown to provide a valid and reliable measure of children's food preferences (Guthrie, Rapoport & Wardle, 2000). In the present study, children were presented with 20 5" x 7" high gloss coloured photographs of individual foods. The foods were presented on a white background, with no serving plate, and were positioned in the middle of the frame. The foods came from four categories: fruit (apple, pear, bananas, mandarin, strawberry), vegetables (potato, tomato, carrot, green beans, pumpkin), salty snacks (hot chips, chicken nuggets, potato crisps, salty flavoured crackers, pre-packaged crackers and cheese dip) and sweets (chocolate, cupcakes, chocolate chip biscuits, lollies, ice cream in a cone) and were presented in a fixed random order. Food items were selected on the basis of national data of the most commonly consumed foods by Australian children (Australian National Nutrition Survey, CSIRO, 2007). Children were asked to describe each food using one of three responses, 'Yucky', 'Ok', or 'Yummy', which were subsequently coded 1 – 3. Preference scores were then averaged for each category (fruit, vegetables, salty food, sweets), with higher scores indicating greater liking for that food category.

Weight status

A trained research assistant measured the child's height and weight at Time 1 and Time 2. Children's standing height was measured to the nearest centimetre using a fixed wall chart and weight was measured to one tenth of a kilogram using an electronic scale without footwear. Because BMI during childhood is age and sex specific, gender specific growth charts were used to calculate BMI z-scores (Kuczmarski, et al., 2000).

Statistical Analysis

Statistical analyses were conducted using SPSS v20 (SPSS Inc Chicago). An alpha level of .05 was used for all statistical tests. Correlational analyses were conducted to assess the bivariate

cross-sectional associations between the parental feeding strategies and children's snack preferences at both time points. As across time correlations do not of themselves indicate temporal precedence, a series of hierarchical multiple regressions was undertaken to examine whether Time 1 parent feeding strategies predicted change in children's food preferences over time, while controlling for covariates (child age, child BMIz, parent age, parent education, SES, parent BMI). Separate regressions were conducted for each food category. In each regression, covariates were entered in Step 1, Time 1 food preference (fruit, vegetables, salty snacks, sweets) was entered in Step 2, and the two Time 1 parent-feeding strategies (Restriction, Covert Control) were entered in Step 3. The relevant Time 2 child food preference was the outcome variable.

Results

Sample Characteristics

The sample comprised 106 children (57 girls and 49 boys) and their mothers. The available demographic characteristics are presented in Table 1. At Time 1 children were aged 3 – 5 years old (M = 4.80 years, SD = 0.43) and mothers had a mean age of 35. 28 years (SD = 6.55), with the majority living in two-adult households (84.2%) with two children (55.4%). At Time 2, children were aged 5 – 7 years old (M = 6.59, SD = 0.49). Participants came from diverse socioeconomic backgrounds, with 46.8% coming from low to middle SES areas (SIEFA deciles 1-7) and 53% coming from high SES areas (decile 8-10).

Based on BMI cut offs (WHO, 1995), the majority of mothers (55.8%) were of normal weight, 6.3% were underweight, 20.0% were overweight and 17.9% were obese. The majority of children at Time 1 were also of normal weight (60.4%) according to the International Obesity Task Force (IOFT: Cole et al., 2007) age and sex specific BMI cut offs, with 16.0% underweight, 17.0% overweight and 6.0% obese.

Table 1

Descriptive characteristics for mothers and children (N = 106)

Characteristics	%	Mean (SD)
Mothers (Time 1)		35.28 (6.55)
Age		
Number of children		2.10 (0.82)
Education		
Some university/completed university	63.2%	
Technical or vocational school	22.4%	
Some high school/completed high school	9.0%	
BMI weight category*		
Underweight	6.3%	
Normal	55.8%	
Overweight	20.0%	
Obese	17.9%	
Number of adults in the home		
One	7.0%	
Two	84.0%	
SES**		
Low (1-4)	36.8%	
Mid (5-7)	10.2%	
High (8-10)	53.0%	
Child		
Gender		
Male	46.3%	
Female	53.7%	
Child's Age		
Time 1		4.80 (0.43)
Time 2		6.59 (0.49)
Child BMI		
Time 1		15.80 (2.38)
Time 2		15.89 (2.78)

*BMI weight category for Adults based on WHO weight categories; underweight <18.50, Normal weight 18.50-24.99, Overweight BMI >25.0, Obese >30.0

**SES = Socioeconomic status from SIEFA index of relative disadvantage based on residential postcode

Changes over time

As can be seen in Table 2, sweets were the most liked of all the food categories at both Time 1 and Time 2, with ice cream the universally most liked (98% described it as "yummy"). The vegetable category was the least liked at both time points, with pumpkin the least liked vegetable (91% described it as "yucky" at Time 2). Table 2 also shows that children's preference for both fruit, $t(106) = 5.28$, $p <. 001$, and vegetables, $t(106) = 2.22$, $p = .01$, decreased over time. There were no significant changes over time in children's preferences for salty food or sweets or BMI. All correlations between respective Time 1 and Time 2 variables were moderately positive.

Table 2

Means (SDs), t-values, and correlations for child food preferences and BMI at Time 1 and Time 2

	Time 1	Time 2	*t*	Correlation
Preference[a]				
Fruit	2.43 (0.47)	2.17 (0.57)	5.28**	.54**
Vegetable	2.11 (0.59)	1.99 (0.63)	2.22*	.60**
Salty Snacks	2.70 (0.37)	2.71 (0.37)	0.53	.77**
Sweets	2.91 (0.21)	2.88 (0.27)	1.38	.62**
BMI	15.80 (2.38)	15.89 (2.78)	0.36	.53**

* $p <.05$ ** $p <.001$

[a] Scored on a three point scale 1= Yucky, 2 = Ok, 3 = Yummy; range 1-3.

Associations between parent feeding and children's snack food preferences

As expected, restrictive and covert feeding strategies were negatively correlated ($r = -.22$, $p<. 023$). Table 3 displays the correlations between Restriction and Covert Control and children's preferences for fruits, vegetables, salty snacks and sweets. Within Time 1, more frequent use of restrictive feeding was associated with lower preference for fruits and vegetables. Parental use of covert control was not associated -with any children's food preferences. Neither parent feeding strategy was associated with BMI.

Table 3

Correlations between parent feeding strategies, child food preferences and BMI

	Time 1 Parent Feeding Strategy	
	Restriction	Covert Control
Fruit		
Time 1	-.21*	.11
Time 2	-.57**	.58**
Vegetables		
Time 1	-.22*	.09
Time 2	-.57**	.52**
Salty Snacks		
Time 1	.03	-.07
Time 2	.18	-.17
Sweets		
Time 1	.02	-.14
Time 2	.26**	-.20*
BMI		
Time 1	.06	.01
Time 2	-.04	-.02

* $p < .05$ ** $p < .001$

Table 3 also shows across time correlations. Time 1 restrictive feeding was associated with lower preference for fruit and vegetables and with higher preference for sweets at Time 2. The converse relationship was evident for covert control, with Time 1 covert feeding associated with higher preferences for fruit and vegetables and lower preference for sweets at Time 2. Parent feeding strategies were not associated with children's preference for salty snacks nor BMI at Time 2.

Longitudinal tests of parent feeding and children's food preferences

Table 4 displays the results of the regression analyses predicting Time 2 children's food preferences from Time 1 parent feeding strategies. In general, the covariates had little effect, except for the positive effect of parental education on preferences for fruit and vegetables (β = .30, p = .023; β = .33, p = .014, respectively). As can be seen from Step 3, parent-feeding strategies offered significant prediction for each of the categories of child food preference (all R^2_{change} > .06, F_{change} > 5.0, p <. 01). In terms of unique predictors, preference for fruit was associated with lower restrictive feeding (β = -.38, p = .000) and higher covert control (β = .46, p = .000). The same pattern emerged for vegetables: preference for vegetables was associated with lower restrictive feeding (β = -.37, p = .000) and higher covert control (β = .38, p = .000). Children's preference for sweets was predicted only by greater restrictive feeding (β = .22, p = .002).

A similar hierarchical regression for child BMI showed no significant overall prediction. In particular, parent feeding strategies were not associated with change in BMI, R^2_{change} = .01, F_{change} (2, 103) = 0.59, p = .55, confirming the results of the correlations presented in Table 3. Neither restrictive feeding nor covert control at Time 1 significantly predicted child BMI at Time 2.

Discussion

To our knowledge the present study is the first to examine the influence of both restrictive feeding and covert control on the development of children's food preferences over time. The major findings are clear. As predicted, greater use of parental restrictive feeding was associated with decreased liking for fruits and vegetables and increased liking for salty food and sweets among children two years later. In addition, covert feeding was associated with increased liking of fruits and vegetables two years later. In the present study, there was no evidence that either parental feeding strategy influenced change in children's weight.

Table 4

Results for hierarchical regression analyses predicting Time 2 child food preference from Time 1 parent feeding strategies

	Food Preferences			
	Fruit β	Vegetables β	Salty Snacks β	Sweets β
Step1: Covariates				
Child Age	-.03	-.03	-.25	-.20
Child BMIz	.10	.10	.07	.04
Parent Education	.30*	.33*	.12	.06
SES	-.02	-.08	-.08	-.02
Parent BMI	.01	-.12	-.02	-.04
R^2_{change}	.08	.12	.04	.04
F_{change}	1.55	2.38*	0.68	0.66
Step 2: Time 1 Preference				
Food Preference	.53**	.56**	.76**	.66**
R^2_{change}	.24	0.28	.54	.42
F_{change}	31.73**	40.35**	74.39**	66.49**
Step 3: Parent Feeding Strategy				
Restriction	-.38**	-.37**	.12	.22*
Covert Control	.46**	.38**	-.10	-.06
R^2_{change}	.39	.32	.06	.06
F_{change}	58.16**	47.41**	6.05**	5.05*

Our first finding that maternal restrictive feeding at approximately age 4 was associated with greater preference for energy dense (both sweet and salty) foods at approximately age 6 confirms that global parental restriction of energy dense foods increases children's preferences over time for this type of food. This longitudinal finding extends the literature showing the paradoxical effect of

this type of parental control to a new but important outcome, naturalistic food preferences. Our finding is consistent with the results of experimental studies that show that restriction of a particular food increases children's preference for that food in the laboratory (Fisher & Birch, 1999a; Jansen et al., 2007; Ogden et al., 2013). Importantly, not only did we show that child preferences for energy dense salty and sweet foods increased, but we also showed that restrictive feeding had a negative impact on children's preferences for fruit and vegetables. Our longitudinal result contrasts with that of Vollmer and Baietto's (2017) cross-sectional study of children of a similar age, which did not find an effect of restrictive feeding on parent-reported children's fruit and vegetable preferences. The difference may be due to the nature of the reports (parent versus child) or the use of a different specific measure, or perhaps it is the case that preferences for fruit and vegetables take some time to develop. Here, we show that restrictive feeding simultaneously increases preferences for (restricted) unhealthy foods, while decreasing preferences for healthy foods.

As predicted, the specific practice of covert feeding used by parents was beneficial for the development of food preferences, in particular increasing preferences for fruit and vegetables. While covert control can be conceptualised as a type of restriction in that it aims to limit children's intake of 'unhealthy foods', covert control differs from restrictive feeding because it is characterised by controlling the child's environment (whereby parents provide mainly healthy foods and avoid bringing unhealthy foods into the home), rather than directly focusing on the child's eating. Most likely, covert control results in children developing preferences for healthy foods due to exposure to and familiarity with a range of foods in a non-coercive manner, without any sense of the deprivation that seems to eventuate when more controlling feeding strategies are used (Ogden et al., 2006). It is argued that under these circumstances, children develop self-regulation of their eating (Vaughn et al., 2015). It is also likely that the food that parents keep in the house reflects their own food preferences (Kaar, Shapiro, Fell & Johnson, 2016). Our finding not only adds to previous longitudinal work showing that covert control is prospectively associated with parent-reported beneficial outcomes such as children consuming less unhealthy and more healthy snacks

(Boots et al., 2018) and improved overall diet quality (Jarman et al., 2015), but also extends these findings to children's own reports of their preferences for fruit and vegetables. Accordingly, the finding adds to the cumulating evidence that covert control presents a positive and effective feeding strategy for parents to use.

Although we have shown that parental restrictive and covert feeding are associated with children's food preferences, here we showed no prediction of BMI by either feeding strategy. It is likely that, although children's food preferences are a major predictor of diet quality and dietary intake (Birch, 1979; Gibson et al., 1998; Skinner et al., 2002; Jaramillo et al., 2006), resulting changes in weight occur more slowly. As food preferences remain relatively stable over time and carry into adulthood (Hawkes et al., 2015), the associated effects of early feeding strategies used by parents may have greater ramifications as children grow older and develop potential lifelong eating habits. Independent of weight, the consumption of fruit and vegetables in adulthood decreases the risk of coronary heart disease, ischemic stroke, some cancers and neurodegenerative diseases such as Parkinson's and Alzhiemer's (Yahia, 2017). On the other hand, the consumption of energy dense sweet and salty unhealthy foods is associated with chronic disease, leading to premature mortality in adulthood (Cecchini et al., 2010). Therefore, developing preferences for fruit and vegetables at a young age may have associated long-term health outcomes for individuals.

The present study has a number of methodological strengths. First, rather than examining children's food preferences at a single time point, the current study examined the relationship between parent feeding strategies and children's food preferences over a reasonable length of time, two years. Second, children were individually interviewed about their food preferences rather than relying on what parents report, as in the single existing cross sectional study (Vollmer & Baietto, 2017). In addition, the study assessed preferences for a range of foods of different types, and included both ('healthy') fruit and vegetables and ('unhealthy') salty and sweets foods. Finally, our research design allowed the two parental feeding strategies to be examined together and showed that both contribute to (offer unique prediction of) children's food preferences.

The findings from the present study have important practical implications. The contemporary environment, which is saturated with palatable, unhealthy foods that are cheap to buy, presents a major challenge for parents in attempting to establish healthy eating patterns in their young child. Under these circumstances, intuitively it may make sense for parents to actively try to shape children's preferences (and associated consumption) away from unhealthy foods to more healthy foods. In doing so, parents may impose restrictions on the intake of unhealthy foods, such as refusing junk food requests and telling the child that they can only eat a certain amount of sweets. The findings presented here suggest that this type of parental control actually increases children's preference for unhealthy foods and decreases their preference for healthy foods over the longer term. Therefore, parents should be dissuaded from using restrictive feeding strategies and instead be encouraged to use alternative feeding strategies, such as covert control. The findings also have broader ramifications for public health. In the present sample as a whole, although moderately correlated over time, preferences for fruit and vegetables decreased over the two-year period examined, from age four to age six. This is consistent with Australian food intake data; 41% of young children aged between 4 years and 8 years old do not eat the recommended daily amount of fruit, and 98% of young children do not eat the recommended daily amount of vegetables (National Health Survey: ABS, 2012). Arresting this decline in children's preferences for fruit and vegetables is clearly a vital goal toward improving the health of Australian children.

As with all research, the current study contains some limitations that need to be acknowledged. First, the informants were mothers and not fathers or other salient caregivers. Those mothers who consented to their child participating in the follow up were also older and more educated than the initial sample, indicating some degree of self-selection bias. Second, there are other factors that may affect the development of children's food preferences that were not included, such as parental modelling, parents' own food preferences, and child eating characteristics (e.g., food neophobia, food responsiveness) which have previously been shown to influence the development of children's food preferences in cross-sectional studies (Skinner et al., 2002; Fiese &

Jones, 2012; Blissett et al., 2016; Wardle et al., 2005). Third, we used only two well established measures of parental feeding. Future research might include a greater range of parent feeding measures, as well as measures of children's perceptions of their parents' feeding strategies. Fourth, we had no measure of dietary consumption. Although food preferences are shown to be a major predictor of intake (Skinner et al., 2002), future longitudinal studies might track both children's food preferences and consumption. Fifth, it is important to note that longitudinal studies are always limited to the portion of the life span examined, in this case from approximately age 4 to age 6 years, and that relationships may not hold at other time points. In particular, we do not have information on the factors that determine initial parent feeding strategies at an earlier age.

Despite the limitations, the current study has contributed to our understanding of the role of parental feeding strategies in the development of children's food preferences over time. The findings clearly show that the use of global restrictive feeding by parents has a detrimental effect on the development of children's preferences for fruits and vegetables, while increasing children's preferences for sweet and salty snack foods. The results also show that the specific practise of covert feeding has positive influences on children's food preferences over time. At a practical level, the findings can usefully inform advice given to parents about how to foster healthy food preferences in their children.

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CHAPTER 8: General Discussion

Chapter Overview

The present thesis aimed to examine the effect of parental feeding strategies, in particular maternal restriction and covert control, on young children's healthy and unhealthy snack intake. This was addressed in four studies that utilised cross-sectional and longitudinal designs. This final chapter aims to integrate and discuss the results and implications from these studies. The chapter first presents a brief summary of the results, followed by a discussion of the research, theoretical and practical implications.

Summary of Findings

Study 1, which was a large cross sectional study of mothers of children aged 2-7 years from socioeconomically diverse backgrounds, had three major findings. First, factor analysis (Study 1a) showed that the strategies mothers use could be broadly conceptualised into three factors, which we labelled overt, covert and parental modeling. Overt control was associated with parent-reported greater unhealthy and less healthy snack intake in their children, whereas covert control showed the opposite pattern. Second, Study 1 (Study 1b) showed that general parenting dimensions (demandingness and responsiveness) were associated with children's snack intake. Specifically, greater parental demandingness was associated with greater healthy snack intake and lower unhealthy snack intake, and greater parental responsiveness was associated with lower unhealthy snack intake. Taken together, the results showed that children who consumed more unhealthy snacks had parents low on both demandingness and responsiveness, while children who ate more healthy snacks had parents high on demandingness. The study also found that the parent feeding strategies of restriction and covert control mediated the relationship between general parenting dimensions and children's consumption of snack foods. Third, the study (Study 1c) showed that feeding strategies (restriction and covert control) translated into specific parental behaviours in response to challenging snack food requests in real life feeding situations. Further, the parental

responses offered prediction of both healthy and unhealthy snack intake, over and above the prediction offered by the restriction and covert control scale scores.

In the longitudinal follow-up, Study 2 showed that initial use of maternal restriction as a feeding strategy predicted increased unhealthy snack intake in children three years later. In contrast, initial use of covert control predicted lower unhealthy snack intake in children three years later. These associations were independent of known covariates that influence children's eating, such as child and parent weight, parent education, and socioeconomic status.

Study 3 examined the effect of maternal feeding strategies on 4 year-old children's actual eating behavior using a laboratory-based paradigm. Results showed that maternal use of restriction was associated with greater eating in the absence of hunger for girls, but not boys. Covert control was not associated with eating in the absence of hunger for either gender.

Using the same sample, the final study in the thesis (Study 4) examined prospectively the effect of maternal feeding strategies on children's food preferences collected via interviews with children themselves initially and two years later. Results showed that greater use of maternal restrictive feeding at age 4 was associated with an increase in children's preference for sweets and decrease in preference for fruit and vegetables at age 6. Maternal covert feeding strategies at age 4 showed the reverse pattern, with a decreased preference for sweets and increased preference for fruit and vegetables at age 6.

Implications

The overarching aim of this thesis was to investigate mothers' use of restriction and covert control and young children's healthy and unhealthy snack intake, with a view to differentiating protective and detrimental aspects of maternal feeding strategies. In this, the thesis can be deemed successful. The use of restrictive feeding by mothers consistently predicted greater unhealthy snack consumption in their young children both in the short and longer term (Studies 1, 2 & 3). This finding lends support to previous cross sectional and longitudinal studies indicating that restrictive feeding is associated with greater overall calorie intake and poorer diet quality (see reviews by

Savage et al., 2007; Ventura & Birch, 2008) and extends the findings to children's naturalistic snack intake. The findings (Study 4) also show the detrimental impact of restrictive feeding on the *development* of children's food preferences, with children themselves reporting increases in their preference for sweets (snacks high in sugar and fat) when their mothers use more restrictive feeding strategies.

The only study in the thesis in which child gender moderated the observed relationship between mother's use of restrictive feeding and child outcomes was the laboratory based study of children's eating in the absence of hunger (Study 3). Only girls, and not boys, responded to their mothers' use of restriction by eating greater amounts of snack foods in the absence of hunger in the laboratory. This result lends support to two previous studies that examined gender specific effects and reported no association between parental restrictive feeding and boys' eating in the absence of hunger (Fisher & Birch, 1999b; Faith et al., 2003). Why mothers' restriction of palatable foods impacts eating in the absence of hunger for their daughters, and not their sons, likely occurs in the context of societal thin ideals for girls (and women), with mothers particularly worried about protecting their daughters from becoming over weight. The imposed restrictive feeding by mothers may lead girls, more so than boys, to internalize feelings regarding the 'goodness' and 'badness' of foods, potentially leading to a loss of control or binge eating.

Taken together, the studies (Study 1, 2, 3 & 4) have identified significant detrimental impact when mothers use restrictive feeding strategies when managing their young child's snack intake. As a set, the findings sit with the previous literature, which has primarily focused on children's consumption of unhealthy foods (for review see Blaine et al., 2017), and extend the findings to children's snack intake. However, not only is restrictive feeding associated with unhealthy snack intake, but the present findings also show that it actively inhibits children's preference for and consumption of healthy foods (Study 1 & 4). Thus the findings add to our broader understanding of the paradoxical effect of restriction on children's eating in the short and longer term. While well-meaning mothers intend to limit the intake of and preference for unhealthy snack foods through the

use of restriction, the net effect appears to be that it simultaneously results in children's greater intake of and preference for unhealthy snack foods, as well as reducing intake of and preference for healthier foods. In sum, these findings add to and extend the significant existing body of work on the effects of mothers' use of restrictive feeding.

Far less work has been conducted on the effects of maternal use of covert control, which was studied as an alternative feeding strategy. When this PhD research was initially formulated, the conceptualisation of covert control of feeding was new and there was relatively little research on its effect on children's eating. The present results (Study 1, 2 & 4) clearly extend the literature to show the beneficial impact of mothers' use of covert control on young children's snack intake, both in the short and longer term. Specifically, the results show that mothers' use of covert control was associated with more healthy and less unhealthy snack intake in young children initially (Study 1), and less unhealthy snack intake three years later (Study 2). These findings add to the few existing cross sectional results with older children (Brown et al., 2004; Ogden et al., 2006; Brown et al., 2008; Rodenberg, Kremers, Oenema & van de Mheen, 2013). They also extend the one previous longitudinal study on general diet (Jarman et al., 2015) to show that maternal covert control has a beneficial influence on children's snack consumption in particular.

Mothers' use of covert control was also associated with children's own reports of preferring healthier, nutrient rich food, in this case fruit and vegetables, both initially and two years later, and less preference for sweets two years later (Study 4). The present findings demonstrate that the development of children's food likes and dislikes are positively impacted by mothers' use of covert control. This is an important finding, especially in light of Australian national data which indicate that eating fruit and vegetables is problematic for many young Australian children (NNAPS: ABS, 2014). These data show that many 4 year olds (41%) do not eat enough fruit, and nearly all (98%) do not eat enough vegetables according to dietary guidelines. In addition, consumption of fruit and vegetables declines as children get older, with even lower daily intake reported for 8 year old

children (NNAPS: ABS, 2014). To the extent that covert feeding can assist in arresting this decline, encouraging its use may be an important public health strategy.

Together the findings (Study 1, 2 & 4) provide cumulative evidence for covert control as a positive and effective feeding strategy in promoting healthy eating in young children in the short and longer term. It is likely that covert control results in children developing healthier eating habits due to exposure to and familiarity with a range of foods in a non-coercive manner, without any sense of deprivation that seems to eventuate from more child-targeted feeding strategies, such as restriction. It is also likely that in an environment where mainly healthy food is provided, parents do not need to make comment to their children about their eating. In this context, children have the opportunity to develop the necessary skills to self regulate their eating based on hunger and satiety cues, rather than eating in response to environmental cues such as the presence of palatable foods.

Although not the major aim of the thesis, the studies (Study 1, 2 & 4) identified several predictors of the use of feeding strategies. These included child age, maternal age and maternal education. Specifically, mothers were more likely to use either feeding strategy when their children were younger. This makes sense as children of a young age are more dependent on their adult caregivers. Mothers of young children determine the foods made available, the portion sizes offered and where the eating occasion will occur. Particularly with the commencement of schooling, other influences will contribute to and shape children's eating. Therefore, the preschool years may represent a window of time where mothers have the greatest responsibility in feeding their child, and their effect will be the greatest.

In terms of maternal characteristics, older and more educated mothers were more likely to use covert control. Education provides mothers with skills that include greater locus of control and persistence, expanded personal networks, and better health self-efficacy (Kingston, Hubbard, Lapp, Schroeder & Wilson, 2003). This may mean that more educated mothers have greater personal resources to overcome difficulties that arise in food parenting. It is also likely that older and more educated mothers have greater knowledge and understanding of the benefits of a healthy diet and,

accordingly, may explicitly think about strategies and outcomes in relation to feeding their child (Wardle, 1995). More educated mothers are also more likely to be invested in their child in general; research shows that having more highly educated parents results in a broad range of better outcomes for children (Prickett & Augustine, 2016; Kalil, Ryan & Corey, 2012).

A different kind of predictor of mothers' use of particular feeding strategies was their general parenting style (Study 1b). A general parenting style that was low in warmth/responsiveness and high in demands placed on children (beyond appropriate for their developmental stage) was associated with the use of restrictive feeding. This finding supports previous literature which showed that restrictive feeding is associated with an authoritarian parenting style (low responsiveness/high demandingness) (for a review, see Vollmer & Mobley, 2013). While restrictive feeding has been conceptualized as a moderating influence on the relationship between general parenting style and child developmental outcomes (Steinberg & Darling, 1993), in the present study, feeding strategies were found to mediate the relationship between general parenting style and children's snack intake. The results of this study add to previous results showing beneficial outcomes of high parental demandingness and responsiveness (authoritative parenting) on children's food quality (Cullen et al., 2000; Gable & Lutz, 2000; Patrick et al., 2005) and extend these findings to children's snack intake.

Although most of the predictions of the thesis were confirmed, one outcome of interest that was not affected was child weight (BMI). Much of the interest in parental use of restriction and associated poor diet quality relates to concern about childhood overweight, but in the present thesis, feeding strategy was not associated with child weight (BMI) either cross sectionally (Study 1 & 3) or over time (Study 2 & 4). These findings stand in contrast to some other studies showing a relationship between parental restriction and increased child adiposity (Birch & Fisher, 2000; Birch, Fisher & Davison, 2003; Francis & Birch, 2005; Faith, Berkowitz, Stallings, Kerns, Storey et al., 2004; Moens & Braet, 2007). It seems likely that resulting changes in weight occur more slowly than changes in eating patterns. In addition, evidence suggests that BMI declines after infancy to a

minimum at around age 6 years before increasing until adulthood (for review see Williams, 2012). In particular, if children have disproportionately high increases in fat mass index between the ages of 7 -11 years (adiposity rebound), then they are more likely to be overweight or obese as an adult (Williams & Goulding, 2012). The children in the present studies were largely between 4 - 6 years old, and thus in the time of the lowest BMI and before adiposity rebound. It is possible that weight change may have been observed had they been older or studied over a longer period of time.

Theoretical Implications

The findings of the thesis have a number of implications for the theoretical understanding of parenting feeding. First, the results offer strong support to the conceptualisation of parental feeding strategy as either overt or covert as presented by Ogden and colleagues (2006). Overt control differs from covert control in that overt parent feeding strategies target the child, whereas covert feeding strategies target the child's environment (Odgen et al., 2006). More recently, Ogden and colleagues' conceptualisation of parent feeding has been reframed as either control or structure (Rollins, Savage, Fisher & Birch, 2015). Rollins and colleagues (2015) argue that control encapsulates power-based, coercive parent feeding strategies, whereas structure represents parent feeding strategies that organize the child's environment. In this conceptualisation, control refers to overt control and includes restrictive feeding, whereas covert control is a form of structure.

The conceptualisation of feeding as either control or structure is seen as a specific example of the broader parenting strategies postulated by Grolnick and Pomerantz (2009), where control in parenting impedes the development of self regulation in childhood while structure in parenting facilitates this development. Rollins et al. (2015) argue that parental use of control or structure plays out in the feeding domain, with control inhibiting the self regulation of eating, resulting in children responding to external cues for eating such as the presence of palatable foods, while structure moderates children's unhealthy food intake by promoting self-regulation of eating. In addition, the findings presented here indicate that covert control, a practice that governs the availability of foods in the child's environment and conceptualised by Rollins et al. (2015) and later

by Vaughn et al. (2016) as a form of structure, seems to promote more healthful eating. Specifically, structuring the child's environment through limiting the availability of energy dense - nutrient poor foods and importantly providing mainly healthy foods, leads to lower intake (Study 3) and lower liking (Study 4) of energy dense / nutrient poor foods.

The conceptualisation of parent feeding has continued to evolve and a model proposed by a working group of content experts (Vaughn et al., 2016) offers a three factor model: coercive control, structure, and autonomy support. This model includes an additional factor that acknowledges feeding strategies that support children's autonomy and encourage their independence. Examples of autonomy supporting feeding strategies include involving the child in food preparation, providing the child with nutrition education so that they can make informed, independent choices and reasoning and negotiating. However, this specific model of parent feeding has yet to be widely applied. To our knowledge, only one research team (Davison, Blake, Blaine, Younginer, Orloski, et al., 2015) has used the conceptual model to examine parental use of coercive control, structure and autonomy support through interviews with 60 low-income American carers of preschool children. Davison and colleagues found evidence to support the three factor model but also suggested a fourth factor, namely, permissiveness.

Interestingly, the factor analysis here (Study 1a) also identified three broad parent feeding styles. A principal component factor analysis was used because the sample of mothers was large and diverse and the aim was to examine feeding strategies broadly, to better understand the underlying factor structure of different widely used measures of parent feeding. The three factors identified were called overt control, covert control, and a factor neutral to control (here termed modeling), which may be viewed as a form of autonomy support. Thus, the factor analysis provides some independent support for a three-factor conceptualisation of parent feeding. In addition, while the focus of this thesis has been on parent feeding strategies that are motivated by parents wanting to discourage unhealthy eating and avoid their child from becoming overweight, some parents have the opposite concern. That is, they are worried because their child is underweight and not eating

enough. The factor analysis showed that the strategies mothers use when their child does not eat enough (pressure to eat) were conceptually similar to strategies mothers use to stop their children from eating too much (restriction), as the items loaded on to the same factor (overt control). While these strategies are clearly very different in their intent, they are both overt strategies that are communicated directly to the child. They both result in outcomes that are opposite to what is intended (eating too little in the case of pressure to eat; eating too much in the case of restrictive feeding).

With respect to measurement, covert control was measured by the one available measure, namely the Covert Control Scale (Odgen, Brown & Reynolds, 2006). Restrictive feeding was measured by the Restriction subscale of the Child Feeding Questionnaire (CFQ: Fisher & Birch, 2001), the most widely used measure of restrictive feeding. Results presented in this thesis provide some support for the construct validity of the Restriction subscale of the CFQ. Previous validation studies in various populations (Anderson et al., 2005; Boles et al., 2010; Corsini et al., 2008; Nowicka et al., 2014) have identified some psychometric issues with the restriction subscale, including low internal reliability, suggesting that the subscale could be capturing other parent feeding strategies. Indeed, in the factor analysis of the measures examined (Study 1a), the restriction subscale was the only scale where the items did not cohere well. In particular, it has been suggested that items from the Restriction scale do not necessarily (by definition) tap into overt control strategies (Vaughn, Tabak, Bryant & Ward, 2013). For example, an item such as "I have to be sure that my child does not eat too many junk foods" could, in principle, reflect an overt or covert feeding strategy. However, in our studies, scores on the restriction scale were consistently negatively correlated with scores on covert control (Study 1, r = -.17; Study 2, r = -.28; Study 3, r = -.19; Study 4, r = -.22). Further, the results presented here, cross sectionally, longitudinally and in the field, have consistently shown that restriction and covert control had differential effects on children's eating outcomes. Thus our results are very clear that restriction is

measuring a different construct from covert control, and the thesis as a whole confirms that the restriction subscale of the CFQ is a useful measure.

Practical Implications

Despite much focus by government and policy makers on improving children's diet quality by reducing the intake of discretionary (energy dense) snack foods and encouraging the intake of nutrient rich foods, national dietary intake data show that this has not occurred. Specifically, discretionary foods make up one third of contemporary young Australian children's daily energy intake, while the consumption of nutrition rich foods, such as fruits and vegetables, are well below recommended daily intake levels (NNPAS: 2014-2015, ABS, 2014). These data indicate that current feeding strategies are not resulting in positive outcomes for children's diets.

In this context, it is clear that feeding children is a very challenging task that most mothers want to do well. Yet, at the same time, it is one of the most repetitive and mundane chores reported by mothers (Aviram, Atzaba-Poria, Pike, Meiri, & Yerushalmi, 2014). This daily grind occurs for most mothers with little preparation or training, and in many cases little support from extended family and the wider community (Castle & Jacobsen, 2013). Mothers, feeling that they are time poor (Rose, 2017), seek convenient and quick food options for their children and, likely due to TV advertising and unclear food labeling, feel confused about foods to feed their children (Lovelace & Rabiee-Khan, 2015).

The task is made even more difficult in an environment where palatable, energy dense foods are in abundant supply, are cheap to buy, and packaged ready to go. Some mothers may seek information from a huge variety of books that are available on the topic of children's health or seek guidance from the internet, only to be bombarded with a plethora of information about 'action plans' for a healthy family and images of the perfect afternoon snack created by the latest celebrity family. Some of these contain material that promotes the use of restrictive feeding or in particular, other quick fix strategies that lead to longer-term problems with eating (Ogden, 2014). To compound the issues, childhood nutrition problems are widely publicized: from childhood obesity

and eating disorders to food allergies, learning and behavioral problems, and picky eating. Mothers may be scrambling to make sure that they feed their children 'right'. The combination of fear of raising an overweight child and pressure for them to eat healthily adds to the burden on mothers. While never assuming to be a panacea for the issues mothers face in child feeding, the results of the four studies presented in this thesis have a number of practical implications, and it is hoped that the studies may usefully inform advice provided to parents.

It has been well established, through the studies presented here and in the literature more widely, that mothers should be dissuaded from using restrictive feeding strategies, as they lead to poorer child eating outcomes, both in the short and longer term. When mothers use restrictive feeding, children prefer and consume more of the snacks mothers are trying to limit, while simultaneously inhibiting the development of children's preferences for and intake of healthier foods. The strategy seems to undermine children's sense of autonomy, resulting in children focusing on what they can not have, and interferes with their ability to self regulate their eating based on hunger and satiety. However, while it seems clear what mothers should not do, it is less clear as to what they should do.

Fortunately the thesis offers evidence for the use of an alternative feeding strategy for mothers in the form of covert control. Covert control, whereby mothers do not target the child, but rather manage the child's eating environment, has been shown to be beneficial for children. Covert control might be conceptualised as a more proactive feeding strategy, in which mothers plan ahead for what, where and when their child might eat. In this, covert control contrasts with restrictive feeding, which seems be a more reactive feeding strategy where, in the moment, mothers react to what their child is eating. As covert control does not involve reacting in the moment, the focus is taken away from battles over a specific food (such as a sweet treat) within the parent-child interaction, likely removing the emotional angst associated with restrictive feeding strategies.

It is also likely that when mothers use covert control in the context of general structure based parenting, children have the opportunity to develop skills in self regulation. In structure

based parenting, predictable routines and reasonable boundaries appropriate for the child's developmental stage are set. This type of parenting is similar to other proactive parenting strategies whereby along with structure, parents provide scaffolding and reasoning to minimize the child's transgressions in what could be potentially troublesome situations (Chang et al., 2013). Structure based strategies are used preemptively before any conflict arises and have been found to be associated with positive child behavior (Gardner, Shaw, Dishion, Burton, & Supple, 2007). Numerous studies have documented the association between proactive parenting and better self regulation of behavior and emotion in young children (Bernier et al., 2010; Lengua, Honorado, & Bush, 2007). The present studies suggest that this may extend to self regulation of eating.

However, it should be acknowledged that the use of covert control may be more difficult for parents to implement given the cognitive and emotional demands required of the parent. Thus, providing training for mothers early in the child's life may give mothers the best opportunity to learn and think about child feeding prior to the commencement of introduction of solid foods. In Australia, training for mothers might most readily be delivered in the child's first 4 months of life through extending existing parenting and child health programs ('Mothers' groups') that educate first time mothers about a range of parenting issues (Child and Family Health Services; Dept Health and Aging).

The results of the present thesis suggest that, in addition to basic nutrition information, such parental training should include evidence-based information (psycho-education) about feeding strategies and their effects on children's eating. It needs to be explicitly explained to mothers that, while intuitively restrictive feeding may make sense, it does not work. To this end, training for mothers could include media literacy, in order to help them to make their way through the media hype surrounding children's eating and weight, as well as 'fad' dieting more broadly. Mothers might be directed to useful existing internet and print resources that offer evidence-based information (e.g., *The Good Food Parenting Guide,* Ogden, 2014). By empowering mothers to critically evaluate media claims, mothers may become more confident in their feeding strategies

based on factual information. In addition, mothers could be offered tips on how to use covert control, including learning responses to use in specific difficult feeding situations, e.g., at birthday parties (see Study 1c). More generally, training could educate mothers about how to develop and maintain predictable routines around eating occasions (e.g., eating together as a family, eating at the table and when food will be offered). Mothers could also learn how to identify their child's satiety and hunger cues, and help their child to do the same, as well as learn to use non-food strategies to manage their child's behaviour (Redsell et al., 2015).

For mothers of older children, where feeding patterns are already established, change may be more difficult. Mothers are likely to have to undo the habits (both the child's and their own) that have developed around eating. In addition to the training discussed above, mothers could learn specific strategies to make gradual changes to the child's food environment through the foods that are purchased and brought into the home. Mothers could learn how to act as a positive role model, eating foods that they would like their child to eat (Ogden, 2014). Mothers need to be aware that change will be a gradual process which requires persistence and consistency. Most importantly, mothers need to be educated as to how to control the food environment without making a fuss about the child's eating. This presents a major difficulty for parents, particularly for those who are already worried about their child's eating and weight, but minimizing comments directed at children about eating and weight are key in utilizing covert control strategies.

Perhaps most helpfully, training regarding parent feeding strategies could be done in the context of broader general parenting. This broader training might include teaching parents about children's specific needs at each developmental stage (Kendall-Taylor & Lindland, 2013). This would allow parents to learn about making developmentally appropriate demands, along with teaching parents about how to respond to their child in a way that supports the development of the child's psychological autonomy (Soenens, Deci & Vansteenkiste, 2017). General parenting skills around developing predictable routines and providing a structure driven (as opposed to chaotic)

home environment (Joyce & Zimmer-Gembeck, 2009) are also likely to promote beneficial outcomes for the child.

Conclusion

This thesis has examined maternal restriction and covert control feeding strategies and young children's snack intake across four different studies using different methodologies. The results contribute to the conceptual understanding of the two different feeding strategies, as well as offering practical implications that can usefully inform parents about effective strategies to limit the intake of unhealthy, energy dense snack foods and promote the intake of healthy, nutrient rich snack foods. Taken together, the results indicate that restriction has a detrimental effect on children's eating in the short and longer term, while covert control seems to have a beneficial impact.

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