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A review of the influence of fathers on children's eating behaviours and dietary intake

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ABSTRACT

The role of fathers in child rearing has changed in recent years due to an increase in maternal employment. Despite this, the majority of research has focused on maternal influences and behaviours in relation to child feeding. Therefore, the aims of the narrative review were: 1) to examine the role and responsibility of fathers in child feeding and the factors associated with paternal responsibility in child feeding; 2) to establish how paternal modelling, paternal diets, and paternal feeding practices relate to children's eating behaviours and dietary intake; and 3) to explore the role of maternal perceptions on paternal feeding roles, as well as how maternal and paternal behaviours relate to children's dietary intake. Firstly, given the limited research, no conclusions can be drawn in relation to the factors associated with fathers' roles. An association with child's gender and age as potential drivers of paternal mealtime behaviours was observed, however more longitudinal research is necessary. In addition, research suggests that the majority of fathers have some responsibility in feeding their child, however, mothers are the primary caregiver and somewhat dictate the level of responsibilities fathers have. Interactions during mealtimes between fathers and their child can both positively and negatively influence children's long-term eating behaviours. Inconsistencies in the literature still prevail in terms of whether the child's diet resembles his fathers or mothers more, however, overall family resemblance is evident. Differences exist between maternal & paternal feeding practices with more coercive feeding practices reported by fathers, suggesting they are a more authoritarian figure during mealtimes than mothers. Overall, it is clear that interventions need to adopt a whole-family approach when tackling children's lifestyle behaviours in order to address the differential influence of both parents.

1. Introduction

Families are complex interactive systems, containing numerous individuals across a series of contexts, which collectively influence children's developmental outcomes (May, Chai, & Burrows, 2017). The definition of a family has evolved over the years due to changes in household composition and living arrangements. In the late 1940s, George Murdock defined the family as "... adults of both sexes at least two of whom maintain a socially approved sexual relationship and one or more children owned or adopted of the sexually cohabiting adults" (Murdock, 1949). Whereas the most recent definition is more generalised: "A family 'nuclei' is constituted when two persons (of either sex) choose to live together as a married couple, in a registered partnership, or a consensual union, whether or not they have children; single parents with children also constitute a family unit, while people living alone do not, nor do groups of unrelated people who choose to share a house together" (eurostat, 2017). However, while definitions of the family outline the composition of the family unit, they do not explicitly state what the role is of each family member. Particularly those of the adult members, which should be understood to establish how the family, as a collective unit, influences children's development.

The fathers' role within the family has evolved dramatically over the last century. Fathers are increasingly spending more time with their

children due to high maternal employment (Bianchi, 2000). The increase in maternal employment has resulted in a rise in fathers' parenting responsibility, which may positively influence children and families (Pleck & Masciadrelli, 2004). With fathers having more caretaking responsibility, fathers' engagement in child-rearing and patterns of co-parenting have grown (Feinberg, 2003). Such that the once 'traditional' roles of mothers and fathers have evolved to both parents having joint or overlapping responsibilities within the family.

Studies suggest that the quality of the co-parenting relationship has an independent influence on maternal/paternal influences on the child's development (May et al., 2017; Morgan et al., 2017). However, this shift in roles and responsibilities has not yet fully transitioned into research or behaviour-change interventions. Morgan et al. (2017) conducted a systematic review of randomised control trials (RCTs) assessing behavioural interventions to treat or prevent obesity (Morgan et al., 2017). Findings revealed that in RCTs who required only one parent to participate, fathers only represented 6% of parents (Morgan et al., 2017). Following on from this, in RCTs where both parents could participate, 92% did not report findings from fathers (Morgan et al., 2017). A similar review was conducted by Davison et al. (2018), with findings from this systematic review highlighting the lack of father participation in interventions, especially in younger children, and suggest that theories focusing on the family as an entire unit may help

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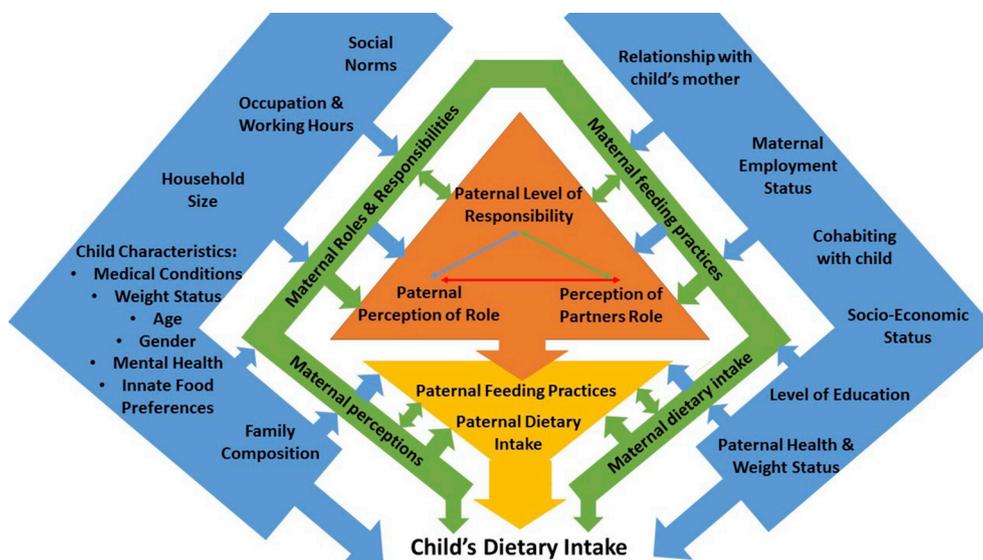


Fig. 1. Conceptual framework on the influence of fathers on child's dietary intake.

support father participation (Davison et al., 2018).

The family systems theory perspective implies that a child's development of eating behaviours can be influenced by both the child's individual interactions with other family members and the relationship between other family members (Minuchin, 1985; Pulley et al., 2014). Evidence to date suggests that there are minimal differences between mothers and fathers ability to rear their children, or tend to their physical needs, except for breastfeeding (Spinney, 2011). While research on fathers' involvement and influence in a child-feeding domain has been investigated, it has not been investigated to the extent that it has been in mothers. Therefore, the aims of this narrative review were: 1) to examine the role and responsibility of fathers in child feeding and the factors associated with paternal responsibility in child feeding; 2) to establish how paternal modelling, paternal diets, and paternal feeding practices relate to children's eating behaviours and dietary intake; and 3) to explore the role of maternal perceptions on paternal feeding roles, as well as how maternal and paternal behaviours relate to children's eating behaviours and dietary intake.

The aims of this review are illustrated in more detail in Fig. 1. The sections that explain the first and second aim are represented by the yellow, orange and blue backgrounds, such that numerous factors that are components of a father's individual, household, and community life (blue) influence fathers role/responsibility (orange) and behaviours during mealtimes (yellow), which collectively can influence children's dietary intake. The third aim is represented by the green, orange and yellow backgrounds. Firstly, following the unidirectional green arrow, maternal perceptions and behaviours (green) influence fathers roles (orange) and behaviours during mealtimes (yellow). Secondly, the bi-directional green arrow suggest that there is a potential association between maternal and paternal factors that can collectively influence child's dietary intake. Therefore, to develop interventions that promote both mother and father engagement, it is essential to form an understanding of the roles and responsibilities of both parents in feeding their child and ultimately identifying differences in how each parents' behaviour can influence their child's dietary intake.

2. Methodology

A literature search for relevant peer-reviewed scientific articles was conducted using Science Direct, PubMed, and Google Scholar between July to December 2018. "Limit to English language" and "remove duplicates" were applied to all searches. Combinations of some of the following key search terms (not exclusive) were used for individual

searches, with only specific words used in relation to each section of this review: fathers/paternal/dad, breastfeeding, role, responsibility, paternal/maternal/parental feeding practices, family mealtimes, food consumption, resemblance, dietary/food intake, children's eating behaviours, mothers/maternal, comparison. For example, the search about fathers' role in child feeding would contain the following (father OR paternal OR dad) AND (role OR responsibility OR involvement) AND (child feeding OR feeding practices OR family mealtimes). In addition, further studies were identified from the reference list of the included studies.

Inclusion criteria: Articles were considered if they were available in full text in a peer-reviewed journal and were in English, up to December 2018. Both quantitative and qualitative studies were included in this narrative review. The age range of studies included was from birth to 18-years-old. Tables were created to give an overview of the studies discussed in each section. However, some studies were utilised in more than one study and therefore were assigned to a table based on when they first appeared in the literature.

3. Results

In line with the aims of this narrative review, the results section was divided into three overarching topics, all of which form an important component in fathers' involvement in child feeding: fathers' responsibility and role in child feeding; fathers' behaviours during mealtimes; and maternal perceptions and behaviours in the context of paternal feeding responsibilities and feeding practices. Within each of the three sections, the overarching topic was elaborated on, which lead to the creation of sub-sections. Therefore, the results are presented by an outline and summary of the studies included, followed by a table for the three sections, that includes the relevant information on each study included.

3.1. Fathers' responsibility and role in child feeding

The results of studies investigating fathers' perceived responsibility and role in child feeding are presented in Table 1. A father's role in the upbringing of his child is more loosely defined by society than a mother's role, with a father's perception of his role a potential driver of his behaviour (Parke, 2008; Tamis-Lemonda & Cabrera, 1999). The type of interactions a mother and father have with their child are likely to be unique but may also be contrasting with one another, such that a father's behaviour may contribute to the child's development in an

Table 1
Summary of studies in relation to fathers' responsibility in relation to child feeding.

| Authors & Country | Study Aim | Study Design | Sample Size | Children's Age | Methodology | Main Findings |
|--|---|-----------------|----------------------------|--------------------------------|---|---|
| 3.1.1 Fathers' role in the first six months of his child's life Kenosi et al. (2011) Ireland | To evaluate if fathers felt included in the BF education and decision process | Cross-sectional | 67 fathers | < 2 days old | Questionnaire | The majority of fathers of BF & FF infants believe it is the mothers' decision to choose method of feeding. |
| Bennett et al. (2016) Ireland | To investigate the relationship between fathers and breast feeding in Ireland | Cross-sectional | 583 fathers | 4–7 months | Semi-quantitative postal Q | Sample of well-educated and high SES found it challenging to support BF in a practical and informed manner |
| Rempel and Rempel (2011) Canada | To investigate a fathers perspective on what it is like to be the father of a BF baby and what role they play. | Cross-sectional | 21 couple | 1 month–4 years | Semi-Structured interview with mother and father separately | Fathers recognise their roles as team members and need to become BF savvy to support their partner. |
| Brown and Davies (2014) UK | To explore fathers' experiences of supporting their partner during BF | Cross-sectional | 117 fathers | < 2 years old | Semi-quantitative Q | Fathers knew that their support was important, but felt that they did not have the knowledge or skills to truly help during BF. |
| 3.1.2 Fathers' role in child feeding beyond six months old (Vollmer, Adamsons, Foster, et al., 2015b) USA | To evaluate the influence of father-reported maternal and paternal perceptions of the role of the father on child FP & weight status. | Cross-sectional | 150 fathers | 3–5 years old | One-on-one interview which included questionnaires – CFQ, ROFQ, ROFMQ | Father's perception of his role in the family was not related to his perceived responsibilities, FP, child's weight status. |
| 3.1.3 Fathers level of responsibility in child feeding (Guerrero et al., 2016) ^c USA | To examine the associations of father-child feeding and physical interactions with dietary practices and weight status in children. | Longitudinal | 2441 fathers | Wave 1 & 2 aged 24 & 48 months | Child Intake = FFQ; Father covariates = Self-Admin Q | Fathers have some influence on child's nutrition and preparation of meals. Eating out with child promotes unhealthy eating. |
| (Khandpur, Charles, et al., 2016) ^{a d} USA | To establish how fathers managed responsibilities for food parenting with the child's mother and the extent to which their PPP were co-operative versus conflicting with those of the mother. | Cross-sectional | 37 fathers | 2–10 years old | Semi-structured interviews | A majority of fathers reported sharing responsibility for planning, procuring, and preparing food with the child's mother. Most fathers reported using cooperative PPP, with conflicting PPP related to energy-dense food consumption and child's refusal to eat. |
| (& Arndt, 2005) ^a USA | To identify mealtime behaviours of fathers with their toddlers to provide cultural knowledge about feeding practices that contribute to childhood obesity. | Cross-sectional | 6 African-American fathers | 0–3 years old | Focus Group | Five thematic categories were identified: mealtime rituals and routines, division of responsibility, family constellation, nutritional knowledge, and tension during mealtimes. |
| 3.1.4 Factors associated with fathers perceived responsibility and role in child feeding (Kimberley M Mallan et al., 2014a,b) ^{a c} Australia | To identify whether characteristics of fathers and their concerns about child's weight are associated with PPP and responsibility. | Cross-sectional | 436 fathers | 2–5 years old | Self-reported Questionnaire-CFQ | More concern over weight increased perceived responsibility and controlling PPP. |
| (K. M. Mallan et al., 2014) ^{b a} Australia | To describe fathers' perceived responsibility for child feeding, and to identify predictors of family mealtimes | Cross-sectional | 436 fathers | 2–5 years old | Self-reported Questionnaire –CFQ, ROFQ | Majority of fathers ate dinner as a family. 40% of fathers were responsible at least half of the time for organising meals. Time spent working was inversely associated with no. Of family mealtimes. |
| (Walsh et al., 2017) ^{b a c} Australia | To assess fathers' beliefs and perceived role in the eating and physical activity behaviours of their child and examine fathers' support of these behaviours | Cross-sectional | 20 fathers | < 5 years old | Semi-structured interviews | Revealed eight themes: shared responsibility, family meal environment, parental role modelling, parental concern around food, food rewards, health education, limiting screen time, parental knowledge. No differences of views based on paternal education/employment. |

BF = Breastfed; FF = Formula-fed; CFQ = Child Feeding Questionnaire; ROFQ = Role of the father questionnaire; ROFMQ = Role of the father during mealtimes questionnaire.

^a These studies were also included in section 3.1.2.

^b These studies were also included in section 3.1.3.

^c This study was also included in Table 2a.

^d This study was also included in Table 3.

alternative way from the child's mother (Doherty, Kouneski, & Erickson, 1998; Pulley et al., 2014). Therefore, in order to understand how fathers' role in child feeding influences children's development we need to explore the progression of his roles and responsibilities from infancy to later childhood. In addition to exploring the level of paternal involvement and responsibility and establishing the factors that may contribute to differing levels of involvement and responsibility.

3.1.1. Fathers' role in the first six months of his child's life

Firstly, it is important to take into consideration the foundations of parental roles as this may help understand how roles evolve throughout a child's life from birth to adulthood. Worldwide, one of the many decisions new parents face is whether to breastfeed or formula-feed their new-born baby, with the mother naturally having the ultimate say, according to 75–80% of fathers (Bennett, McCartney, & Kearney, 2016, pp. 169–176; Hansen, Tesch, & Aytton, 2018; Kenosi et al., 2011). Therefore, from the onset fathers are the secondary decision-makers about the earliest dietary intake of their child, which may perhaps influence their future feeding practices decision making. There are different feeding responsibilities between the mother and father depending on whether the infant is breastfed or formula-fed. The feeding routine for formula-fed infants has the opportunity to be shared between both parents, with shared responsibility between parents more difficult with breastfed infants, even with the availability of breast pumps. Therefore, the fathers' role of a breastfed infant, in terms of feeding, is ultimately that of a support person. The role as a support person is of utmost importance, with evidence suggesting that fathers support for their breastfeeding partner is an important component in ensuring a positive breastfeeding experience for both the mother and child (Brown & Davies, 2014; Rempel & Rempel, 2011). Overall, despite this it is commonly reported by fathers that breastfeeding can make fathers feel left out or unimportant in the child's life and deprive them of bonding time with their child (Bennett et al., 2016, pp. 169–176; Rempel & Rempel, 2011). Overall, it is clear that the role of fathers of breastfed infants differ to the role of fathers of formula-fed infants, in terms of having a choice whether to be physically involved or not. Research needs to establish whether fathers' role of the breastfed infant during complementary feeding and later childhood differ to the fathers' role of formula-fed infants.

3.1.2. Fathers' role in child feeding beyond six months old

Both quantitative and qualitative studies have gained insight into fathers' role in child feeding. However, given the nature of qualitative studies, they have provided more information given the descriptive subjective responses. The quantitative studies to date have used the perceived responsibility subscale of the Child Feeding Questionnaire (CFQ) (K. M. Mallan et al., 2014a,b; Kimberley M Mallan et al., 2014a,b; Vollmer, Adamsons, Foster, et al., 2015b) and the Role of The Father Questionnaire (ROFQ) (K. M. Mallan et al., 2014a,b; Vollmer, Adamsons, Foster, et al., 2015b). The ROFQ was further adapted by Vollmer and colleagues to become the Role of The Father at Mealtimes Questionnaire (ROFMQ) (Vollmer, Adamsons, Foster, et al., 2015b). The ROFQ assesses fathers' beliefs about their general attitude and involvement in their child's upbringing and therefore it is difficult to understand fathers' involvement in feeding when using this questionnaire independently. However, both studies that used this tool have explored the mean score of the ROFQ in aspects of child feeding. According to the title of the paper by (K. M. Mallan et al., 2014a,b) and the subsequent analysis conducted, 'the frequency of meals with child' was the dependent variable and thus suggests that this is the extent of fathers role in child feeding. The mean subscales scores of both the ROFQ and ROFMQ were examined in relation to paternal perceived responsibility and paternal feeding practices, with only involvement during mealtime significantly associated (Vollmer, Adamsons, Foster, et al., 2015b). The findings in relation to paternal feeding practices give more insight into fathers behavioural roles during mealtimes, such that

higher involvement was associated with lower reports of controlling feeding practices, with Vollmer and colleagues suggesting that high paternal involvement may be protective against child obesogenic behaviours (Vollmer, Adamsons, Foster, et al., 2015b).

The perceived responsibility subscales (CFQ) was used in the three quantitative studies (K. M. Mallan et al., 2014a,b; Kimberley M Mallan et al., 2014a,b; Vollmer, Adamsons, Foster, et al., 2015b) and gives a clear indication on fathers' level of responsibility on three important components of meal preparation: organising their child's meal, deciding their child's portion size and deciding the types of food served. Meal preparation is a large component of child feeding responsibilities, which can involve a lot of time and skills, depending on the type of meal being prepared. However, unfortunately, the data from these quantitative studies cannot provide this level of detail.

Findings from two qualitative studies somewhat elaborated on this, with fathers in these studies reporting that role sharing involved cooking and doing the grocery shopping with their partner (Khandpur, Charles, & Davison, 2016; Walsh et al., 2017). In addition, a similar number of fathers reported dividing child feeding tasks with the child's mother, for example, some fathers reported that their partner was responsible for cooking while they were responsible for rules around mealtimes (Khandpur, Charles, et al., 2016). Findings from qualitative studies suggest that some child-feeding roles are shared among parents, with some clear distinct roles for both parents established within some families.

Exploring and defining the roles of fathers in a child-feeding context allows us to understand how paternal perceptions and behaviours can influence children's dietary intake. However, determining how often fathers occupy their child-feeding role must be explored as their level of responsibility may also influence children's dietary intake.

3.1.3. Fathers level of responsibility in child feeding

Mothers feel they have a greater responsibility in feeding their child (Daniels et al., 2013), with research suggesting that fathers have significantly lower perceived responsibility than mothers (Blissett, Meyer, & Haycraft, 2006; Ek et al., 2016; Harris et al., 2018a; Pulley et al., 2014). Only five studies to date have tried to quantify and understand fathers' level of responsibility, which includes two quantitative studies (K. M. Mallan et al., 2014a,b; Guerrero et al., 2016) and three qualitative studies (Horodyski & Arndt, 2005; Khandpur, Charles, et al., 2016; Walsh et al., 2017). Findings from quantitative research suggest that fathers have some level of responsibility in child feeding. More than half of fathers (~50%) of pre-school children reported being responsible *at least half of the time* for organising meals and deciding the quality and quantity of food offered to their child during mealtimes (K. M. Mallan et al., 2014a,b). With only a small proportion of fathers (10–16%) reporting that they were rarely responsible for feeding their child (K. M. Mallan et al., 2014a,b). In addition, findings from this study show that higher paternal perceived responsibility and a positive attitude towards their role as a father was associated with a greater number of mealtimes per week with their child (K. M. Mallan et al., 2014a,b). These findings are supported by a large quantitative longitudinal cohort of American fathers of preschool children (n = 2441), which found that 43% of fathers had a great deal of influence on their child's nutrition and almost 50% of fathers reported daily involvement in preparing food for their child and assisting in their child's eating (Guerrero et al., 2016).

Although qualitative studies gained some further insight into fathers perceptions and attitudes towards their roles in child feeding, they also quantified the level of fathers' perceived responsibility based on responses. However, the quantification of responsibility levels need to be taken with caution due to the low sample size within the three studies (n < 37) (Horodyski & Arndt, 2005; Khandpur, Charles, et al., 2016; Walsh et al., 2017). Khandpur and colleagues found that 62% (n = 23) of fathers reported shared responsibility with their partner in respect to their child's dietary intake, with 16% of fathers reporting sole

responsibility and the remaining 22% reporting that their partner was solely responsible (Khandpur, Charles, et al., 2016). Horodyski & Arndt, (2005) found that 84% (n = 5) of fathers in their study consumed a meal with their children at least once a day, with all fathers reporting that they participated in childcare activities either on a daily or weekend basis, which included food preparation, cooking, and feeding (Horodyski & Arndt, 2005). Findings from the study by Walsh et al. (2017) suggest that the majority of fathers (n = 16/20) share the responsibility with their partners in relation to the dietary behaviour of their young children (Walsh et al., 2017). Overall, both quantitative and qualitative research suggests that the majority of fathers have some form of responsibility in feeding their child. Following on from this, we need to establish and explore the factors that influence a father's role and his level of responsibility in feeding his child.

3.1.4. Factors associated with father's perceived responsibility and role in child feeding

Limited research has been conducted in the feeding domain to establish the factors associated with perceived responsibility and/or paternal roles, with only two Australian quantitative studies addressing this topic directly (K. M. Mallan et al., 2014a,b; Kimberley M Mallan et al., 2014a,b). Both studies were conducted by Mallan and colleagues, with the aim of one study (Kimberley M Mallan et al., 2014a,b) to identify the child's and father's characteristics associated with fathers' perceived responsibility (CFQ). The first aim of the other study (K. M. Mallan et al., 2014a,b) was to describe the perceived responsibility and degree of involvement of fathers, with the second aim to investigate the predictors of how frequently fathers eat meals with their child. The two studies were conducted using the same cohort of Australian fathers of preschool children aged 2 to 5-years-old (n = 436). Findings suggest that a father's role within the feeding domain is highly influenced by the number of hours they spend working, with fathers who spend more time in work having a significantly lower perceived responsibility in feeding their child (Kimberley M Mallan et al., 2014a,b). In addition to working hours, having an older child, higher socio-economic status, and concern for their child's weight were all significantly associated with increased paternal perceived responsibility for feeding, while child gender, paternal age, paternal BMI, and education level were not significantly associated (Kimberley M Mallan et al., 2014a,b). This study contributes to the limited research that has been conducted on determining the influence of SES on fathers' roles in feeding their children and consequently, the feeding practices utilised by fathers (Kimberley M Mallan et al., 2014a,b). Findings from (K. M. Mallan et al., 2014a,b) also found that fathers who spend more time in paid employment report fewer meals/week with their child. While higher levels of perceived responsibility and more engaging and involved fathers (High score ROFQ) report having more meals/week with their child (K. M. Mallan et al., 2014a,b). A child's age and gender, along with father's age, BMI and education were not associated with the frequency of meals/week with their child (K. M. Mallan et al., 2014a,b). Although not the primary aim of the qualitative study by Walsh et al. (2017), which interviewed twenty Australian fathers of preschool children, analysis of themes according to paternal education/employment revealed no substantial differences in the views of the fathers, in terms of shared responsibility, role modelling, and knowledge, to name a few (Walsh et al., 2017). Overall, given the inconsistent findings in terms of SES and education level in relation to paternal responsibility and roles, and as suggested in the systematic review by Khandpur et al. (2014); studies need to recruit fathers from diverse ethnicity/race, socioeconomic, and geographic backgrounds (Khandpur et al., 2014). In conclusion, findings from these studies suggest that a range of paternal and child factors influence fathers' level of responsibility.

Family mealtimes are a prime opportunity for roles and responsibilities to flourish and evolve. Therefore, it is necessary to establish paternal behaviour during mealtimes, which primarily constitutes of paternal modelling and paternal feeding practices.

3.2. Fathers behaviours during mealtimes

Table 2a summarises studies exploring how fathers can influence children's dietary intakes during mealtimes in terms of paternal modelling and the resemblance between a father's and their child's dietary intake, while Table 2b summarises the studies that focus on paternal feeding practices. Family mealtimes and the importance of them are a reoccurring theme within qualitative studies that investigated fathers' role in feeding their child. Walsh et al. (2017) found that Australian fathers of preschool children believe that mealtimes are an essential part of the "family social fabric", which allows them to share each other's company and develop family traditions (Walsh et al., 2017). Similarly, in the qualitative study by Horodyski & Arndt, (2005) fathers believe that parental interactions with their child during mealtimes is a responsibility and the majority of fathers felt that mealtime routines and rituals were important (Horodyski & Arndt, 2005). Within this study mealtime routines and rituals were defined as "those activities that encompass and govern the selection, preparation, and eating of food" (Horodyski & Arndt, 2005). Family mealtimes give parents the opportunity to engage and interact with their child in a food-centred setting, which can allow the transfer of a father's knowledge and attitude towards foods via paternal modelling and paternal feeding practices. For the purpose of this review paternal modelling and familial resemblance of dietary intake will be discussed separately as current literature reveals that although a parent's and their child's diets are related, there is growing evidence to suggest that parental diet and parental modelling are two distinct constructs (Harris & Ramsey, 2015; Larsen, Roel C J Hermans et al., 2015).

3.2.1. Paternal modelling

Parental modelling promotes observational learning, whereby children perceive their parents eating behaviours as the 'norm' which can influence their food intake leading to children adopting their parents eating behaviours (Bandura, 1977). Therefore, parental eating behaviours are a reference for what is appropriate behaviour, which can influence children's long-term consumption patterns in terms of food choice and quantity consumed (Herman & Polivy, 2005; Larsen, Roel C J Hermans et al., 2015). Parental modelling occurs when a parent purposefully demonstrates healthy food choices and eating behaviours to encourage similar behaviours in the child; or a parent unintentionally exhibits unhealthy eating behaviours in front of the child (Vaughn et al., 2016). Within the current literature, many studies have focused on the influence of intentional modelling of healthy habits, as it is harder to assess unhealthy role modelling due to lack of awareness of these behaviours and greater likelihood of response bias (Vaughn et al., 2016). The systematic review and meta-analysis by Yee et al., (2017) revealed there was a strong positive association between parental modelling and both their child's healthy and unhealthy food consumption patterns (Yee et al., 2017). However, one must take into consideration that within this review that first, parental modelling also encompassed the parent's own food consumption behaviour (Yee et al., 2017). Secondly, of the eighteen studies that were included in the meta-analysis (role modelling healthy food only), five studies included fathers but they only represented a small proportion of the entire sample size (Brown & Ogden, 2004; Cooke et al., 2004; Goldman, Radnitz, & McGrath, 2012; Reinaerts et al., 2007; Wardle, Carnell, & Cooke, 2005), with only one study solely focusing fathers only (Harris & Ramsey, 2015). In addition, only one of the five studies exploring the association between role modelling and unhealthy food consumption (Yee et al., 2017) had a small sample of fathers (n = 15) (Brown & Ogden, 2004).

As evident by the lack of studies included in the systematic review/meta-analysis by (Yee et al., 2017), to date only two studies have directly assessed paternal modelling, with both using the Comprehensive Feeding Practices Questionnaire (CFPQ) (Harris & Ramsey, 2015; Watterworth et al., 2017). The study by Harris and Ramsey (2015) (included in meta-analysis (Yee et al., 2017)) had a small sample size

Table 2a
Summary of studies on paternal modelling & dietary resemblance.

| Authors & Country | Study Aim | Study Design | Sample Size | Children's Age | Methodology | Main Findings |
|---|---|-----------------|--|---|---|---|
| 3.2.1 Paternal modelling (Watterworth et al., 2017) ^b Canada | To determine the association between mothers' and fathers' PFP and their child's nutrition risk | Cross-sectional | 44 families | 1.5–5 years old | Self-reported Questionnaire –CFPQ, NutriSTEP® | Both parents involvement of children in meal preparation and father modelling was associated with lower child nutrition risk, whereas coercive PFP associated with higher nutrition risk. |
| (Khandpur et al., 2016) ^b USA | To identify the specific PFP utilised by fathers and describe how these practices varied by fathers' education levels and their residential status | Cross-sectional | 40 fathers | 2–10 years old | Semi-structured interview | 20 PFP were identified: 13 responsive practices and 7 unresponsive practices. Differences were seen in PFP according to fathers education level and residential status |
| (Harris & Ramsey, 2015) ^a USA | To investigate how fathers' dietary intake and PFP predict their child's dietary intake | Cross-sectional | 102 African-American fathers | 3–13 years old | CFPQ & PFPQ | Child's F&V intake was only predicted by paternal intake. Child's SSB intake was predicted by paternal intake & household availability. Modelling did not predict consumption of F&V or SSB. Mothers are committed to the provision of a healthy diet for their child, with fathers seen as a threat to this provision. Fathers turn to quick unhealthy options when responsible for feeding. |
| (Fielding-Singh, 2017) ^c USA | To identify how fathers influence family diet | Cross-sectional | 44 families: 42 mother, 14 father, 53 adolescent | Adolescent | Semi-structure, in-depth interviews | |
| 3.2.2 The association between father and child dietary intake Walsh et al. (2016) Australia | To examine associations between dietary intakes of fathers and their children, and to determine if fathers' intake predicts change in children's intake between these ages. | Longitudinal | n = 317 n = 214 n = 208. | 20 months 3.5 years old 5 years old | Child = Telephone-administered multi-pass 24hr recall Fathers = Semi-quantitative 98 item PFPQ | Fathers' intake was associated with change in fruit, SSB, and snack intake from 20 months to 3.5 years, along with change in SSB and snack intake from 20 months to 5 years. Fathers intake was associated with fruit and snack intake at 20 months and 5 years |
| Hall et al. (2011) Australia | To examine the associations between father-child dietary intakes of fruit, vegetables, and selected energy-dense nutrient-poor foods. | Cross-sectional | 50 father-child dyads | 5–12 years old | PFPQ for both | Moderate-strong association between father child intake of fruit, cookie and potato chip intake. |
| Walsh et al. (2015) Australia | To investigate associations between the dietary intakes of fathers and their children | Cross-sectional | 317 families | 20 months old | Child = 24hr recall Fathers = semi-quantitative 98 item PFPQ | Positive associations fathers' and children's intake of fruit, sweet snacks and take-away foods. Maternal intake partially mediated the association. |
| (Vollmer, Adamsons, Gorin, et al., 2015) ^b USA | To determine whether an association exists between fathers' and children's BMI, diet quality, and physical activity duration and intensity level. | Cross-sectional | 148 fathers | 3–5 years old | One-on-one interview – 24hr recall | Moderate association between fathers and child's HEI score, with the majority of foods and nutrients also moderately associated. |
| Lloyd et al. (2014) Australia | To examine a range of potential behavioural and maternal/paternal correlates of children's adiposity. | Cross-sectional | 93 fathers | 5–12 years old | PEAS – contains 8 items from CFPQ, Australian Eating Survey | Three out of five parenting constructs were significantly different between mothers and fathers. Children's energy intake from core foods was associated with paternal energy intake from core foods but not with mothers. |
| Zuercher et al. (2011) USA | To estimate these relationships between minor children and the female or male head of household. | Cross-sectional | 2380 children & primary caregiver | 2–18 years old | Multiple 24-hr recalls | Associations between food group/nutrient densities were significant but weak to moderate. Parents consuming in the highest quintile for food group density predicted that children's intakes were also in the highest quintile. |
| Hebestreit et al. (2017) Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain and Sweden. | To determine whether an association exists between children's and parental dietary patterns (DP) | Cross-sectional | 1662 child-mother and 789 child-father dyads | 6–16 years old | 24hr dietary recalls | Children were more likely to be allocated to the Sweet & Fat DP when their fathers were allocated to this DP and when they shared at least one meal per day. Children's Sweet & Fat DP increased when the mother or the father was allocated to the Sweet & Fat DP and when soft drinks were available. |
| Williams et al. (2018) Australia | To investigate whether an association exists between father-child dietary intakes after fathers complete lifestyle intervention | RCT | 93 fathers | 5–12 years old | Child = 120-item PFPQ (reported by mother) Father = 120-item semi-quantitative PFPQ | Significant correlations were observed for father-child change scores. |

PFPQ = Food Frequency Questionnaire; CFQ = Child feeding questionnaire; CFPQ = Comprehensive feeding practice questionnaire.

^a This study is also included in section 3.2.2.^b These studies is also included in Table 2b.^c This study is also included in Table 3.

Table 2b
Summary of studies that discuss paternal feeding practices.

| Authors & Country | Study Aim | Study Design | Sample Size | Children's Age | Methodology | Main Findings |
|---|---|----------------------------------|---------------------------------------|------------------|---|--|
| Pulley et al. (2014) USA | To investigate family perceptions of PFP | Cross-sectional | 70 two-parent families | 6–12 years old | Self-reported Questionnaire-CFQ, CFQC | Differences in mothers and father PFP suggest that mothers and fathers may have distinct interactions with their child regarding food, with child's characteristic also contributing to this. |
| Blissett et al. (2006) UK | To assess whether mothers' and fathers' controlling PFP differed, and varied according to child gender. | Cross-sectional | 94 cohabiting mothers and fathers | 1–5 years old | Self-reported Questionnaire- Eating Disorder Inventory-2, CFQ | Different attitudes but not controlling PFP between mothers and fathers. Mothers higher responsibility and monitoring than fathers. Parental extrapolation of weight concerns may be more likely to occur within mother-daughter and father-son relationships. |
| Matton et al. (2013) Belgium | To examine the differential influence of maternal and PFP on child's eating problems | Longitudinal (6 month follow-up) | 613 parents | 8–12 years old | CFQ, Children's Eating Disorder Examination Q | Maternal pressure and the gender of the child was predictive for increases in overeating, whereas the interaction between paternal monitoring and gender of the child was predictor for decreases in overeating. |
| (E. L. Haycraft and J. M. Blissett, 2008a) UK | To examine the relationship between PFP and mental health symptoms by child gender | Cross-sectional | 107 fathers | 18–59 months | CFQ | No differences in mothers' and fathers' PFP. Higher paternal psychological distress associated with higher pressure to eat in girls. Higher paternal bulimia symptoms associated with lower paternal restriction of sons' food intake. Higher paternal psychological distress associated with greater restriction of daughters' and sons' food intake. |
| (Haycraft & Blissett, 2012) ^a UK | To examine the association between children's eating behaviours and PFP | Cross-sectional | 48 fathers | 2–5 years old | CFQ | Child emotional under-eating associated with greater paternal monitoring. Slow eating in children associated with higher paternal control in feeding. No associations between child temperament and fathers' feeding practices. |
| Payne et al. (2011) USA | To examine differential PFP and weight status in siblings | Cross-sectional | 70 fathers | 6–12 years old | CFQ | Higher paternal concern for child weight was associated with higher paternal restriction. |
| (Loth et al., 2013) ^a USA | To examine the association between PFP and adolescent weight status | Cross-sectional | 1210 fathers | ~14 years old | CFQ | Fathers reported significantly higher pressure to eat compared with mothers. Higher child BMI associated with higher paternal restriction and lower paternal pressure to eat. |
| (Orrell-Valente et al., 2007) ^a USA | To describe childhood mealtime environment and identified strategies used to influence children's eating | Cross-sectional | 98 fathers | ~60 months | Mealtime observation | Neutral prompts, reasoning & pressure to eat were the most common strategies used by fathers |
| (Musher-Eizenman et al., 2009) ^a USA/France | To examine differences in PFP and assessed relationships between parent and child characteristics and PFP | Cross-sectional | 38 fathers (USA), 50 fathers (France) | 3–7 years old | CFPQ | Fathers of older children reported lower use of food for emotional regulation compared with fathers of younger children. Higher child BMI associated with greater paternal restriction for weight. |
| (Blissett & Haycraft, 2011) ^a UK | To examine the associations between parental eating disorder symptoms, PFP and child eating behaviours | Cross-sectional | 23 fathers | 18–67 months old | Mealtime observation | No differences in feeding practices were observed for mothers and fathers. Higher paternal body dissatisfaction was associated with greater paternal verbal pressure to eat. |
| (E. L. Haycraft and J. M. Blissett, 2008b) ^a UK | To examine differences in maternal & paternal PFP | Cross-sectional | 23 fathers | 18–67 months old | Mealtime observation | No differences between mothers and fathers in either reported or observed child-feeding practices. Greater reported paternal pressure to eat and restriction associated with greater observed verbal pressure, use of incentives, prompting during meals. |

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Table 2b (continued)

| Authors & Country | Study Aim | Study Design | Sample Size | Children's Age | Methodology | Main Findings |
|---|--|-----------------|--|--|---|--|
| (Harris et al., 2018b) ^a Australia | To examine how the level and concordance of nonresponsive feeding practices of mothers and fathers are associated with child fussy eating | Cross-sectional | 208 mother-father pairs | 2-5 years old | FPSQ, CEBQ | Fathers' reports of persuasive feeding, reward for eating and reward for behaviour were associated with child's food fussiness score. Similar associations were observed with mother except for that with reward for behaviour. If both parent were concordantly high for persuasive feeding they reported fussier children compared to parents who were concordantly low. |
| Vollmer, Adamsons, Foster, et al., (2015a) USA | To determine the relationship of PPP on child diet quality, weight status, and eating behaviour | Cross-sectional | 150 fathers | 2-5 years old | CFQ, CFQSQ, CEBQ, 24hr diet recall-HEI | Father's PPP and feeding style were not associated with children's diet quality. Paternal restriction was associated with certain child food avoidant and approach eating behaviours. Paternal pressure to eat was inversely associated with child's enjoyment of food but positively associated with some child food avoidant eating behaviours. |
| Powell, and et al (2017) USA | To examine the simultaneous effects of both attachment anxiety and avoidance in relation to persuasive-controlling feeding and children's self-regulated eating within the same model. | Cross-sectional | 180 mothers & 85 fathers | 2-7 years old | Relationship Structures Scale, FPSQ, CEBQ, Tan & Holub child self-regulation measure, CFPQ, PFQ, CEBQ | Greater association between fathers' persuasive feeding practices and child's emotional and self-regulated eating than mothers. |
| Lora et al. (2016) USA | To examine the association between PPP and child's desire to drink & intake of beverages | Cross-sectional | Hispanic fathers = 61, African-American = 49 | 2-5 years old | | Differences were observed between Hispanic and African-American fathers. In Hispanics fathers use of food as a reward & food to calm was associated with child's intake of SSB. |
| Alsharairi and Somers (2015) Australia | To explore relationships between parenting style and fruit and vegetable intake | Longitudinal | 4310 children - Number of fathers unknown | 4-5 years old; 6-7 years old; 8-9 years old | Validated face-to-face interviews | Children of both genders with authoritative and permissive fathers, and girls with authoritative mothers at 4-5 years were found most likely to consume fruits and vegetables two and four years later. |
| Berge et al. (2010) USA | To examine the longitudinal association between parenting style & teenagers weight-related behaviours | Longitudinal | 2516 teenagers - Number of fathers unknown | Time 1 mean age 12.8 years/15.8 years, Time 2 mean age 17.2 years/20.4 years | Q completed by teenagers | Time 1 paternal permissive parenting style predicted more fruits and vegetables intake in daughters at Time 2. |

PPP = Parental feeding practices; CFQ = Child feeding questionnaire; CFQSQ = Child feeding questionnaire-child reported; CFPQ = Comprehensive feeding practice questionnaire; CEBQ = Child eating behaviour questionnaire; FPSQ = Feeding practices & structure questionnaire; PFQ = Pre-schooler Feeding Questionnaire.

^a This study is also included in Table 3.

Table 3
Maternal perceptions and behaviours in the context of fathers feeding responsibilities and feeding practices.

| Authors & Country | Study Aim | Study Design | Sample Size | Children's Age | Methodology | Main Findings |
|--|--|-----------------|--|----------------------|--|---|
| 3.3.1 Maternal perceptions of fathers feeding roles & responsibilities (Tanner et al., 2014) ^a Australia | To address the silence surrounding fathers' participation in the feeding of their families. | Cross-sectional | 30 women: mothers (n = 24) & childcare workers (n = 6). | n/a | Semi-structured interviews | Mothers' accounts reveal how gender is relationally produced in the context of parental food work, with descriptions of maternal expertise, concern and commitment to health being contrasted with stories of paternal authority, complacency and selfishness. |
| 3.3.2 <i>The influence of maternal behaviours during family mealtimes in comparison to paternal behaviours</i> Robinson et al. (2015) Australia | To assess mother-father and parent-child dietary relationships and to identify which parent-child relationship is stronger. To assess familial aggregation of nutrient intake among these families. | Cross-sectional | 66 families | 8-12 years old | Adult & child specific, validated semi-quantitative 120 item FFQ | Weak-moderate correlations were observed for both mother-child & father-child dietary intake, with a stronger correlations among mother-child dyads |
| Oliveria et al. (1992) USA | To assess familial aggregation of nutrient intake among these families. | Longitudinal | 106 families | 3-5 years old | Four sets of 3-day food diaries for child and each parent | Modest association between parental SFA and cholesterol intake and child's intake. Greater number of mother-child nutrient correlations than father-child. |
| Beydoun and Wang (2009) USA | To examine parent-child dietary patterns inter-relationships | Cross-sectional | 1061 fathers, 1230 mothers, 1370 sons & 1322 daughters. | 2-18 years old | Two 24hr dietary recall - Healthy Eating Index | Parent-child resemblance in dietary intake is weak and it varies by food/nutrient groups |
| Vanhala et al. (2011) Finland | To analyse differences in consumption and predictors of F&V intake between children and their parents. | Cross-sectional | 119 families | 8 years old | FFQ | Mothers & fathers intake of F&V were significant predictors of child's F&V intake (mother's stronger association). |
| Vauthier et al. (1996) France | To determine if and how dietary intake aggregates within families | Cross-sectional | 774 families | > 7 years old | 3 days food diary | Moderate levels of family aggregation for dietary intake. Greater father-child correlations for energy & macronutrient intake than mother-child correlations. |
| Thorsdottir et al. (2006) Iceland | To investigate the serum concentration of vitamin C and b-carotene in relation to fruit and vegetable intake in 6-year-old children and their parents. | Cross-sectional | 112 mothers & 75 fathers | 6 years old | Child = 3 day weighed food diary Parent = FFQ | Stronger father-child correlation for F&V intake compared to mother-child. A moderate correlation for serum Vit C & β-carotene between family members |
| Bogl et al. (2017) Belgium, Cyprus, Estonia, Germany, Hungary, Italy, Spain, Sweden. | To quantify familial correlations and estimate the proportion of variation attributable to genetic and shared environmental effects for dietary intake variables and examine determinants | Cross-sectional | 1435 families (1007 mothers, 438 fathers, 1035 daughters, 1080 sons) | 2-19 years old | Blood samples from both child & parent 24hr recall | Parent-offspring correlations were stronger for the intake of healthy than unhealthy (r = foods. Familial factors explained a larger proportion of the variance in healthy food intake in younger children below the age of 11 than in older children |
| Blissett and Haycraft (2008) UK | To examine the relationships between parenting styles, feeding practices and BMI in a non-clinical sample of mothers and fathers of UK preschool children | Cross-sectional | 96 parents of 48 children | 2-5 years old | CFQ, Eating Disorder Inventory-2, Parenting style & dimension Q | Permissive parenting style was related to lower monitoring of children's unhealthy food intake, & increased use of restriction by mothers and pressure to eat by fathers. Authoritative parenting style was also related to lower use of pressure to eat by fathers only. |
| Zhang and McIntosh (2011) USA | To explore whether maternal and paternal feeding behaviours influence children's weight status in significantly different manners. | Cross-sectional | 247 fathers & 320 mothers | 9-15 years old | Study specific Q | Maternal and paternal feeding practices do not have significantly different effects on children's weight highlights an equivalent role of maternal and paternal feeding practices in shaping children's weight status. |
| Hendy et al. (2009) USA | To identify dimensions of mealtime behaviours used by mothers and fathers, then examine for its usefulness to explain variance in children's diet and weight status. | Cross-sectional | Two confirmatory factor analyses with 541 mothers & 439 fathers | School-aged children | Parent Mealtime Action Scale (PMAS) | Greater maternal use of snacking limits, fat reduction and positive persuasion during mealtimes while reporting provision of F&V ability. Greater report of father insistence on eating during mealtimes. |
| Tschann et al. (2013) USA | To develop a measure of self-reported parental feeding practices that assesses a broad range of feeding practices in Mexican American parents | Cross-sectional | 322 mothers & children, 54% (n = 174) of fathers participated. | 8-10 years old | Parental Feeding Practices Q | Mothers had higher scores than fathers on 'Positive involvement in child eating', while fathers had higher scores on 'Pressure to eat' and 'Use of food to control behaviour' |
| Adamson and Blight (2014) Australia | To compare mother and father reports of child mealtime difficulties and associated parenting | Cross-sectional | 110 mothers 109 fathers, 44 mother-father dyads | 1.5-6 years old | 90-item Parent & Toddler Feeding Assessment | Mothers and fathers did not differ significantly on reports of child behaviour, parenting strategies and cognitions at mealtimes |

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Table 3 (continued)

| Authors & Country | Study Aim | Study Design | Sample Size | Children's Age | Methodology | Main Findings |
|--|---|-----------------|----------------------------|--------------------|---|--|
| Jansen et al. (2018) Australia | To determine whether PFP across mothers and fathers are interpreted and measured with equivalent accuracy (measurement invariance) using FPSQ-28. | Cross-sectional | 279 mothers | 2-5 years old | FPSQ-28 | Mothers used more 'covert restriction' than fathers. |
| Powell, Frankel, and Hernandez (2017) USA | To examine the inter relationships between parental use of food as a reward, child self-regulation of eating, and child emotional over eating. We | Cross-sectional | 179 mothers & 81 fathers | Preschool children | CEBQ, FPSQ, Child Self-Regulation in Eating Questionnaire | Fathers reported lower self-regulation scores for their children than mothers did, and fathers reported higher scores for emotional overeating than mothers did. Fathers endorse using food as a reward more so than mothers. Ideally, |
| Pratt et al. (2017) USA | To compare mothers' and fathers' PFP across multiple domains of positive and negative food parenting behaviours. | Cross-sectional | 376 mothers 119 fathers | 2.5-7.5 years old | Parenting style & dimensions Q, F-SCAPE, | Fathers were more authoritarian than mothers. Authoritarian and permissive parenting practices were related to more coercive strategies. Mothers |

^a This study was also included in section 3.2.2.

(n = 102) of African-American fathers of children aged 3 to 13-years-old and found that reported paternal modelling was not associated with child's intake of fruit, vegetables or sugar-sweetened beverages (Harris & Ramsey, 2015). The study by Watterworth et al., (2017) that had a sample of 44 Canadian families with at least one preschool-age child, found that paternal modelling was associated with a lower children's nutrition risk score (Watterworth et al., 2017). However, comparisons cannot be generated between these studies, as the children's dietary outcome variables are different and the age ranges in each study are also not comparable.

Three qualitative studies to date have explored fathers' perceptions of role modelling and its importance (Fielding-Singh, 2017; Khandpur et al., 2016; Walsh et al., 2017). Fathers in the qualitative study by Walsh and colleagues believed they had a responsibility as the first role models to their child in terms of healthy eating behaviours. However, they feel that there was lack of information to guide them and that reliable information needs to be more accessible (Walsh et al., 2017). The majority of fathers in this study believed that there were ample opportunities to set an example and influence their children's eating behaviour, through both their words and actions around mealtimes (Walsh et al., 2017). Over 35% of fathers in the qualitative study by Khandpur, Charles, et al. (2016) and Khandpur, and et al (2016) reported using role modelling to encourage their child aged 2 to 10-years-old to consume a balanced diet (Khandpur et al., 2016). Findings from the qualitative study by Fielding-Singh (2017) suggests that American fathers of adolescents felt that it was not their responsibility to cook or provide a healthy meal for their child; rather, for fathers, the drive-through and processed foods were common solutions when faced with food-related tasks (Fielding-Singh, 2017). This lack of feeding responsibility in fathers of adolescents could be attributed to their child's age and their potential ability to prepare and cook meals on their own.

Overall, findings from studies suggest that fathers of younger children believe that role modelling is important to promote healthy eating behaviours, however, findings suggest that fathers need to be more aware of their behaviours around food as they can promote their child's intake of both healthy and unhealthy foods. Despite these findings, it is also necessary to examine the dietary intake between fathers and their child, because as previously stated paternal modelling can transfer eating behaviours from parent to child and is not always intentional (Vaughn et al., 2016).

3.2.2. The association between father and child dietary intake

Several studies to date have attempted to establish family resemblance in the dietary intake patterns, including both parents and at least one child. Findings from a systematic review and meta-analysis revealed that there are weak to moderate associations between parents and children's dietary intake (Wang et al., 2011). Although there has been no systematic review or meta-analysis conducted with studies containing fathers only, two longitudinal studies (Guerrero et al., 2016; Walsh et al., 2016), seven cross-sectional studies (Hall et al., 2011; Zuercher, Wagstaff, & Kranz, 2011; Lloyd et al., 2014; Harris & Ramsey, 2015; Vollmer, Adamsons, Gorin, et al., 2015; Walsh et al., 2015; Hebestreit et al., 2017), and one randomised-control trial (Williams et al., 2018) have investigated the potentially similarities between father's and their child's dietary intake. The two longitudinal studies have only investigated the influence of fathers' behaviours on pre-school aged children's dietary intake. The large American longitudinal study (n = 2441) by Guerrero et al., (2016) found that children had a lower odds ratio of consuming sugar-sweetened beverages (SSB) at 4 years of age if their fathers consumed breakfast more frequently with them when they were 2-years-old (Guerrero et al., 2016). Whereas, fathers who reported eating out more often with their child had children who were more likely to eat fast food and consume SSB (Guerrero et al., 2016). The other longitudinal study by Walsh et al. (2016) had a significantly smaller sample size of Australian fathers (n = 208), irrespective of this, findings suggested that fathers' intake of fruit and sweet

snacks were positively associated with their child's intake of these foods between 20 months and 5 years of age (Walsh et al., 2016). In addition, a father's intake when the child was 20 months old was positively associated with a change in their child's sweet snack and SSB intake at both 3.5 and 5 years of age, along with an increase in their child's fruit intake at 3.5 years of age (Walsh et al., 2016).

The cross-sectional studies included had a low to large sample size ranging from 50 to 566 fathers, with two studies focusing on preschool-aged children (Vollmer, Adamsons, Gorin, et al., 2015; Walsh et al., 2015), two on primary school-aged children (Hall et al., 2011; Lloyd et al., 2014), two on both age groups (Harris & Ramsey, 2015; Zuercher et al., 2011) and one study in children aged six to sixteen years old (Hebestreit et al., 2017). The studies were conducted in primarily Australian (Hall et al., 2011; Lloyd et al., 2014; Walsh et al., 2015) or American (Zuercher et al., 2011; Harris & Ramsey, 2015; Vollmer, Adamsons, Gorin, et al., 2015) samples of fathers, with one study conducted in a European sample of fathers (Hebestreit et al., 2017). Findings from cross-sectional studies revealed that fathers' intake of fruit (Hall et al., 2011; Zuercher et al., 2011; Harris & Ramsey, 2015; Vollmer, Adamsons, Gorin, et al., 2015; Walsh et al., 2015) and vegetables (Zuercher et al., 2011; Harris & Ramsey, 2015; Vollmer, Adamsons, Gorin, et al., 2015; Walsh et al., 2015) were moderately to strongly positively associated with their child's intake of these food groups, with both positive (Hall et al., 2011; Walsh et al., 2015) and inverse (Harris & Ramsey, 2015) associations observed with a child's and fathers' intakes of energy-dense foods.

Alternative methods to identify family resemblance have been conducted in cross-sectional studies in recent years to look beyond food group resemblance and take into consideration energy consumption (Lloyd et al., 2014), nutritional adequacy (Zuercher et al., 2011), and dietary patterns (Hebestreit et al., 2017). Lloyd et al. (2014) found a significant bivariate association between paternal and child percentage energy from core foods (i.e. foods providing essential nutrients for health) (Lloyd et al., 2014). The study by Zuercher et al. (2011) found significant correlations between fathers' and children's nutrient intake and if a father's intake was on course to meet their recommended nutrient intake, this doubled the odds for their child's diets to also meet recommendations (Zuercher et al., 2011). Finally, in terms of dietary patterns a large (n = 566) cross-sectional European study found that children's "Sweet & Fat" dietary pattern was associated with fathers' "Sweet & Fat" dietary patterns when they shared at least one meal a day with them (Hebestreit et al., 2017). In addition, the same dietary pattern correlation was evident between children and their fathers when soft drinks were available in the home (Hebestreit et al., 2017). The RCT called *Healthy Dads, Healthy Kids* was implemented in Southern Australia in 93 overweight or obese fathers with primary school-aged children to help fathers achieve their weight loss goals and educate them on how to be a role model of positive health behaviours for their children (Williams et al., 2018). Findings from 3 months post-RCT suggest that there was significant correlations between changes in fathers' and their child's intakes of carbohydrates, fruits, vegetarian sources of protein and the frequency of meals eaten with vegetables (Williams et al., 2018).

It should be noted that when evaluating these type of studies, it is important to take into consideration the reporter-bias of the child's dietary intake. Findings from a recent study revealed that there were significant parent-respondent interactions, such that there was a stronger parent-child association with the diet of parent reporting child's intake than the other parent (Vepsäläinen et al., 2018). In relation to the seven studies discussed, it is difficult to determine if reporter-bias influences these observed findings; as the child's intake was reported by mothers in three studies (both studies by Walsh and colleagues use the same sample cohort) (Hall et al., 2011; Walsh et al., 2015; Williams et al., 2018), by fathers in two studies (Harris & Ramsey, 2015; Vollmer, Adamsons, Gorin, et al., 2015), unclear in three studies (Guerrero et al., 2016; Hebestreit et al., 2017; Lloyd et al.,

2014), and one study also unclear for younger children (< 6 years old) but self-reported by older children (Zuercher et al., 2011).

Overall, current research illustrates the positive and negative influence of paternal intake on child's food preference and subsequent food intake. Future studies should promote children's self-reported dietary intake (in children \geq 8 years old (Burrows et al., 2013)) or use more advanced methods of dietary assessment (e.g. biochemical sample analysis) to eliminate reporter's bias. All of the longitudinal studies reported in this review were in younger children (< 5-years-old) and therefore it is difficult to determine if observed father-child correlations track into later childhood when the child becomes more autonomous and is subjected to numerous social and environmental factors. In addition, more research is required to determine the potential mechanisms that explain the associations between parent and a child's dietary intakes.

Family mealtimes also allow fathers to enforce rules around food and to encourage children to consume their dinner through paternal feeding practices. Therefore, it is important to establish the association between paternal feeding practices and children's eating behaviours and dietary intake.

3.2.3. Paternal feeding practices

Parenting practices relate to the behaviours or actions of parents for child-rearing purposes that may impact their child's beliefs, behaviours, and attitudes (Vaughn et al., 2016). Parenting behaviours can be domain-specific and parenting practices can vary based on the context in which they are used and therefore should be assessed individually i.e. parental feeding practices (Vaughn et al., 2016). Within the last two decades, there has been an increase in the quantity of research on paternal feeding practices and their association with various child outcomes. To understand these associations, the child and paternal characteristics must be taken into consideration first.

3.2.3.1. Paternal feeding practices in relation to child and paternal characteristics. Most of the studies exploring this association are primarily cross-sectional quantitative studies, except for one longitudinal study (Matton et al., 2013). Four studies found no differences in paternal feeding practices based on child's gender (Blissett et al., 2006; E. L.; Haycraft & Blissett, 2008a; Payne, Galloway, & Webb, 2011; Haycraft & Blissett, 2012), with three studies illustrating that fathers reported more pressure to eat with their sons than their daughters (Loth et al., 2013; Orrell-Valente et al., 2007; Pulley et al., 2014). Findings from the longitudinal study suggest that more paternal monitoring led a reduction in overeating in only boys over the 6 month follow-up period, with these results marginally significant (Matton et al., 2013). In terms of a child's age, fathers of older children reported more feeding responsibilities (Kimberley M Mallan et al., 2014a,b) and restriction if concerned about their child's weight (Musher-Eizenman et al., 2009; Payne et al., 2011) than fathers of younger children. However, two studies found no association between a child's age and paternal controlling feeding practices (Blissett et al., 2006; Haycraft & Blissett, 2012). The review by Khandpur et al., (2014) stated that there are inconsistent findings in terms of a child's gender and that fathers report using food to regulate emotions in younger children more so than older children (Khandpur et al., 2014). Therefore, more longitudinal research is required to establish how the temporality and stability of paternal feeding practices change as children get older.

In terms of paternal characteristics, five studies in the review by Khandpur et al. (2014) focused on paternal weight status or father's perception of his weight status (Khandpur et al., 2014). Findings from these studies suggest that higher body dissatisfaction was associated with higher paternal reports of monitoring with their sons (Blissett et al., 2006) and higher reports of pressure to eat with both their sons and daughters (Blissett & Haycraft, 2011). Only one cross-sectional observational study to date has shown an association between fathers

self-reported BMI and paternal use of pressure to eat during feeding (E. L. Haycraft & Blissett, 2008b), with three other cross-sectional studies finding no associations (Blissett et al., 2006; Mallan et al., 2014a,b; Musher-Eizenman et al., 2009; Kimberley M. Only two quantitative cross-sectional studies have examined a possible association between paternal socio-economic status (SES) and paternal feeding practices, with one study suggesting that fathers from lower SES use more pressure to eat with their children (Kimberley M. Mallan et al., 2014a,b), while the study found no significant associations between SES and paternal controlling feeding practices (Haycraft & Blissett, 2012). A qualitative study by Khandpur and colleagues have also explored the influence of fathers' education level and residency status on paternal feeding practices (Khandpur et al., 2016). Twenty individual feeding practices were identified within this sample of American fathers, with fathers with higher education levels reporting more feeding on schedule (75% vs. 50%), modelling eating practices (50% vs. 29%) and using a distraction to feed (37% vs. 4%) than fathers with lower education levels (Khandpur et al., 2016). Whereas fathers with lower education levels reported higher levels of letting their child dictate food preferences (92% vs. 37%) and using food to bond with their children (29% vs. 6%) than fathers with higher education levels (Khandpur et al., 2016).

3.2.3.2. Paternal feeding practices and children's eating behaviours. Limited research has been conducted to establish the association between paternal feeding practices and children's eating behaviours, with the majority of research conducted in mother-child dyads. However, there have been four cross-sectional quantitative studies (Haycraft & Blissett, 2012; Vollmer, Adamsons, Foster, et al., 2015a; Powell et al., 2017; Harris et al., 2018b) and one longitudinal (Matton et al., 2013) quantitative study conducted to explore this research question. The four cross-sectional studies included fathers of preschool children (Haycraft & Blissett, 2012; Vollmer, Adamsons, Foster, et al., 2015a; Powell et al., 2017; Harris et al., 2018b) and the longitudinal study included fathers of school-aged children (Matton et al., 2013). Studies suggest that paternal reports of restriction and pressure to eat are associated with higher levels of avoidant eating (Haycraft & Blissett, 2012; Vollmer, Adamsons, Foster, et al., 2015a; Harris et al., 2018b) and decreased ability of the child to self-regulate in the context of eating (Powell et al., 2017). In contrast Vollmer and colleagues found that paternal restriction was associated with higher food approach eating behaviours and pressure to eat was associated with lower food approach eating behaviours (Vollmer, Adamsons, Foster, et al., 2015a). Finally, as previously mentioned, Matton et al., (2014) found that more paternal monitoring led a reduction in overeating in only boys over a 6 month follow-up period (Matton et al., 2013), with Haycraft & Blissett finding that higher paternal monitoring was associated with decreased emotional under-eating in all children (Haycraft & Blissett, 2012). No qualitative studies to date have explicitly investigated fathers' behaviours around mealtimes in relation to their child's eating behaviours. Therefore, more research is required to understand fathers' attitudes and beliefs in relation to their child's eating behaviours, such as how they respond to them, while longitudinal studies would allow us to examine the direction of the relationship.

3.2.3.3. Paternal feeding practices and child's dietary intake. Following on from this, we need to establish direct associations between paternal feeding practices and child's dietary intake. As illustrated by the systematic review and meta-analysis by Yee et al., (2017) there is a large body of research investigating the association between parental feeding practices and their child's 'healthy' and 'unhealthy' dietary intake. However, unfortunately, the majority of studies do not include fathers at all or if fathers are included in the study, they only represent a small proportion of the sample and the results report mothers and fathers collectively (Yee et al., 2017). To date, only three cross-sectional

studies directly explored the association between paternal feeding practices and a measure of their preschool child's dietary intake (Vollmer, Adamsons, Gorin, et al., 2015; Lora et al., 2016; Watterworth et al., 2017). Vollmer and colleagues found no significant association between paternal feeding practices and their child's dietary quality score (Vollmer, Adamsons, Gorin, et al., 2015). The study by Watterworth and colleagues used a child's nutrition risk score as an outcome measure of the child's dietary intake and found that a father's use of coercive feeding practices were associated with a higher children's nutrition risk score (Watterworth et al., 2017). With fathers' reports of role modelling, involving children in meal preparation and providing a healthy home, associated with a reduced children's nutritional risk score in preschool Canadian children (Watterworth et al., 2017). The cross-sectional study by Lora et al., (2016) found that paternal use of food as a reward or to calm the child was associated with increased SSB intake in Hispanic but not African American preschool children (Lora et al., 2016). Therefore, no clear conclusion can be made given the range of outcome variables used to assess children's dietary intakes. While the potential long-term influence needs to be established by recruiting a sample of older children or ideally conducting longitudinal studies.

It should also be noted that two longitudinal studies have explored associations between parenting styles and their child's food intake, with parenting styles representing the emotional condition of the parent-child relationship (Alsharairi & Somerset, 2015). The study by Alsharairi and Somerset (2015) found that fathers, who reported a permissive parenting style when child was aged 4 to 5-years-old, had children with higher odds of consuming > 1 portion of fruit and vegetable two years later, compared to fathers who reported a disengaged parenting style (Alsharairi & Somerset, 2015). While fathers who reported an authoritative parenting style when child was aged 4 to 5-years-old, had children with higher odds of consuming > 1 portion of fruit and vegetable two years later (in girls only) and four years later (in boys only), compared to fathers who reported a disengaged parenting style (Alsharairi & Somerset, 2015). The longitudinal study by Berge and colleagues in American adolescents found that paternal permissive feeding style predicted their daughter's fruit and vegetable intake five years later when compared to authoritarian fathers (Berge et al., 2010). More research is required to establish how the emotional climate in relation to feeding can influence paternal feedings practices and children's dietary intake.

Overall, findings suggest that fathers play an important role in the development of eating behaviours. The context and type of paternal behaviour around mealtimes can determine whether paternal presence and influence will have a positive or negative influence on a child's eating behaviours and dietary intake. However, as research predominately focuses on mothers in relation to child feeding, this review needs to address maternal perceptions of fathers feeding responsibilities and explore the differences in maternal and paternal behaviours during family mealtimes.

3.3. Maternal perceptions and behaviours in the context of paternal feeding responsibilities and feeding practices

Mothers are predominately the primary caregiver and according to Townsend are referred to as the 'default parent' (Townsend, 2002). This statement is supported by most studies and interventions that include children as they primarily include mothers as the primary care-giver (Davison et al., 2018; Morgan et al., 2017). As research suggests that mothers are more responsible for feeding their children than fathers, it is necessary to understand their perceptions in relation to their partners' involvement in feeding their child as this may give insight to the factors influencing the roles and responsibilities of fathers (Blissett et al., 2006; Ek et al., 2016; Harris et al., 2018a; Pulley et al., 2014). In addition, children's dietary intake can be influenced by their mothers' and fathers' attitudes and behaviours, and therefore the associations between

mothers' and fathers' behaviours during mealtimes need to be examined collectively to determine if similarities or differences exist.

3.3.1. Maternal perceptions of fathers feeding roles & responsibilities

To establish how mothers perceive fathers' role in feeding, we need to determine how mothers view their responsibilities in comparison to fathers. Two qualitative studies addressed this question in mothers of preschool children (Tanner, Petersen, & Fraser, 2014) and adolescents (Fielding-Singh, 2017). Findings from Tanner and colleagues suggest that all the women ($n = 24$ mothers, $n = 6$ social care providers) participating in the study viewed themselves the primary, or in some cases the only person responsible for managing their family's diet (Tanner et al., 2014). Women in this study said fathers lack of cooking skills were the most common reason for fathers not preparing or cooking meals, with many mothers believing they had to cook in order to provide 'fresh' and healthy family meals. However, the women interviewed were accepting of their partners lack of involvement, as although fathers were often willing to cook, mothers knew they were the superior cook and in addition had a greater interest in cooking than fathers (Tanner et al., 2014). The study by Fielding-Singh (2017) consisted of in-depth interviews of American middle- and upper-class families, with at least one parent and one adolescent interviewed (Fielding-Singh, 2017). Findings suggest that mothers were concerned about fathers detachment or disinterest in a healthy diet, with mothers worried about fathers modelling of unhealthy dietary behaviours to adolescents, and fathers feeding adolescents unhealthy foods (Fielding-Singh, 2017). Mothers in this study did not see food-work or healthy eating as part of their partners' duties and only a few mothers thought that the unequitable division of labour around mealtimes was unjust (Fielding-Singh, 2017).

In terms of general paternal roles, studies have found that maternal perception of a father's responsibility as a carer for their child is a strong predictor of father involvement, regardless of a father's perception of his role (Grossman, Pollack, & Golding, 1988; McBride et al., 2005; McBride & Rane, 1997). Limited research within a feeding context has been conducted and therefore it is not fully understood how this psychological concept may influence paternal feeding practices. A quantitative study in American fathers ($n = 150$) somewhat investigated this concept, with a father's perception of his partner's views of both his role as a father in general and during mealtimes not differing from his own perceptions (Vollmer, Adamsons, Foster, et al., 2015b). These findings suggest that fathers believe that their partner identifies the father as an important figure within the family and during mealtimes. However, as stated by Vollmer and colleagues in the limitations of the study, it is difficult to determine if fathers reported their partner's perceptions of the role of the father accurately and ideally the father's partner should have completed this questionnaire (Vollmer, Adamsons, Foster, et al., 2015b).

It is necessary to explore parental perceptions of feeding roles, as they can influence parental behaviours during mealtimes and can be directly interpreted by children. Therefore, the similarities or differences between mothers and fathers behaviours during mealtimes need to be examined and subsequently how their behaviours are associated with their child's eating behaviours and dietary intake.

3.3.2. The influence of maternal behaviours during family mealtimes in comparison to paternal behaviours

There is some conflicting evidence within the literature in terms of which parent has the greatest influence on a child's diet, with some studies reporting greater mother-child correlations (Beydoun & Wang, 2009; Oliveria et al., 1992; Robinson et al., 2015; Vanhala et al., 2011; Vepsäläinen et al., 2018) and others reporting greater father-child correlations (Thorsdottir et al., 2006; Vauthier et al., 1996) for food and nutrient intake. The studies that found greater mother-child dietary associations were generally more recent, and were larger cross-sectional studies with a larger age range (1–18 years old) (Beydoun &

Wang, 2009; Bogl et al., 2017; Robinson et al., 2015; Vanhala et al., 2011; Vepsäläinen et al., 2018) compared to those who reported greater father-child correlations (Thorsdottir et al., 2006; Vauthier et al., 1996). However, in the majority of studies, it is unclear whether the mother or father reported their child's dietary intake, which may result in reporters-bias and parent-respondent interactions, such that there may be a stronger parent-child association with the diet of parent reporting the child's intake compared to the other parent (Vepsäläinen et al., 2018).

In terms of parental feeding practices findings from the comprehensive review by Khandpur et al. (2014) illustrate that nine out of twelve studies found significant differences between the meal-time feeding practices of mothers and fathers, which will be elaborated on below (Khandpur et al., 2014). The three studies that found no significant differences were cross-sectional in design and had small sample sizes (two had 23 fathers and one had 107 fathers) (E. L. Haycraft and Blissett, 2008b,a, Blissett & Haycraft, 2011). Khandpur et al. (2014) suggest that in comparison to mothers, fathers reported lower levels of monitoring (Blissett & Haycraft, 2008; Blissett et al., 2006) and frequency of meals with their child (Haycraft & Blissett, 2012). Fathers were also less likely to monitor children's snack food intake (Zhang & McIntosh, 2011), place limit on snack foods or ensure availability of fruit and vegetables (Hendy et al., 2009). In contrast, fathers had a higher level of control in the amount of food consumed by the child (Hendy et al., 2009), restrictive feeding practices (Musher-Eizenman et al., 2009) and greater use of pressure to eat (Hendy et al., 2009; Loh et al., 2013; Tschann et al., 2013) than mothers. While the observational study by Orrell-Valente et al., (2007) found that fathers were less likely to use neutral prompts, reasoning, or praise and used fewer feeding strategies in general per meal than mothers (Orrell-Valente et al., 2007).

The studies that have been conducted in the years after Khandpur and colleagues comprehensive review in 2014 also illustrate conflicting evidence between maternal and paternal feeding practices. The six cross-sectional quantitative studies are primarily in parents of preschool-aged children (Adamson & Blight, 2014; Harris et al., 2018b; Jansen et al., 2018; Powell, Frankel, & Hernandez, 2017; Pratt et al., 2017). Half of the studies conducted with both parents (Adamson & Blight, 2014; Harris et al., 2018b; Jansen et al., 2018; Pulley et al., 2014) and half using the same measurement tool to assess parental feeding practices (Feeding Practices and Structure Questionnaire) (Harris et al., 2018b; Jansen et al., 2018; Powell, Frankel, et al., 2017). Out of the six studies, three were in Australian samples (Adamson & Blight, 2014; Harris et al., 2018b; Jansen et al., 2018) and three were in American samples (Powell, Frankel, et al., 2017; Pratt et al., 2017; Pulley et al., 2014). One study found no significant difference between mothers and fathers and how they respond to mealtime issues (Adamson & Blight, 2014). While another study assessed the parental feeding practices of 77 American families (children aged 6–12 years) and found that fathers reported greater pressure to eat with their children than mothers did, with no differences reported between mothers and fathers use of restrictive feeding practices (Pulley et al., 2014). Two studies conducted secondary analyses on the same study sample: *Mums and Dads (MAD) for mealtimes* (Harris et al., 2018b; Jansen et al., 2018). The study by Jansen and colleagues included all mothers ($n = 279$) and fathers ($n = 335$) from the *MAD for mealtimes* study (Jansen et al., 2018), whereas Harris and colleagues only included mother-father pairs ($n = 208$) (Harris et al., 2018b). Both studies found that fathers endorsed using food as a reward for good behaviour more so than mothers (Harris et al., 2018b; Jansen et al., 2018), with no significant difference observed between mother and father reports of persuasive feeding and reward for eating (Harris et al., 2018b). In contrast, Jansen and colleagues found that fathers reported more reward for eating and less covert restriction and structured meal timing than mothers (Jansen et al., 2018). Differences may exist between studies due to the set of subjects selected within the sample.

Similarly, Powell, and et al (2017) and Powell, Frankel, et al. (2017) found that fathers endorse using food as a reward for good behaviour more so than mothers (Powell, Frankel, et al., 2017), and Pratt et al. (2017) also found that fathers used more coercive food parenting strategies and less structure-based parenting strategies than mothers (Pratt et al., 2017).

Findings from two qualitative studies support those from quantitative studies (Khandpur, Charles, et al., 2016; Tanner et al., 2014). Tanner and colleagues suggest that mothers believe that fathers were 'tougher' or 'harder' with their children than they were and displayed a more authoritarian role in relation to feeding routines, especially when the father expressed concern over their child's weight (Tanner et al., 2014). Khandpur and colleagues conducted a study investigating fathers perceptions on feeding practices and responsibilities utilised by them and their partners (Khandpur, Charles, et al., 2016). Findings revealed that approximately half (46%) of fathers reported cooperative food parenting practices with their partner, whereas 40% stated that there were conflicting food parenting practices. Fathers reported that conflict arose around access to energy-dense foods and introducing variety to the diet. Dissimilarities in practices were due to differences in parental eating habits and feeding philosophies as well as concern for their child's health/weight, which fathers reported often resulted in the child refusing to eat (Khandpur, Charles, et al., 2016).

Overall, it is clear that there are some differences between maternal and paternal feeding practices. In general, it appears that fathers utilise more coercive feeding practices, which suggests they adopt a more authoritarian figure during mealtimes than mothers. In addition, further research is required to establish both the individual and common predictors of maternal and paternal feeding practices.

4. Conclusion

The literature to date suggests that while mothers still view themselves as the primary caregiver, fathers have some form of responsibility in some aspect of feeding their child, from deciding food availability in the home (grocery shopping) to interacting with their child during mealtimes. However, as with research in mother-child dyads, the interactions during mealtimes between fathers and their children can both positively and negatively influence children's long-term eating behaviour. These interactions include the types of foods fathers choose to eat in the presence of their children, which can consequently encourage role modelling and influence children to adopt a similar eating patterns to their fathers if they frequently engage in mealtimes with one another. Another interaction during mealtimes and a recurrent theme in the literature is fathers' greater use of coercive feeding practices in comparison to mothers and its association with food avoidant eating behaviours in children. Overall, research to date highlights the importance of including fathers in research relating to children's dietary intakes. Studies to date that have touched on various aspects of fathers' attitude and behaviour in relation to child feeding and have significantly contributed to the literature. However, future research needs to investigate family meals as a broader construct and include children from infancy to adolescence. The entire family context needs to be taken into consideration, with both quantitative and qualitative studies necessary to gain a fuller understanding of the differential influence on children's dietary intake from the numerous individuals involved in the child's daily routine.

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Authorship

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Declaration of competing interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.appet.2019.104540>.

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