Systematic review

Food parenting practices among parents with overweight and obesity: A systematic review

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Abstract: Given the links between parental obesity and eating psychopathology in their children, it is important to understand the mechanisms via which unhealthy relationships with eating are passed from parents to children. The aim was to review research focusing on food-related parenting practices (FPPs) used by parents with overweight/obesity. Web of Science, PubMed and PsycINFO were searched. Twenty studies were included in the review. Single studies suggest differences between parents with healthy-weight vs overweight/obesity with respect to; food accessibility, food availability and modelling. Multiple studies suggest that several parenting strategies do not differ according to parental weight status (child involvement, praise, use of food to control negative emotions, use of food-based threats and bribes, pressure, restriction, meal and snack routines, monitoring, and rules and limits). There was inconclusive evidence with respect to differences in parental control, encouragement and use of unstructured FPPs among parents with healthy-weight vs overweight/obesity. The findings of this review imply some differences between parents with overweight/obesity and healthy-weight and the use of some food-related parenting practices, however they should be interpreted with caution since research remains limited and is generally methodologically weak. The review highlights opportunities for further research and to improve current measures of FPPs and help clarify current study findings.

Keywords: Children; Eating disorders; Eating behavior; Feeding practices; Obesity

1. Introduction

A child is ten to twelve times more likely to have obesity when they have two parents with obesity when compared to having two parents with healthy weight [1,2]. In addition, children are developing obesity earlier [3], increasing the risk of developing adiposity-related conditions later in life including type II diabetes mellitus, cardiovascular diseases, sleep apnoea, problems with physical function, and some cancers [4-7]. Not only is parental obesity linked to obesity in their children, it has also been implicated in the aetiology of eating disorders (EDs) such as bulimia nervosa [8], binge-eating disorder (BED) [9], and anorexia nervosa [10]. For example, patients with anorexia nervosa have cited that living with a family member with obesity was one of the causes of the development of their ED [11].

Both obesity and eating disorders present in a significant proportion of young people. For instance, in 2016, 41 million infants and young children were overweight or obese globally [12]. In the UK, approximately one third of 2 to 15 year old children have overweight or obesity [13,14]. ED prevalence is also high, approximately five percent of children aged thirteen to eighteen will suffer from anorexia nervosa, bulimia or binge eating disorder , with lifetime prevalence rates of .9%, 1.5% and 3.5% among women, and .3%, .5% and 2.0% among men [9]. BED is the most prevalent eating disorder associated with obesity among adults and adolescents [9,15] where the transmission of disordered eating has been illustrated in research. Parents with obesity, reporting binge-eating

disorder (BED) behaviours, are significantly more likely to also report their child binge-eating, and overeating than parents without BED behaviours [16]. Furthermore, children of mothers with overweight and obesity exhibit higher levels of emotional eating than children of healthy-weight mothers [17].

Research suggests that a child's diet and preferences for food are usually influenced by food environments, including the eating behaviours of their parents [18,19]. This influence is strongest in early childhood, where parents act as gatekeepers and role models around food [20,21]. One important approach to tackling obesity in childhood and prevent the development of disordered eating behaviours is to understand and positively influence the modifiable determinants of healthy eating behaviours early in life [18,22]. Food parenting practices (FPPs) have been found to be one of the environmental factors associated with the development of overweight and obesity in childhood [22], and encompass the behaviours used by parents to influence their child's behaviours, attitudes or beliefs around food and eating [23]. FPPs are defined as active techniques or behaviours used by parents to influence a child's food intake [24-26]. Although the relationship between FPPs, child weight and dietary intake is complex and bidirectional [27], one known predictor of children's Body Mass Index (BMI)/weight is parental BMI [28-30]. This association can be attributed to genetic predisposition and environmental factors [31,32], including FPPs. Indeed, parents have a vital role in modelling food choices and shaping their children's food preferences [33,34].

Due to recognised inconsistencies in the terminology and definitions on parents' food-related behaviours, a working group of experts critically appraised the FPP literature and devised a content map to guide future research and to assist with study comparisons [23]. The appraisal resulted in three higher-order FPP constructs: coercive control, structure, and autonomy support/promotion [23]. Coercive control involves FFPs such as restriction, pressure to eat, threats and bribes, and use of food to control negative emotions [23]. Structure involves FPPs such as rules and limits around food, limiting/guiding food choices, monitoring, meal and snack routines, modelling, food availability, food accessibility, food preparation and unstructured practices [23]. Autonomy support or promotion involves FPPs such as nutrition education, child involvement, encouragement, praise, reasoning, and negotiation [23]. For the purpose of this review the FPP map was adopted to guide the description of results.

FPPs that support autonomy are non-directive, for example, encouraging balance and variety around food and providing nutritional education [35]. Such FPPs are believed to stimulate healthy food intake, and prevent consumption of unhealthy foods [25]. Conversely, coercive FPPs are directive, for example, pressuring a child to eat, restricting unhealthy or snack foods and use of food-based threats and bribes [36].

The latter type of FPPs, although well intended to prevent overeating [26], have been found to be associated with increased childhood weight and obesogenic eating behaviours, such as emotional eating and overeating [37]. For example, the use of food-based threats has been shown to affect BMI in adulthood [38]. This is because the reward status placed on the restricted food(s) increases the food's affective value [39] and desirability [40], thus making them more likely to be eaten in excessive amounts [41]. Retrospective research conducted among adults indicates a heightened preference for foods that were restricted in childhood and higher levels of emotional overeating in adulthood [38,42], increasing risk of binge-eating and bulimia [43,44].

Additionally, the use of food to control negative emotions is another coercive FPP that has been found to be associated with increased child BMI [45] and eating in the absence of hunger [46]. Adults recalling their own parents use of food to control their behaviours as a child via reward or punishment have also reported higher levels of binge-eating and dietary restraint [38]. Further, pressure to eat beyond satiety is detrimental to a child's ability to acknowledge and react appropriately to hunger and fullness cues which in turn influences food intake [47]. Loth and colleagues identified that pressure to eat and food restriction were both significantly and positively associated with disordered eating among adolescent boys [48].

Extensive research has also shown that parents who are concerned with their own weight and eating behaviours are likely to exert coercive FPPs when feeding their children [49,50]. However later in life, the use of such FPPs are associated with children's less healthy eating behaviours, and

disordered eating [51-53]. Studies such as these suggest that parents may, unknowingly, be promoting disordered eating and subsequent excessive weight gain in their child/ren via the use of unhelpful FPPs and eating behaviours [54]. Furthermore, since the risk of obesity is greater for children with one or more parents with obesity, identifying the particular FPPs used by parents with overweight/obesity could be helpful in informing the development of family based interventions.

In order to understand the determinants of FPPs, Birch and Davison's model of multiple interactions proposes that there are numerous familial influences on the use of FPPs [55]. The influences described in the model are: parental weight status, parental eating behaviours, child weight status and child eating behaviours [55]. Although the model does not acknowledge all the environmental factors associated with the development of childhood obesity [55], the model is appropriate for exploring the influences at the parental level, such as parental weight, on the use of FPPs.

In summary, the FPPs currently being used by parents with overweight and obesity are yet to be identified despite parental BMI being associated with eating disorders and the strongest predictor of child weight/BMI. Therefore, the aim of this review is to systematically identify and review the types of parental FPPs used by parents with overweight and obesity (defined by a BMI ≥ 25.0 [56]). To aid cross-study comparisons, minimise conflicting findings and move towards consensus in measurement, the results are presented under Vaughn and Colleagues' three higher-order food parenting constructs of the content map [23].

2. Methods

2.1 Search Strategy

Potential studies were identified from three relevant electronic databases: Web of Science, PubMed and PsycINFO. Published, peer-reviewed articles that examined FPPs were included. The reference lists of all relevant articles were hand-searched to ensure that any additional studies were identified that may have not been captured by the searches [57]. There was no limit placed on the publication date. Figure one outlines an example search strategy, which was adapted for each database.

Figure 1: Example search strategy

> (((feeding OR mealtime*) AND child* AND obes* AND (parent* OR mother* OR father* OR maternal OR paternal)) AND (la.exact("ENG") NOT me.exact("Systematic Review" OR "Meta Analysis") NOT po.exact("Animal") NOT rtype.exact("Comment/Reply" OR "Editorial" OR "Erratum/Correction" OR "Review-Book" OR "Column/Opinion" OR "Letter") AND PEER(yes))) NOT (me.exact("Prospective Study" OR "Clinical Trial" OR "Mathematical Model" OR "Twin Study" OR "Brain Imaging") NOT po.exact("Animal") NOT rtype.exact("Review-Book" OR "Column/Opinion" OR "Letter") AND PEER(yes))

2.2 Selection Criteria

The inclusion of studies was based on the PRISMA checklist's PICOS (Participants; Interventions; Comparators; Outcome and Study design) taxonomy [58]. Participants: Studies were eligible if they were conducted with participants who identified themselves as parents, primary caregivers or legal guardians. Participants had to have been grouped by BMI status or equivalent (e.g., healthy-weight, overweight or obese). Studies were excluded if they included participants with medical conditions or disabilities that may influence FPPs and/or weight (e.g., Prada-Willi syndrome, Anorexia Nervosa, Binge Eating Disorder, Type I Diabetes Mellitus). Interventions: Studies needed to have used a measure of FPPs, e.g., the Child Feeding Questionnaire. Comparators: Studies were eligible where there was a comparison group of parents with healthy-weight. Outcome: Studies needed to have considered a relationship between parental BMI and FPPs. Study design: Studies conducted quantitatively (cross-sectional, laboratory-based observation, longitudinal) were

included. Peer reviewed studies that were written in English were considered eligible. Individual case studies, prospective and protocol articles were excluded. Studies involving FPP intervention or manipulation were excluded as these studies do not capture naturalistic FPPs. Furthermore, participating in an intervention study can raise awareness of participants' unhealthy behaviours [59].

2.3 Article Screening

The most recent studies identified from the search were published in 2018 and the oldest study was published in 1969. The titles and abstracts were screened for potential inclusion by one author (CP). A second reviewer (DM) also independently assessed each potential article for inclusion to determine whether it could be excluded on the basis of the inclusion/ exclusion criteria. Disagreements were discussed and resolved by consensus [60]. A third reviewer (CM) was consulted where there was uncertainty. Full texts of potentially eligible studies were then screened by one reviewer (CP) and verified by the second (DM).

2.4 Data Extraction and Synthesis

Data from each article were extracted and tabulated to present study information. A data extraction form was developed according to the Centre for Reviews and Dissemination guidance [60]. The review and narrative synthesis was guided by the PRISMA statement for systematic reviews [58], and was registered on the PROSPERO database (CRD42018108891). A meta-analysis was not appropriate due to the heterogeneity between studies.

2.5 Quality Assessment

Articles were scored on their methodological quality, internal and external validity using the NICE quality appraisal for quantitative studies checklist [61]. It has been used in previous systematic reviews [62,63] and was adapted for the purposes of this review. The scoring for each criterion in the checklist ranged from ++ (when all or the majority of criteria were fulfilled), + (the criteria have been partially fulfilled), to - (few or none of the criteria have been fulfilled). Due to the limited number of studies revealed by the review, no publications were excluded from the review based on quality scoring. Study quality was also independently assessed by the second reviewer (DM) to examine possible risks of study bias, as suggested by Moher and colleagues [58]. Publication bias was not assessed due to heterogeneity among studies. Inter-rater reliability was in the acceptable range, *ICC* = .87, and was assessed using a two-way mixed, consistency, average-measures ICC to examine the degree of agreement in study ratings between the two reviewers (CP and DM).

3. Results

3.1. Summary of Included Studies

The initial search yielded 5,599 abstracts (Figure 2: PRISMA flowchart). A proportion of articles (n = 197) were removed due to duplication, and 5,402 abstracts were screened. The majority of abstracts (n = 5,356) were excluded upon review as they did not meet the inclusion criteria. Forty-seven full-text articles were retrieved and read, however a further twenty-seven were excluded from this review for the following reasons: not reporting FPPs by parental weight status (n = 10), no demographic data on the number/percentage of parents per BMI category (n = 11), the article presented the results of an intervention (n = 4), the sample included parents with healthy-weight only (n=1), and measured perception of hunger (n=1). One additional study was identified from a systematic review article [64] that was not identified in the search. Twenty studies were included in this review. Using the NICE rating system, four studies were rated as poor (-), fourteen were rated reasonable in quality (+), and two studies were rated good (++).

Apart from one study, nineteen of the twenty included studies used widely accepted BMI cut-offs for overweight and obesity (≥ 25). Lipowska and colleagues [65] used body-fat status measured

by a body composition analyser and grouped parents into either overfat, healthy or underfat categories according to societal norms proposed by Gallagher and colleagues [66].

The oldest studies included in the review were published in 2001[67,68] and the most recent studies were published in 2018 [65,69] (Table 1: Study Results Table can be found in supplementary materials, S1). Of the twenty relevant studies, sixteen were cross-sectional [67,68,70-79], three were observational [80-82], and one longitudinal [83]. Research was conducted in the USA (n = 9), the UK (n = 2), Germany (n = 2), Turkey (n = 1), Australia (n = 1), Australia and New Zealand (n = 1), Brazil (n = 1), The Netherlands (n = 1), Poland (n=1) and China (n = 1). Mothers comprised the participants in the majority of the studies (n = 13).

All twenty studies used nonclinical samples. The sample sizes varied where the largest sample was over three-thousand parents [79], the smallest sample size was twenty mothers [80] (Table 1). FPPs were measured using questionnaires (n = 17), observations (n = 2) and a conjunction of both (n = 1). The questionnaires used in studies varied, however the Child Feeding Questionnaire (CFQ) and CFQ subscales appeared to be used most frequently [68,70-72,74,75,79,80,83]. Other measures used to collect FPP data included the Pre-Schooler Feeding Questionnaire (PFQ) [67], the Chatoor Feeding Scale (CFS) [84], the Parental Feeding Style Questionnaire (PFSQ) [65,77], , the Toddler Snack Food Feeding Questionnaire (TSFFQ) [71], the Comprehensive Feeding Practices Questionnaire (CFPQ) [35,69,85], the Caregiver's Feeding Styles Questionnaire (CFSQ) [86], the Feeding Strategies Questionnaire (FSQ) [69], the Parenting Strategies for Eating and Activity Scale (PSEAS) [87], and the Meals in our Household (MioH) [69] measure.

Figure 2: PRISMA flowchart
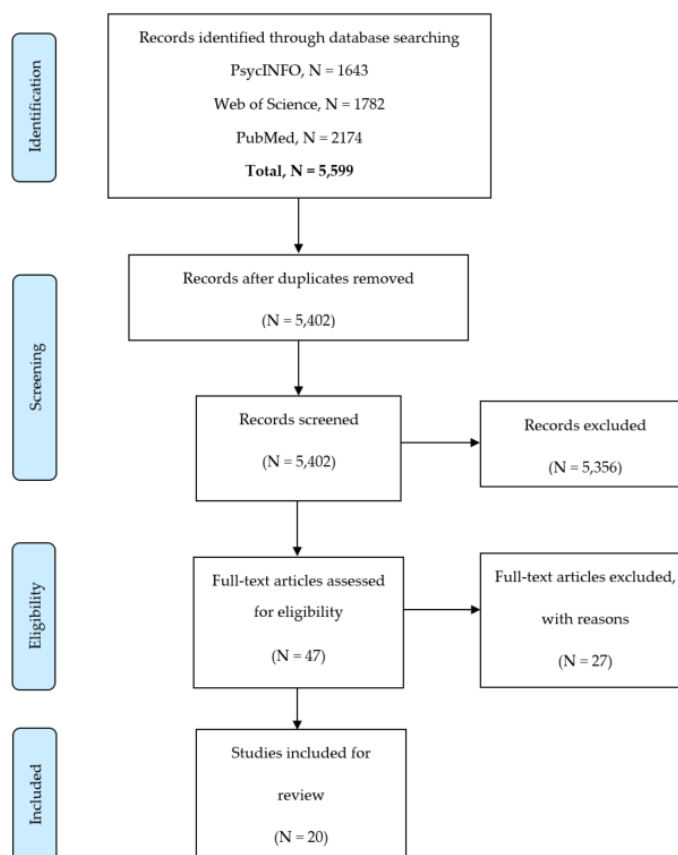
3.2 FPP Results

3.1.1. Coercive control

The term "coercive control" is a distinct type of control that reflects parental attempts to dominate, pressure, or impose parental will on the child [88]. FPPs that are coercive have been described as parent-centred strategies with aim to meet parental goals and desires [23]. Such FPPs that have been identified by the review are the following:

Parental control

The measures that assessed parental control over their child's eating were heterogeneous. This, in turn, revealed an inconclusive relationship between parental weight and use of parental control.

There is some evidence to suggest that mothers with overweight/obesity have less control over their child's intake, and therefore their child has more control around their own intake of food [77]. Specifically, Wardle and colleagues [77] found that mothers with overweight/obesity reported significantly less control over their child's food intake on the PFSQ when compared to mothers with healthy-weight. Similarly Haycraft and colleagues [73] found significantly higher reports of mothers with overweight/obesity giving their child more control around eating, as assessed by the CFPQ, in comparison to mothers with healthy-weight. In contrast, two cross-sectional studies reported no significant differences between parents with healthy-weight, overweight and obesity and CFQ control [75] and PSEAS control [87].

In one laboratory-based observational study, fathers with overweight demonstrated significantly more struggle for control (efforts by parent or child to control feeding) than fathers with healthy-weight and obesity [82]. The authors suggested that fathers with overweight attempt to try and control feeding due to concern about their child's weight. This finding was not observed among the mothers in the sample.

Using food to control negative emotions

Using food to control negative emotions [23] is a behaviour used by parents in response to their child's emotional state [35,89], and is suggested to influence emotional eating in adulthood [90]. In the reviewed studies, the use of food to control negative emotions was measured using the PFSQ emotional feeding, e.g., "I give my child something to eat to make him feel better when he is upset" [77], the PFQ using food to calm a child, e.g., "Gave something to eat/drink if the child was upset" [67], the CFPQ emotion regulation, e.g., "Do you give this child something to eat/drink if s/he is upset even if you think s/he is not hungry?" [73] and by newly developed questions, e.g. "Do you use foods to comfort your child?" [76].

There were five studies that reported no significant difference between parents with healthy-weight, overweight and obesity and the use of food to control negative emotions. Raaijmakers and colleagues [76] also reported no significant difference between use of food to control negative emotions and maternal healthy-weight, overweight and obesity. However this assessment was dichotomous, and consequently the frequency of the use of this FPP is unknown [76]. Another study reported that mothers with overweight/obesity use food to soothe their child significantly less than mothers with healthy-weight [78].

Threats and bribes

Five of the twenty identified studies explored the use of food-based threats and bribes. The majority of evidence identified appears to show no significant difference between parents with healthy-weight, overweight and obesity and the use of food-based threats and bribes in exchange for a favourable outcome (e.g., good behaviour from the child [37]), despite the varied measurement of this FPP. Wardle and colleagues [77] reported no significant differences between parents with healthy-weight, overweight and obesity and PFSQ instrumental feeding. Haycraft and Colleagues study also reported non-significant findings among maternal healthy-weight, overweight and obesity using the CFPQ food as a reward subscale where their data was collected from a large sample of mothers with healthy-weight, overweight and obesity in a community setting [73]. Two further studies also concluded that maternal weight had no significant effect on the use of food based threats and bribes [74,76]. In contrast however, one study reported that the odds of mothers with obesity using CFPQ food as a reward was higher than compared to mothers with healthy-weight [85].

Discipline

One study examined the use of discipline among parents with their children via the PSEAS, which asks parents whether they discipline their child for unhealthy eating [87]. There were no significant differences between healthy-weight, overweight and obese parents and use of discipline for eating unhealthy foods [87].

Pressure to eat

Pressure to eat is a controlling, directive feeding practice that aims to increase a child's food intake [91]. There appears to be no difference between parents with healthy-weight, overweight and obesity and pressuring a child to eat. No significant difference was found on PFQ pushing the child to eat more [67], CFQ pressure to eat [68,70,72,74,75,80], PFSQ prompting/encouragement to eat [77] CFPQ pressure [73], and laboratory observational prompting a child to eat [81]. One study however, reported that parents with healthy-weight used significantly higher levels of CFQ pressure to eat when compared to parents with overweight and obesity, suggesting that parents with overweight/obesity use pressure to eat less [79]. Francis and colleagues [68] reported that pressure to eat by mothers with overweight/obesity was significantly predicted by daughters' adiposity, and mothers' concern for daughters' weight. Pressure to eat by mothers with healthy-weight on the other hand was significantly predicted by mothers' perception of daughters as underweight [68].

Restriction

Restriction involves controlling a child's intake of unhealthy foods [91]. Parents might control a child's intake with the intention to limit unhealthy foods or to decrease or maintain a child's weight [35]. Ten identified studies included the assessment of restriction which used the CFQ and the CFPQ [68,70,72-75,79,80,83,85]. The evidence suggests that there is no difference between parents with healthy-weight, overweight and obesity and the use of restrictive FPPs. Five studies found no significant differences in CFQ restriction [68,70,75,80,83] among mothers with healthy-weight, overweight and obesity. Additionally, there was no significant difference between mothers with healthy-weight and overweight/obesity on CFPQ subscales: restriction for health and restriction for weight [73]. It has also been reported that the odds of mothers with obesity using CFPQ restriction for health were lower compared to mothers of healthy-weight [85].

Contrary to the aforementioned findings, two studies did report a significant difference in CFQ restriction between mothers, caregivers and parents with healthy-weight and overweight/obesity [72,79]. Francis and colleagues [68] conducted a five-year longitudinal study that reported among mothers with overweight/obesity, restriction could be significantly predicted by maternal concern for their daughters' weight regardless of their daughters' actual weight status, maternal perception of daughters as overweight, and maternal investment in weight and eating issues.

One study combined multiple subscales from the CFPQ, FSQ, and the MioH [69] measure, and analysed the three overarching food parenting constructs outlined by Vaughn and colleagues [23]: coercive control, structure and autonomy. Roberts and colleagues reported that there was no significant differences between parents with healthy-weight, overweight and obesity and use of coercive FPPs [69].

3.1.2. Structure

Meal and snack routines

Meal and snack routines are created by parents and includes the "location, timing, presence of family members, atmosphere or mood, and presence or absence of distractions during meals and snacks"[92](p. 106). With regards to mealtime structure, the evidence remains inconclusive as this was explored in only one identified study [67]. Specifically, Baughcum and colleagues [67] included a domain in the PFQ that assessed structure during feeding interactions. This domain asked about whether the child watched TV during meals, whether the child had a set mealtime and snack routine

and whether the mother sat down with the child during mealtimes. A significantly lower degree of structure during mealtimes was reported by mothers with obesity than mothers without obesity [67].

Only one study examined mealtime atmosphere which reported no significant difference in dyadic reciprocity (affective engagement and quality of relatedness between mother and child), dyadic conflict (conflicts between mother and child over eating), talk and distraction during feeding (mother or child attempts to engage or control each other by talking or distracting), and maternal non-contingency (parental inability to interpret and respond to child cues) among mothers and fathers with healthy-weight, overweight and obesity [82]. More research is needed to examine meal and snack routines and parental BMI.

Monitoring

Parental monitoring involves the degree to which the parent keeps track of a child's food consumption [36]. The small amount of evidence identified appears to suggest no difference between parents with healthy-weight, overweight and obesity and monitoring. Four studies found no significant difference in CFQ monitoring and CFPQ monitoring [70,72-74] and parent weight. Costa and colleagues [72] suggested that rather than parental weight, parental concern about their child's weight, i.e., where the child is at risk of developing overweight or is already overweight, is related to parental monitoring of their child's eating which questions the direction of this relationship. In contrast, another study using the PSEAS, reported that underweight and healthy-weight parents monitor their child's diet significantly more than parents with overweight and obesity [87], suggesting that parents with overweight and obesity monitor their child's diet less.

Food accessibility

Food accessibility involves how easy or difficult it is for a child to access food independently or with assistance [23]. Access to such foods was assessed using the TFSSQ, and only one study used this measure [71].   Compared to mothers with obesity, mothers with healthy-weight and overweight recall previously allowing access to sweets and snack foods significantly less [71], suggesting that mothers with obesity allow access to sweets and snack foods more frequently than mothers with healthy-weight/overweight. In this particular study, mothers were asked to recall their previous and current FPPs. The recollection of CFPs may have been influenced by mothers' current CFPs or weight status and therefore this non-significant finding should be interpreted with caution.

Rules and limits

Parents may set rules and limits to clarify what, how much, when and where their child/ren should eat [23]. Rules around snack foods was assessed in two studies via the TFSSQ [71] and PSEAS [87]. There was no significant difference between mothers with obesity and without obesity regarding their implemented rules around snack foods *(*TFSSQ), however this did approach significance [71]. Also measured in this study was mothers' flexibility around snack foods (TFSSQ), where there was also no significant difference between maternal BMI and this FPP [71]. Limit setting is assessed on the PSEAS, and asks parents about their use of boundaries around the consumption of unhealthy foods [87]. In this study there were no significant differences with parents with healthy-weight and overweight/obesity and limit setting [87].

Food availability

The types of food available and unavailable in the home is described as food availability [23]. Parental encouragement of balance and variety around food and the home food environment was assessed by one study [73]. This study utilized the CFPQ [35] where there were significantly lower reports of encouraging balance and variety among mothers with overweight/obesity in comparison to mothers with healthy-weight. Further, mothers with overweight/obesity reported having a significantly less healthy home food environment [73]. However the sample in this study lacked heterogeneity as the majority were identified as white (76%).

Modelling

One study with a rather large sample (n=437) explored maternal BMI and food modelling using the CFPQ [73]. Mothers with overweight/obesity demonstrated significantly less modelling of healthy eating in comparison to mothers with healthy-weight [73].

Unstructured practices

FPPs that are "unstructured" involve the absence of parental control or structure around child eating, examples include meeting the child's demands, allowing the child to make inappropriate food-related decisions, and providing little guidance or direction [23].

Child control of feeding interactions is a domain in the PFQ and CFPQ and asks mothers whether they let their child choose their food from what is being served, whether mothers make something different if their child did not like what was being served and whether mothers allowed their child to eat snacks whenever their child wanted [35,67]. Three studies explored child control around eating and reported contradictory findings. Specifically, Baughcum and colleagues reported no significant difference in PFQ child control around eating between mothers with obesity and mothers without obesity [67]. However, Haycraft and colleagues reported that mothers with overweight and obesity gave their child significantly more control around eating when compared to mothers with healthy-weight [73]. Russell and colleagues also reported that the odds of mothers with obesity allowing child control (CFPQ child control) is higher when compared to mothers with healthy-weight [85].

Age inappropriate feeding is a domain assessed by the PFQ and asks mothers to report, for example, if they gave the child a bottle during the day and whether they fed the child themselves if they did not eat enough [67]. Only one study found that mothers with obesity used significantly more age-inappropriate feeding in comparison to mothers without obesity. However, this difference was no longer significant after adjusting for family income [67].

One study combined multiple subscales from the CFPQ, FSQ, and the MioH [69], and analysed the three overarching food parenting constructs outlined by Vaughn and colleagues [23]: coercive control, structure and autonomy. Roberts and colleagues concluded that in comparison to parents with healthy-weight, parents with obesity use significantly less structure FPPs (there was no significant difference between parents with healthy-weight and overweight).

3.1.3. Autonomy support/promotion

Child involvement

There was no significant difference between mothers with healthy-weight, overweight and obesity and involving their child in planning and preparing meals and encouraging participation in food shopping. This is based on just a single study examining maternal BMI and involvement using the CFPQ [73].

Encouragement

In contrast to pressure to eat, whereby parents demand that their child eats more, encouragement involved parental use of positive, gentle, and supportive behaviours that are non-coercive [23]. Parental encouragement aims for children to build habits around healthy eating [23].

Two studies assessed parental encouragement using the PSFQ [65,77] which presented contradictory results. Lipowska and colleagues [65] reported that among a Polish sample of parents, mothers with healthy body fat (body fat composition was measured rather than BMI) used PSFQ encouragement FPPs significantly less than mothers with an overfat body status, suggesting that mothers with overfat use more encouraging FPPs than mothers with a healthy body fat status. Wardle and colleagues [77] on the other hand, reported that there are no significant differences in the PSFQ encouragement among mothers with healthy-weight, overweight and obesity.

Praise

Vaughn and colleagues define praise as a form of positive reinforcement where parents provide verbal feedback to the child [23]. One study assessed praise in the PSEAS which asks parents whether

they use praise when their child eats healthy snacks [87], there were no significant differences between parental BMI and use of praise.

One study combined multiple subscales from the CFPQ, FSQ, and the MioH [69], and analysed the three overarching food parenting constructs outlined by Vaughn and colleagues [23]: coercive control, structure and autonomy. Roberts and colleagues reported that there was no significant differences between parents with healthy-weight, overweight and obesity and use of autonomy support FPPs [69].

Nutrition education

Teaching about nutrition involves parents providing information and skills to their children to aid their decision making about the foods they eat, thus supporting the child's autonomy since this information guides volition, and eating behaviours. One study included the assessment of teaching about nutrition using the subscale from the CFPQ [73], however due to subscale reliability in the study was excluded from the analyses. More research is warranted to explore this FPP further.

4. Discussion

The aim of this review was to systematically identify the types of food-related parenting practices used by parents with overweight/obesity in comparison to parents with healthy weight as examined by currently available measures. This is important since extensive research indicates an increased presence of EDs among individuals who have parents with overweight and/or increased BMIs [9,93-95].

With regards to coercive food parenting practices, there is evidence (based on eleven studies) suggesting that there is no difference among parents with healthy-weight, overweight and obesity in their use of food to control negative emotions, use of food-based threats and bribes, pressure to eat and restriction [67,68,70,72-77,80,81,83]. The evidence examining parental control was inconclusive due to contradictory study findings [73,75,77,87].

With regards to parenting practices involving structure, there also appears to be no significant difference between parents with healthy-weight, overweight and obesity and: meal and snack routines, monitoring, and rules and limits [67,70-74,82,87]. However, the available research indicates significant differences between parents with healthy-weight, overweight and obesity with respect to food accessibility, food availability and modelling [71,73]. Apart from rules and limits which was assessed in two studies, the structure FPPs described above were all examined in single, unreplicated studies. With regards to unstructured FPPs, the evidence was inconclusive due to contradictory study results [67,69,73,85].

Finally the results examining autonomy support FPPs, indicated that there are no significant differences between parents with healthy-weight, overweight and obesity and child involvement and praise which is also based on single, unreplicated studies[73,87]. Encouragement was examined in two studies, however due to contradictory results, the evidence is inconclusive[65,77].

The findings from this review should be interpreted with caution, as it has been revealed that often some FPPs in relation to parental BMI were examined in single studies, particularly where the research involved structure and autonomy support FPPs. It is not known whether the research indicating that there is no relationship between parental BMI and FPPs is because there are not enough studies of a good quality (only two studies received ++ in this review) or if the measures used to capture FPPs are inadequate.

The current review highlights the numerous and inconsistent measures that are available to measure FPPs. Although the CFQ was the most frequently used measure to capture self-reported FPPs, many more feeding practices have been identified [23]. The CFQ does not capture the wider range of FPPs, such as parental modelling and teaching about nutrition [35], and so it is possible that there were additional FPPs used by parents that were not captured.

It has been suggested that the inconsistent results between parent BMI and FPPs may be due to other variables, for example, parents own weight concerns, child age, child weight [69], however it is possible that some of the inconclusive findings described above between parental BMI and FPPs are

due to existing measures being of an inadequate quality based on a lack of well-defined and operationalised constructs[92]. This has subsequently resulted in a number of FPP measures that include similar subscales, yet assess different behaviours [92]. For example, the CFQ's restriction subscale covers items about regulating the child's intake such as limiting the amount of sweets and high fat foods consumed [36] and items such as, "I offer my child her favorite foods in exchange for good behavior". However this is an item that others measures such as the CFPQ Food as a reward subscale [35] and PSFQ Instrumental feeding subscale [77] regard as food-based threats and bribes to behave [35].

Often only the minimal stages are used to design measures rather than what is required for rigorous measure development [92]. For example, seventy-one FPP measures have been identified, however just less than half of these involved clear identification and definition of concepts to be measured during the development stage[92]. For the review this was problematic since there were limitations when comparing and evaluating the relationships between parental weight and subsequent use of FPPs among the studies included in the review. One of the strengths of the current review however, is that the study findings were grouped and guided by Vaughn and Colleagues' FPPs content map [23] that will help researchers plan future studies.

4.1 Study quality

The majority of research examined (fourteen studies) was rated as reasonable in quality. This means that the criteria for internal and external validity were partially met to a standard whereby any criteria that were not fulfilled, would be unlikely to change the study conclusions [61]. Four studies were rated as poor in quality. This means that the design of the study contained sources of bias, such as little consideration for confounding variables [72,80], small sample sizes [80], and little or unclear information about the study sample [71,72,81].

4.2 Study limitations and future research

Several limitations have been identified. The samples in some of the studies may have introduced bias to the data identified in the review. For instance, Kröller and Warschburger [74] recruited mothers from clinics where they were receiving psychoeducation about their weight. So, their conclusion that maternal weight does not influence the use of FPPs, might have been due to the mothers' newly acquired knowledge about the potential relationship between the use of certain FPPs and their children's weight [74]. Two studies also reported there are no particular FPPs shared among mothers with overweight/obesity [67,75], however this may have been due to mothers being recruited from the Special Supplemental Nutrition Programme for Women, Infants and Children where they may have been more attuned to eating behaviours before participating.

Participants were predominantly white across the studies, so the generalisability of findings is restricted to other ethnicities. Two of the identified studies are applicable to white mothers and their daughters only[68,83]. Future research should seek to include more diverse ethnic samples, particularly as South Asian and Black Afro-Caribbean parents have reported greater pressure to eat [96], higher levels of restrictive FPPs and lower levels of monitoring [97] in comparison to White British and White German parents.

In addition to ethnicity, the current evidence could be strengthened by larger sample sizes in future studies. Although Stevens suggests that "power is not an issue" when there is sample of 100 or more more [98], none of the included studies presented a power calculation. Therefore, the results of those studies that included less than 100 parents with healthy-weight, overweight and obesity suggesting that there is little or no difference in the use of FPPs between parents with healthy-weight, overweight or obesity may have been due to studies being insufficiently powered [80,81,83,87].

With regards to study design, the current review identified only one longitudinal study [83]. The majority of studies were cross-sectional which is an appropriate design for capturing the prevalence of behaviours without the risk of losing participants to follow-up (e.g. in longitudinal studies) [99]. However, neither the causality nor long-term impact of specific FPPs on child weight can be

determined in cross-sectional studies. More longitudinal studies are required to further explore the relationship between parental BMI, FPPs and childhood weight and eating behaviours.

More research is also needed to help determine inconclusive and limited findings. Future research aiming to develop or improve measures of FPPs should do so using the appropriate steps for questionnaire development. Additionally, the bidirectional relationships that exist between parental FPPs and child eating behaviours should also be explored that includes parental BMI. Parents are not only influential on their children, but also react, respond and modify their FPPs to children's behaviours and own parental feeding goals[100]. It is also important for research to acknowledge that other adult caregivers may be influential on a child's diet and eating behaviours.

5. Conclusions

In conclusion, the findings of the review showed that studies with an improved methodological quality is required. A better understanding is required around the potential influence parental BMI has on the use of FPPs which may contribute to the parent-child BMI and eating behaviour relationship. Particularly as FPPs are deeply influential on children's eating behaviours and relationships with food later in life. This could be achieved by replication and extending of existing research including more longitudinal research with repeated use of the same or improved measures to capture FPPs[23]. Despite the mixed findings in the review, it is important that healthcare professionals working in weight management address disordered eating if successful weight-loss is the desired outcome. Similarly, it is important that healthcare professionals working with patients with EDs address weight management.

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