

# Changing Families, Changing Food

Working Paper Series

**How do parents' child-feeding behaviours influence child weight? Implications for childhood obesity policy**

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# **How do parents' child-feeding behaviours influence child weight? Implications for childhood obesity policy.**

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Running title: Child-feeding behaviours and child weight

## ***Abstract***

**Background:** Parents have some responsibility for children's dietary habits and they are often the focus of public health interventions designed to improve children's diets and thereby reduce the prevalence of childhood obesity. Current UK interventions promote awareness of healthy food choices, but offer little guidance for parents on child-feeding behaviours.

**Methods:** A review of recent literature around child-feeding behaviours and child weight.

**Results:** Parents report using a wide range of child-feeding behaviours, including monitoring, pressure to eat and restriction. Restriction of children's eating has most frequently and consistently been associated with child weight gain. Furthermore, there is substantial evidence for a causal relationship between parental restriction and childhood overweight.

**Conclusions:** Parents may inadvertently promote excess weight gain in childhood by using inappropriate child-feeding behaviours. We recommend the development of interventions to increase awareness of the possible consequences of inappropriate child-feeding behaviours. Parents who are concerned about their child's weight will also require guidance and support in order to adopt more appropriate child-feeding behaviours.

## ***Introduction***

Diet is a major environmental factor in the aetiology of childhood overweight and obesity <sup>1</sup>. Dietary habits formed in childhood are likely to persist into adulthood, so an unhealthy diet in childhood has implications for health throughout the life course <sup>2</sup>. Children's diets may be influenced by parents, friends, school, the media and their own tastes and preferences <sup>3,4</sup>. Parents' influence is thought to be strongest in early childhood, when parents act as providers, enforcers and role models <sup>5,6</sup>. Hence, parents of young children are often the focus of public health interventions designed to improve children's diets and thereby reduce the prevalence of childhood obesity. For example, Sure Start groups promote breastfeeding and encourage parents and children to get involved with healthy cooking and organic vegetable growing <sup>7</sup>.

Although many factors are thought to influence parental food choice, parents with good dietary awareness (or nutrition knowledge) are more likely to make healthy food choices for their children. Observational studies have shown that higher levels of maternal nutrition knowledge are associated with higher fruit <sup>8</sup> and fibre intakes <sup>8,9</sup> and lower fat intakes <sup>9</sup> by children. Current UK dietary interventions reflect these knowledge-behaviour associations by promoting healthy food choices, for example, the Healthy Start and 5-a-day initiatives <sup>10</sup>; and raising awareness of the nutrient content of foods, for example, the traffic light labelling system <sup>11</sup>. These interventions assume that, by improving knowledge and awareness, behaviour change will follow.

If we consider parents' influence in terms of **how** they feed their children, as well as **what** they feed them, it is clear that current interventions primarily address the latter. They do not address parents' child-feeding behaviours directly. Therefore, this review evaluates research on child-feeding behaviours and considers the implications for childhood obesity policy.

## ***Methods***

We reviewed literature on parents' knowledge of nutrition, awareness of obesity, child-feeding behaviours, and associations with child weight. The following electronic databases were searched: MEDLINE, EMBASE, CINAHL, Web of Knowledge,

accessed via Athens Gateway ([www.athensams.net](http://www.athensams.net)); Science Direct ([www.sciencedirect.com](http://www.sciencedirect.com)), PubMed ([www.pubmed.gov](http://www.pubmed.gov)) and The Cochrane Library ([www.theCochraneLibrary.com](http://www.theCochraneLibrary.com)). The following key words were used in various combinations: obesity, overweight, child, parent, nutrition, healthy eating, knowledge, health knowledge, attitudes, practice, awareness, food choice, choice behaviour, food preferences, feeding behaviour, food habits. An example search strategy is reproduced in the Appendix. Searches were restricted to papers published in the English language from 1996 to 2006.

The title of this paper was identified as a key theme from the wider literature review. Thereafter, papers were only included if they addressed the specific questions of dietary intake and child weight gain in relation to child-feeding behaviours. For example, a number of studies were excluded because they focussed on topics such as underweight and eating disorders. Reference lists and internet searches were also used to find additional papers and reports, including those detailing public health policies.

### ***How do parents' child-feeding behaviours influence dietary intake?***

A variety of methods have been used to explore parents' child-feeding behaviours and their effects. Table I summarises the 26 studies included in this review; of which 11 are cross-sectional, six longitudinal, four experimental, two observational, two qualitative and one retrospective. Most of this research was conducted in the US on parents with pre-school and primary age children, although some studies do include older children.

Qualitative studies provide valuable information from the parents' perspective on child-feeding behaviours and reasons for using them. In two studies using focus groups, mothers described a wide range of child-feeding behaviours; including control or restriction of portion sizes or food eaten, encouragement or pressure to eat, using food as a reward or bribe (e.g. for good behaviour), using food to pacify children, providing treats and accommodating requests<sup>12 13</sup>.

An early observational study found that parental 'monitoring' influenced children's food selection <sup>2</sup>. When children (aged 4 to 7 years) were allowed to choose freely from a variety of foods, they selected a large number of foods high in added sugar. When they were told that their mothers would be monitoring the meal they selected, children's choices were significantly lower in added sugar than before ( $p < 0.05$ ). When mothers actually did monitor their children's selections, children's choices were significantly lower in total calories, saturated fat and salt than the previous selection ( $p < 0.05$ ) <sup>2</sup>. These results indicate that young children may make healthier food choices when they know or suspect that their parents are watching.

A cross-sectional study found that 'pressuring' behaviours, such as making children finish everything on their plate and bribing them to eat healthy food, were reported less by parents than other behaviours, such as sharing information, encouragement, setting a good example and making healthy foods available <sup>14</sup>. These pressuring behaviours predicted higher fruit and vegetable intake ( $p = 0.02$ ) and lower fat intake (not significant) by children; whereas setting a good example and making healthy foods available predicted lower fat intake ( $p = 0.02$ ) <sup>14</sup>. Although causal associations are not proven by cross-sectional studies, these results also suggest that some child-feeding behaviours may have beneficial effects on dietary intake.

However, other studies have shown negative effects of pressure to eat. In an experimental study, pressure did not affect children's intake of soup significantly; but children who were not accustomed to being pressured at home responded more to pressure in the experiment (greater increase in soup intake) than children whose parents reported pressuring them regularly ( $p < 0.05$ ) <sup>15</sup>. The children (aged 3 to 5 years) made 157 negative comments during the pressure sessions, compared to 30 negative comments during the no pressure sessions <sup>15</sup>. In a retrospective analysis, college students recalled a childhood experience of being pressured to eat and this was usually associated with negative feelings (predominantly anger), memories of conflict and a current dislike for that food (72%) <sup>16</sup>. Therefore, parents' child-feeding behaviours may have long term effects as well as immediate ones.

Another observational study found that girls who experienced parental 'restriction' of snack foods (as reported by parents and girls) were more likely to consume those snack foods immediately after a meal, when they claimed not to be hungry ( $p < 0.05$ )

<sup>17</sup>. Girls were given free access to ten snack foods (sweet and savoury) for ten minutes. Afterwards, half of the girls felt that they had eaten too many snacks and 44% felt bad about it <sup>17</sup>. It is possible that parents who restrict snack foods do so in response to their child's tendency to eat snacks in the absence of hunger; or conversely, that parental restriction promotes (unintentionally) this type of behaviour. Further studies which support this bi-directional relationship will be discussed, in relation to child weight, later in the review.

Some of these studies relied on parental reporting of child-feeding behaviours and therefore may be subject to recall bias <sup>12-14</sup>. Most also had predominantly White samples (some were limited to two-parent families of high socio-economic status) and so their results may not be generalisable to other groups <sup>2 13 14 17</sup>. Cross-sectional studies do not determine causality, so it is not clear whether parents child-feeding behaviours influence children's eating habits or vice versa. For example, parents of children who are fussy eaters may adopt pressuring behaviours; or children who are pressured by their parents may become fussy eaters. Nevertheless, they highlight a wide range of child-feeding behaviours used by parents, which may influence children's dietary intake – sometimes in unintended ways – and possibly also their emotions.

### ***How do parent's child-feeding behaviours influence child weight?***

A US cross-sectional study (2000) found that mothers with one obese child and one non-obese child reported similar control over feeding for both siblings <sup>18</sup>. However, a number of subsequent studies have shown links between child-feeding behaviours and child weight; including monitoring, control and pressure to eat <sup>19-26</sup>. For some of these behaviours, the results have been inconsistent.

A US longitudinal study found that parental monitoring of fat intake at age 5 predicts lower BMI at age 7, when BMI at age 3 was accounted for; but only among children with low genetic risk of overweight ( $p < 0.05$ ) <sup>19</sup>.

In a UK longitudinal study, maternal control of solid food intake moderated infant weight gain in the first year of life <sup>20</sup>. High maternal control was associated with

consistent weight gain throughout the year, whereas low to moderate maternal control was associated with either slow growth (first 6 months) followed by catch-up growth (second 6 months) or vice versa<sup>20</sup>. Therefore, it seems that infants have a natural ability to self-regulate their feeding and weight gain, so maternal control at this age is unnecessary and may be counterproductive<sup>20</sup>. In older girls, paternal control has been linked to higher percentage body fat<sup>21</sup>. However, other studies found an inverse relationship between parental control and child BMI<sup>22 23</sup>.

In cross-sectional studies, maternal pressure to eat has been positively correlated with children's total fat mass ( $p < 0.001$ )<sup>24</sup>; but also inversely correlated with children's BMI ( $p < 0.001$ )<sup>25</sup>. In a longitudinal study, maternal pressure to eat was associated with high fat intake in girls, even when BMI was adjusted for ( $p < 0.05$ ); and high fat intake was associated with greater increase in BMI between 5 and 7 years of age, even when BMI at age 5 was adjusted for ( $p < 0.05$ )<sup>26</sup>.

In the context of childhood overweight and obesity, restriction has most frequently and consistently been associated with child weight gain<sup>27</sup>. Indeed, we found four longitudinal studies and three experimental studies whose results support this relationship. All of these studies were US based, with pre-school to primary age children. The term 'restriction' may refer to general dietary intake or specific snack food intake; and this varies between studies.

Longitudinal studies demonstrate associations between parental restriction and child weight over time. Lee et al. found that maternal restriction was associated with high fat intake in girls, even when BMI was adjusted for ( $p < 0.05$ ); and high fat intake was associated with greater increase in BMI between 5 and 7 years of age, even when BMI at age 5 was adjusted for ( $p < 0.05$ )<sup>26</sup>. Fisher and Birch found that girls who ate large amounts of snack food 'in the absence of hunger' (i.e. immediately after a meal) were 4.6 times as likely to be overweight at ages 5 and 7 years ( $p < 0.01$ )<sup>28</sup>. This eating behaviour was associated with parental restriction at age 5. Faith et al. found that parental restriction of food intake at age 5 predicted higher BMI at age 7, even when BMI at age 3 was adjusted for; but only among children with high genetic risk of overweight ( $p < 0.05$ )<sup>19</sup>. They used mothers' pre-pregnancy weight to indicate genetic risk, but this has some associated problems because mothers' weight is affected by environmental as well as genetic factors. Francis and Birch compared the effects of

restriction by overweight and normal weight mothers<sup>29</sup>. They found that restriction at age 5 predicted daughters' 'eating in the absence of hunger' from age 5 to 9 ( $p < 0.05$ ), which predicted daughters' BMI increase from age 5 to 9 ( $p < 0.05$ ); for overweight mothers only<sup>29</sup>. Therefore, it is possible that maternal weight may influence mothers' approach to using restriction and consequently the outcome.

The strongest evidence for a causal relationship between restriction and child weight comes from experimental studies conducted by Fisher and Birch. They found that children made more requests for, comments about and attempts to obtain a palatable snack food over a five week period of restriction, compared with a similar snack food that was not restricted ( $p < 0.01$ )<sup>30</sup>. In other words, their behavioural response to the restricted food was greater. Furthermore, in a series of 15 minute snack sessions, children's behavioural response to, selection of and intake of a well-liked snack food were greater during restricted sessions (free access for 5 minutes only) than during unrestricted sessions (free access for the full 15 minutes), compared with a similar snack food that was available throughout the sessions ( $p < 0.001$ ,  $p < 0.001$ ,  $p < 0.01$ )<sup>30</sup>. For girls only, maternal restriction was associated with greater snack food intake immediately after a meal, despite claiming to be full after the meal ( $r = 0.59$ ,  $p < 0.01$ )<sup>31</sup>. Finally, they found that maternal restriction predicted daughters' inability to regulate snack food intake ( $\beta = 0.26$ ). This eating behaviour was associated with daughters' energy intake ( $\beta = 0.19$ ), which itself predicted daughters' weight ( $\beta = 0.24$ )<sup>32</sup>.

The longitudinal and experimental studies also relied on parental self-reporting of restriction<sup>19 26 28 29 32</sup> and had homogenous samples of White, two-parent families<sup>19 26 28-32</sup>. Despite these limitations, their results provide strong support for a causal pathway between parental restriction and childhood overweight. Only one cross-sectional study found no significant relationship between parental restriction (of favourite foods) and child weight<sup>25</sup>.

A number of inter-related mechanisms have been proposed. Restriction of palatable foods may have the undesired effect of drawing attention to them and increasing children's desire for them<sup>30 33</sup>. Therefore, children may be more likely to seek and consume restricted foods when they are outside of parental control. Children may become overexcited when restricted foods are available, so that self-control is not exercised and eating becomes frenzied<sup>30 31</sup>. Children may not develop the essential

awareness of hunger and satiety, which enables them to regulate their own food intake <sup>13 33</sup>. Instead, a pattern of 'eating in the absence of hunger' may develop, similar to eating behaviours observed in overweight adults <sup>28</sup>.

It has been acknowledged that the relationship is likely to be bi-directional; that is, parents may adopt child-feeding behaviours in response to child weight, or perceived child weight <sup>19 26 28 29 31 32 34-36</sup>. However, results from the longitudinal and experimental studies show that restriction may precede child weight gain and furthermore may cause children to put on weight. Restriction has also been linked to various maternal characteristics, including dietary restraint, concern about own weight, concern about child's weight, perception of daughter's risk of overweight and level of education (all positive associations at the 5% or 1% significance level) <sup>24 30-32 37 38</sup>. Therefore, it is likely that other factors, as well as child weight, may lead parents to adopt this particular child-feeding behaviour – consciously or unconsciously. Similarly, other child-feeding behaviours have been associated with parent and child factors, including maternal weight, breastfeeding, child temperament and income <sup>20 39</sup>.

Many of the studies reviewed used samples of girls only, or found more significant associations for girls <sup>17 21 23 26 28 29 31 32</sup>. For example, in a sample of 36 boys and 35 girls, maternal restriction of snack foods predicted greater intake of snack foods immediately after a meal (i.e. in the absence of hunger) for girls only <sup>31</sup>. These gender differences may reflect generic differences between boys and girls, or may reflect gender bias in parents' child-feeding behaviours <sup>21</sup>. Parents may need to be aware that their child-feeding behaviours could have a greater impact on girls.

## ***Discussion***

### **Main findings of this study:**

These studies provide evidence for a relationship between parents' child-feeding behaviours, children's dietary intake and child weight. The evidence is inconsistent for some behaviours and bi-directionality is likely for all behaviours. Restrictive behaviours are best represented in the literature; nine studies found a positive association between parental restriction (of dietary intake or specific snack food intake) and either dietary intake, child weight or both <sup>17 19 26 28-32 37</sup>. Four of these

studies provide evidence for a causal relationship, where restrictive behaviour preceded weight gain <sup>19 26 28 29</sup>. Other child-feeding behaviours have not been linked to child weight longitudinally.

### **What is already known on this topic:**

Although parents may use child-feeding behaviours with the intention of modifying children's dietary intake <sup>2</sup>, and possibly even their weight, there is evidence to suggest that certain child-feeding behaviours may have unintended consequences for child weight. In the case of overweight children, or children perceived as overweight, parents who attempt to restrict dietary intake in order to manage their child's weight may in fact make matters worse.

In the White Paper 'Choosing Health' (2004), the UK government stated its objective "to halt, by 2010, the year-on-year increase in obesity among children under 11" by providing "information, guidance and practical support for parents" <sup>40</sup>. Various health campaigns have been launched and initiatives implemented, most of which focus on improving nutrition knowledge and awareness of healthy eating guidelines <sup>10 11</sup>. Whilst there is support for a link between parents' nutrition knowledge and child weight <sup>8 9</sup>, longitudinal studies are needed as causality has not been established. Nutrition knowledge has also been associated with socio-economic variables, including level of education <sup>41 42</sup>. Therefore, current interventions may be more effective in some families, where parents are well-educated and information may be better understood and applied, but less effective in less well-educated groups.

### **What this study adds:**

This review draws together previous research on parents' child-feeding behaviours and how they influence children's dietary intake and child weight. The main focus of the review is behaviours associated with child weight gain, given the increasing prevalence of childhood overweight and obesity. Child-feeding behaviours have not been addressed in UK childhood obesity policy. A substantial body of evidence suggests that parental restriction of snack foods may be counterproductive; leading to uninhibited eating and weight gain, particularly for girls. Other parent behaviours may also interfere with children's ability to self-regulate their weight.

### **Limitations of this study:**

The value of this review is limited by the nature of the studies included. The majority were conducted in the US and over half had predominantly or exclusively White samples. Studies with more diverse samples included Hispanic, Mexican-American and African-American groups, which are not representative of the UK population. Further UK research is needed to understand the distribution and influence of parents' child-feeding behaviours in our ethnically diverse population. Longitudinal studies will be necessary to determine causal relationships with child weight. Differences between socio-economic groups also need to be explored further, as level of education and income have been identified as contributory factors<sup>38 39</sup>.

Child-feeding behaviours were assessed using a variety of techniques and instruments, making comparisons between studies difficult. Self-reporting by parents and children cannot be assumed to be accurate; whereas experimental studies provide accurate observations, but do not necessarily simulate normal parent-child interactions. However, the variety of methods used gives this review a broad perspective. Alternative instruments may be needed for UK minority populations, where concern about child weight may not determine parents' child-feeding behaviours<sup>43</sup>.

## ***Conclusion***

Given the considerable evidence for adverse effects of restriction, we believe that parents' child-feeding behaviours should receive more attention in childhood obesity policy. We recommend that parents should be provided with information and guidance on **how**, as well as **what**, to feed their children; particularly aimed at parents who are concerned about their child's weight. Practical support may also be necessary in some cases.

As an alternative to restriction, Satter recommends a "division of responsibility" whereby parents make healthy foods available and allow children to decide how much to eat<sup>44</sup>. This may be counterintuitive for some parents, whose parenting style is more controlling; but children must learn to regulate their own intake, by responding to internal hunger and satiety cues. At the very least, parents should be

made aware of the likely consequences of inappropriate child-feeding behaviours, in order that they do not inadvertently promote excess weight gain.

We propose that the next step is to find ways of communicating messages about child-feeding behaviours to parents. We acknowledge that child-feeding behaviours, like nutrition knowledge and obesity, may be associated with socio-economic status and ethnicity <sup>34</sup>. Therefore, intervention studies are needed to identify approaches that are effective across socio-economic and ethnic groups; or indeed different approaches for different groups.

### ***Acknowledgements***

We would like to thank the Leverhulme Trust for funding this study as part of the Changing Families, Changing Food research programme.

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## ***Appendix***

### Example search strategy

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1. Obesity/ or overweight/
  2. Obesity\$
  3. Overweight\$
  4. 1 or 2 or 3
  5. Child\$
  6. 4 and 5
  7. Knowledge/ or health knowledge, attitudes, practice/
  8. Healthy eating\$
  9. Nutrition\$
  10. 8 or 9
  11. 7 and 10
  12. Parent\$
  12. 11 and 12
- 

### **Table I. Summary of research on child-feeding behaviours**

Authors (date published)	Type of study	Country	N	Child age range (mean)	Ethnicity of sample	Definition of childhood overweight or obesity	Methods used to assess parents/adults	Methods used to assess children	Key findings
Klesges et al. (1991) <sup>2</sup>	Observational	USA	53	4 to 7 (5.3) years	98% White	Overweight $\geq$ 75 <sup>th</sup> percentile	BMI + demographic questionnaire	BMI + observation	Children selected healthier foods when mothers were monitoring ( $p < 0.05$ )
Sherry et al. (2004) <sup>12</sup>	Qualitative	USA	101	2 to 4 years	50 White 27 Hispanic 24 African American	N/A	Focus groups incorporating Child Feeding Questionnaire	N/A	Mothers reported using control, restriction, pressure to eat and food as a reward or bribe
Baughcum et al. (1998) <sup>13</sup>	Qualitative	USA	14	12 to 36 months	9 White	N/A	Focus groups	N/A	Mothers reported using food to shape behaviour in various settings
Bourcier et al. (2003) <sup>14</sup>	Cross-sectional	USA	282	0 to 17 years	85% White	N/A	Questionnaire	N/A	Reliance on self strategies were most used and predicted lower fat intake ( $p < 0.05$ )
Galloway et al. (2006) <sup>15</sup>	Experimental	USA	27	3 to 5 (4.0) years	19 White 6 Asian 2 Hispanic	N/A	Child Feeding Questionnaire	Pressure and no pressure conditions + behavioural observations + BMI	Children accustomed to parental pressure to eat responded less to pressure in the experiment ( $p < 0.05$ ) Children 157 made negative comments whilst being pressured to eat
Batsell et al. (2002) <sup>16</sup>	Retrospective	USA	140 S	16 to 46 (19.1) years	Unknown	N/A	N/A	Forced Consumption Questionnaire	Students associated pressure to eat in childhood with negative feelings, memories of conflict and a current dislike for that food
Fisher and Birch (2000) <sup>17</sup>	Observational	USA	158	4.6 to 6.4 years	Non-Hispanic	N/A	Questionnaire + interview	Questionnaire + interview + weighed intake of snack foods	Parental restriction was associated with daughters' EAH and negative feelings e.g. having eaten too much
Saelens et al. (2000) <sup>18</sup>	Cross-sectional (discordant sibling comparison)	USA	18 P 36 C	7 to 12 (10) years	100% White	Obese $\geq$ 85 <sup>th</sup> percentile	Child Feeding Questionnaire + Three Factor Eating Questionnaire + Hollingshead index of social class + BMI	BMI	Mothers reported similar control over obese and non-obese siblings' food intakes, despite perceiving differences in their ability to regulate food intake ( $p < 0.01$ )

Authors (date published)	Type of study	Country	N	Child age range (mean)	Ethnicity of sample	Definition of childhood overweight or obesity	Methods used to assess parents/adults	Methods used to assess children	Key findings
Faith et al. (2004) <sup>19</sup>	Longitudinal	USA	57	3, 5 and 7 years	100% White	N/A	Child Feeding Questionnaire + pre-pregnancy weight	BMI	Restriction at age 5 predicted higher BMI at age 7 for children with high genetic risk of overweight (p<0.05) Monitoring at age 5 predicted lower BMI at age 7 for children with low genetic risk of overweight (p<0.05)
Farrow and Blissett (2006) <sup>20</sup>	Longitudinal	UK	69	Birth to 1 year	Unknown	N/A	Infant Characteristics Questionnaire + meal time observations recorded using video camera	Weight	Infants self-regulated their weight gain in the first year of life, except when maternal control of food intake was high
Johannsen et al (2006) <sup>21</sup>	Cross-sectional	USA	211 P 148 C	3 to 5 years	Unknown	N/A	BMI + Three Factor Eating Questionnaire + Child Feeding Questionnaire	BMI + percentage body fat	Girls with more controlling fathers had higher percentage body fat
Faith et al. (2003) <sup>22</sup>	Cross-sectional	USA	1790	3 to 6 years	18% Hispanic 30% African American 52% White	Overweight ≥ 85 <sup>th</sup> percentile	3 interview questions + BMI	BMI	Maternal control was associated with lower child BMI after adjusting for maternal BMI (p<0.05)
Robinson et al. (2001) <sup>23</sup>	Cross-sectional	USA	792	8 to 9 years	Diverse 44% White	N/A	Interview + questionnaire	BMI + skinfold thickness	Parental control was inversely associated with BMI for girls only (p<0.05)
Spruijt-Metz et al. (2002) <sup>24</sup>	Cross-sectional	USA	120	7 to 14 (11) years	74 White 46 African American	N/A	Child Feeding Questionnaire + interview + Hollingshead index of social class	24 hour food diary + body composition	Pressure to eat and concern about child's weight were both positively correlated with child's total fat mass (p<0.001)

Authors (date published)	Type of study	Country	N	Child age range (mean)	Ethnicity of sample	Definition of childhood overweight or obesity	Methods used to assess parents/adults	Methods used to assess children	Key findings
Matheson et al. (2006) <sup>25</sup>	Cross-sectional	USA	108	(9.6) years	100% Mexican-American	N/A	Child Feeding Questionnaire + demographic questions	BMI + 24 hour dietary recalls	Maternal pressure to eat was inversely correlated with child BMI ( $p<0.001$ ); maternal restriction was not associated with children's dietary intake or weight
Lee et al. (2001) <sup>26</sup>	Longitudinal	USA	192	5 and 7 years	99% White	N/A	Food Frequency Questionnaire + Child Feeding Questionnaire	BMI + skinfold thickness + 24 hour food diary	Maternal restriction and pressure to eat were associated with high fat intake in girls ( $p<0.02$ ) Girls with high fat intake gained more weight between ages 5 and 7 ( $p<0.05$ )
Fisher and Birch (2002) <sup>28</sup>	Longitudinal	USA	192 (girls only)	5 and 7 years	100% White	Overweight $\geq$ 85 <sup>th</sup> percentile	Child Feeding Questionnaire	BMI + free access experiment + interview	Parental food restriction at age 5 was associated with EAH at age 7 ( $p<0.05$ ) EAH was associated with overweight ( $p<0.01$ )
Francis and Birch (2005) <sup>29</sup>	Longitudinal	USA	171	5 to 9 years	100% White	N/A	BMI + Child Feeding Questionnaire	BMI + free access experiment + interview	Restriction at age 5 predicted daughters' EAH between ages 5 and 9 ( $p<0.05$ ) which predicted greater increase in BMI from 5 to 9 ( $p<0.05$ ) for overweight mothers only
Fisher and Birch (1999) <sup>30</sup>	Experimental	USA	31	3 to 5 years	80% White	N/A	BMI + Eating Inventory Questionnaire + restriction questions	Food restriction experiments + observation + BMI	Restriction of palatable snack food increased behavioural response to, selection of and intake of that food ( $p<0.01$ )
Fisher and Birch (1999) <sup>31</sup>	Experimental	USA	71	3 to 5 years	85% White	N/A	BMI + Three Factor Eating Questionnaire + restriction questions	Interview + BMI + skinfold thickness + free access experiment	Maternal restriction was associated with greater snack food intake after a meal for girls only ( $p<0.01$ )

Authors (date published)	Type of study	Country	N	Child age range (mean)	Ethnicity of sample	Definition of childhood overweight or obesity	Methods used to assess parents/adults	Methods used to assess children	Key findings
Birch and Fisher (2000) <sup>32</sup>	Experimental	USA	156	4.6 to 6.4 (5.2) years	Non-Hispanic	N/A	BMI + Eating Inventory Questionnaire + Child Feeding Questionnaire + Restricted Access Questionnaire	COMPX procedure + free access procedure + 24 food recalls + BMI	Maternal restriction predicted daughters' inability to regulate energy intake ( $\beta=0.26$ ) which predicted high energy intake ( $\beta=0.19$ ) which predicted daughters' weight ( $\beta=0.24$ )
Spruijt-Metz et al. (2006) <sup>34</sup>	Longitudinal	USA	121	10.9 $\pm$ 1.7 years at baseline, follow up 2.7 years	61% White 39% African American	N/A	Child Feeding Questionnaire + Hollingshead index of social class	Total fat mass + total lean mass	Mothers' concern about child's weight was associated with slower increase in total fat mass over time for white children only
Wardle et al. (2002) <sup>36</sup>	Cross-sectional	United Kingdom	214	3.8 to 5.3 (4.4) years	Majority White	According to IOTF cut off points	BMI + Parental Feeding Style Questionnaire	BMI + % body fat	Obese mothers reported less control than normal weight mothers ( $p=0.01$ )
Francis et al. (2001) <sup>37</sup>	Cross-sectional	USA	196	5 (5.4) years	100% White	N/A	Child Feeding Questionnaire + other questions + BMI	BMI + skinfold thickness	Mothers used restriction when concerned about daughters' weight and when daughters were heavier ( $p<0.05$ )
Hupkens et al. (1998) <sup>38</sup>	Cross-national	Germany Belgium Netherlands	849	4 to 14 (8.3) years	Majority White	N/A	Questionnaire	N/A	Higher class mothers restricted more foods than lower class mothers ( $p<0.01$ )
Baughcum et al (2001) <sup>39</sup>	Cross-sectional	USA	453 and 634	11 to 23 (16.2) months and 23 to 60 (39.5) months	23% non White and 19% non White	Overweight $\geq$ 90 <sup>th</sup> percentile	Infant Feeding Questionnaire + Preschooler Feeding Questionnaire + BMI + income	BMI	Infant and child-feeding behaviours were not related to child weight but were related to income ( $p<0.001$ )

N = number of parent-child dyads (unless otherwise stated; P = parents, C = children, S = students)

IOTF = International Obesity Task Force (age and gender specific cut off points for childhood overweight and obesity)<sup>45</sup>

EAH = eating in the absence of hunger

N/A = not applicable