

Running head: FOOD AVOIDANCE EATING BEHAVIOURS IN CHILDREN

Food avoidance in children: the influence of maternal feeding practices and behaviours

Faye C Powell<sup>1</sup>

Claire V Farrow, Ph.D. <sup>1</sup>

Caroline Meyer, Ph.D. <sup>1</sup>

<sup>1</sup> School of Sport, Exercise & Health Sciences, Loughborough University, UK.

All correspondence should be addressed to [c.v.farrow@lboro.ac.uk](mailto:c.v.farrow@lboro.ac.uk) (Dr Claire Farrow),  
Loughborough University Centre for Research into Eating Disorders, School of Sport,  
Exercise & Health Sciences, Loughborough University, Leicestershire. LE11 3TU. UK.

Tel +44(0)1509228487. England

**Abstract**

The aim of this study was to examine the contribution of a broad range of maternal feeding practices in predicting parental reports of food avoidance eating behaviours in young children, after controlling for child temperament, and maternal dietary restraint which have previously been associated with feeding problems. One hundred and eight mothers of children aged between 2-6 years completed self report measures of their child's eating behaviour and temperament, maternal dietary restraint and child feeding practices. Maternal reports of food avoidance eating behaviours were associated with an emotional child temperament, high levels of maternal feeding control, using food for behaviour regulation and low encouragement of a balanced and varied food intake. Maternal feeding practices, predominantly pressure to eat, significantly predicted food avoidance eating behaviours after controlling for child emotionality and maternal dietary restraint. The significant contribution of maternal feeding practices, which are potentially modifiable behaviours, suggests that the feeding interactions of parents and their children should be targeted for the intervention and the prevention of feeding difficulties during early childhood. Future research should continue to explore how a broader range of feeding practices, particular those that may be more adaptive, might influence child eating behaviour.

**KEY WORDS:** feeding problems, eating behaviour, fussy eating, dietary restraint, temperament, emotionality, children, pressure, restriction, food avoidance, feeding practices

## Introduction

Feeding problems during early childhood are common (e.g., Coulthard & Harris, 2003; Lindberg, Bohlin, Hagekull, 1991), affecting around 25% to 35% of children (e.g., Benoit, 2000; Ramsay, Gisel, McCusker, Bellavance & Platt, 2002). Such problems are known to have adverse consequences for both children and their caregivers (Hagekull & Dahl, 1987) with prolonged difficulty in feeding sometimes resulting in growth faltering and cognitive and developmental delays (Chatoor, Egan, Geston, Menveille, & O'Donnell, 1988; Wright and Birks, 2000). In addition, feeding problems can demonstrate continuity from early childhood into mid-adolescence (McDermott, Mamun, Najman, Williams, O'Callaghan & Bor, 2010), and have been associated with the later development of eating disorders (Kotler, Cohen, Davies, Pine & Walsh, 2001; Marchi & Cohen, 1990). Understanding the factors that predict feeding problems in early childhood is therefore imperative. Whilst there is a growing body of literature investigating clinical feeding problems (E.g., Chatoor, 2002; Manikam & Perman, 2000; Nicholls, Chater, & Lask, 2000), far less is known about the wide range of feeding disturbances experienced in non-clinical community samples of children.

Many eating behaviours may be problematic for families and their children, one such behaviour is picky or fussy eating, characterised by children consuming an inadequate variety of foods through rejection of foods that are both familiar and unfamiliar to them (Dovey, Staples, Gibson & Halford, 2008; Galloway, Lee & Birch, 2003; Smith, Roux, Naidoo, & Venter, 2005). Clinical observations suggest that children who are fussy eaters also tend to eat small meals, to eat slowly, and to be less interested in food (Carruth, Ziegler, Gordon, & Barr, 1998; Marchi & Cohen, 1990; Reau, Senturio, Lebailly, & Christoffel, 1996); features which have been associated with lower weight gain (Marchi & Cohen, 1990; Wright & Birks, 2000) and essential nutrient deficiency (Galloway, Fiorito, Lee & Birch, 2005). Whilst these behaviours have largely been assessed clinically, psychometric alternatives are developing to allow these behaviours to be assessed in the general population (Wardle, Guthrie, Sanderson, Rapoport, 2001) and reports of food fussiness and low enjoyment of food have been identified in

underweight samples of children when compared to healthy and overweight groups (Viana, Sinde & Saxton, 2008; Webber, Hill, Saxton, Van Jaarsveld & Wardle, 2009). The Child Eating Behaviour Questionnaire (CEBQ; Wardle et al., 2001), a multi-dimensional measure designed to capture individual differences in aspects of eating style that contribute both to underweight and overweight, defines four avoidance eating behaviours that are related to lower food intake and lower weight status, such as food fussiness and slowness in eating. In line with other research that has used the CEBQ (e.g. Webber et al, 2009) the present paper considers children's eating behaviours using this taxonomy.

Research investigating the aetiology of feeding problems has explored the contribution of the caregiver and child in the evolution of feeding difficulties and the development of eating behaviours (e.g., Coulthard & Harris 2003; Farrow & Blisset, 2006). In recent years, the influence that parents can have on their children's dietary behaviour through food-related parenting practices has received particular attention (e.g., Kremers, Brug, de Vries and Engles, 2003). Feeding practices are the specific strategies that parents use in an attempt to maintain or modify their child's eating style and diet (Ventura & Birch, 2008). Controlling feeding practices are commonly reported in dyads with feeding problems (Sanders, Patel, Le Grice & Sheppard, 1993; Lindberg, Bohlin, Hagekull & Palmerus, 1996) and within the general population controlling feeding techniques, such as pressuring the child to eat and restricting food, have been associated with lower child fat mass (Spruijt-Metz, Cohen, Birch & Goran, 2006), decreased fruit and vegetable consumption (Fisher, Mitchell, Smiciklas-wright & Birch 2002; Wardle, Carnell & Cooke, 2005) and child dietary restraint (Carper, Fisher & Birch, 2000). However some studies have also found favourable associations between these feeding practices and child food intake (e.g., Zabinski et al., 2006) and others have found them to be associated with weight gain and over-eating (e.g., Fisher & Birch, 1999), therefore the relationship between maternal control and feeding problems remains unclear.

In addition, within this body of research literature, the focus has been primarily on two concepts of control: pressure to eat and restriction of food intake, despite evidence that there are

several other measurable aspects of feeding that may be related to child intake such as using food as a reward and feeding for emotion regulation (e.g., Orrell-Valente et al. 2007; Musher-Eizenman & Holub, 2007). Such feeding practices could be problematic; for example, rewarding a child for eating a disliked food can lead to a decline in the preference for that food, instead increasing the preference for the reward food (Newman & Taylor, 1992; Birch, Marlin & Rotter, 1984) which could exacerbate fussy eating behaviour and feeding problems by further decreasing children's preference and intake of a healthy and varied diet. Similarly the use of food for emotion regulation has been associated with consumption of sweet palatable foods in the absence of hunger (Blissett, Haycraft & Farrow, 2010). However less is known about how or if such aspects of feeding may be implicated in the aetiology or continuity of fussy eating and feeding problems. There is also paucity amongst the literature exploring the impact of more positive and adaptive feeding practices such as encouraging balance and varied food intake and providing a healthy food-related home environment (Musher-Eizenman & Holub, 2007). Further elucidation of this, particularly in young non-clinical samples is essential, as it could provide a better understanding of how to promote more successful feeding interactions and prevent negative feeding outcomes.

Previous research exploring the impact of the care-giving environment on child feeding has also pointed to the importance of maternal eating behaviours and attitudes in the feeding interactions and eating behaviours of their children (e.g., Ammaniti, Ambrozzi, Lucarelli, Cimino & D'Olimpio, 2004; Coulthard, Blissett & Harris, 2004; Blissett, Meyer & Haycraft, 2007; Stein, Woolley & McPherson 1999) and mothers' eating concerns have been associated with food refusal in girls (Blissett, Meyer & Haycraft, 2006) and lower child weight (Chatoor, Ganiban, Hirsh, Borman-Spurrell & Mrazek, 2000). In addition, whilst parents represent an essential influence on children's eating behaviours, children are not merely passive responders to parental influences and they significantly contribute to the feeding interaction (Cabanac, 1987; Carnell and Wardle, 2008a). Research has highlighted the influence that child temperament may have on eating behaviour and feeding problems (e.g., Farrow & Blissett,

2006; Hughes, Shewchuk, Baskin, Nicklas & Qu, 2008); Pulkki-Raback, Elovaini, Kivimaki, Raitakari, 2005) and there is evidence that temperamental characteristics in combination with other risk factors may increase later vulnerability to eating problems (Martin et al., 2000). Therefore, within the present study, the associations between maternal dietary restraint and child temperament with child food avoidance eating behaviours will also be explored and controlled for.

In summary, given the negative outcomes associated with fussy eating and feeding problems (e.g., Chatoor et al., 1988; Galloway et al., 2005; Wright and Birks, 2000), and evidence that they can persist across childhood (e.g., Kotler et al., 2001; Marchi & Cohen, 1990; McDermott et al., 2010) more research in non-clinical samples during early childhood is essential. Previous research has begun to highlight the importance of both child temperament (e.g., Farrow & Blissett, 2006; Hughes et al., 2008) and parents own eating (e.g., Coulthard et al., 2003; Blissett, Meyer & Haycraft, 2007) in predicting feeding problems, however despite growing evidence that parental feeding practices are highly influential (Fisher et al., 2002; Sanders et al., 1993; Spruijt-Metz, et al., 2006; Wardle et al., 2005) no research to date has investigated how a comprehensive and broad range of feeding practices may predict child food avoidance over and above the contribution of the other child and parent factors. Such investigation is essential as whilst intrinsic child characteristics such as temperament and parents eating attitudes are largely stable and enduring, feeding practices represent an area that is potentially modifiable that could be targeted for prevention and intervention.

The aim of the present study was to examine the contribution of a broader range of maternal feeding practices than have been previously explored, in predicting parental reports of food avoidance eating behaviours in young children, after controlling for child temperament and maternal dietary restraint which have previously been associated with child feeding. Replicating previous research it was hypothesised that more emotional and shy children, with mothers who reported higher dietary restraint, would report higher levels of child food avoidance eating behaviours. It was also hypothesised that maternal use of controlling feeding practices and

using food to modify or regulate behaviour, would be positively correlated with reports of food avoidance, whereas more adaptive practices such as, provision of a healthy environment and encouragement to consume balance and varied foods, would be negatively correlated with reports of food avoidance eating behaviours. It was finally hypothesised that parental feeding practices would predict reports of child food avoidance eating behaviours after controlling for the contribution of child temperament and maternal dietary restraint.

## **Methods**

### **Participants**

One hundred and eight mothers (mean age 37.18 years; SD=5.76) of children aged between 2-6 years (mean age was 5.11 years, SD = 5.76) completed a set of standardised questionnaires. There were 56 mothers of boys and 43 mothers of girls (gender of 9 children not disclosed). The mothers mean age was 37.18 years (SD= 5.76). The mean maternal years of post-16 education was 3.63 (SD=2.40) and 89% of the mothers in this sample described themselves as White British.

One hundred and four mothers self reported their height and weight, and maternal mean BMI was 23.78 (SD= 4.75). Mothers were, generally, of average weight as defined by body mass index, BMI < 25, (World Health Organization, 1998) with 26% of mothers overweight or obese (BMI > 25, WHO 1998). BMI Z scores for children were calculated using the Child Growth Foundation's growth references which adjust for age and gender (Child Growth Foundation, 1996). The mean BMI Z-score was -.01 (SD 1.78), close to 0 reflecting the average standardised BMI. Using Cole et al's standard definitions for overweight and obesity corrected for age and gender (Cole, Bellizzi, Flegal, & Dietz, 2000), 13% of the sample who provided child BMI data had children who were overweight or obese.

## Measures

Following ethical approval, questionnaire packs were distributed via nurseries/schools to parents of children within the 2-6 year age range. Participants provided background information about their age, height, weight, education and occupation, as well as their child's gender, date of birth, height and weight. Mothers then completed the following self-report measures:

**The Child Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson & Rapoport, 2001).** Parents completed the four 'food avoidance' subscales of the CEBQ; a parent-report questionnaire designed to assess their child's eating styles (Wardle et al., 2001). Parents' were asked to rate the frequency with which their child exhibits a range of behaviours using a 5 point likert scale ranging from never (1) to always (5), with higher scores indicating a greater prevalence of that behaviour. The food avoidance subscales assess Food fussiness (e.g., 'my child refuses new foods at first'); Slowness in eating (e.g., 'my child eats more and more slowly during a meal'); Emotional under-eating (e.g., 'my child eats less when upset') and Satiety responsiveness (e.g., My child gets full up easily).

The CEBQ has been widely used and has been shown to have good test-retest reliability ( $r = .52 - .87$ ), stability over time and internal validity with Cronbach's  $\alpha$  ranging from .72 - .91 (Carnell & Wardle, 2007; Wardle et al., 2001). Its scales have also been found to correlate well with behavioural measures (Carnell & Wardle, 2007) and they are related to lower food intake and lower weight status (e.g., Viana et al., 2008; Webber et al., 2009), they are also stable in children aged 4-11 years old (Ashcroft, Semmier, Carnell, Van Jaarsveld & Wardle, 2008). Analysis of reliability within the present sample revealed good mean Cronbach's  $\alpha$  of .85.

**Comprehensive Feeding Practices Questionnaire (CFPQ; Musher-Eizenman & Holub, 2007).** Parents completed 8 subscales of the CFPQ; a self report measure of 12 dimensions of the feeding practices of parents of young children (Musher-Eizenman & Holub, 2007). Parents completed the following 8 subscales categorised into 3 areas; Control (pressure to eat, restriction for health, restriction for weight control, monitoring), Use of Food for

Behaviour Regulation (using food to regulate child emotional states and using food as a reward) and Environment (encouraging balance and varied food intake and providing a healthy environment). Parents responded on a 5 point likert scale from 1 (never) to 5 (very often); with higher scores indicating a greater prevalence of that feeding practice. The psychometric properties of the CFPQ have been demonstrated; the mean internal reliability for the 12 dimensions of parent behaviour in the CFPQ is .73 (.58–.87) and the scales have good convergent and discriminate validity (Musher-Eizenman et al., 2009). Analysis of reliability within the present sample revealed a good mean Cronbach's  $\alpha$  of .71.

**The Child Temperament Questionnaire (EAS; Buss & Plomin 1984).** Parents completed the parent rated EAS Temperament Survey for Children (Buss & Plomin, 1984) to measure four dimensions of child temperament; emotionality, shyness, activity, and sociability. Emotionality reflects a tendency to become aroused easily and intensely (e.g., 'child tends to be somewhat emotional'); activity reflects high levels of activity and speed of actions (e.g., 'child is always on the go'); sociability reflects the tendency to prefer the presence of others rather than being alone (e.g., 'child likes to be with people') and shyness reflects the tendency to be inhibited and awkward in new social situations (e.g., 'child tends to be shy'). Parents' were asked to rate their children using a 5-point Likert scale (ranging from 'not typical' to 'very typical'), with higher scores reflecting a higher level of each temperament indicator. The EAS for children has been shown to have satisfactory internal consistency (mean .83) and test-retest reliability (.58 - .80) (Buss & Plomin, 1984). Analysis of reliability within the present sample revealed good mean Cronbach's  $\alpha$  of .78.

**Dutch Eating Behaviour Questionnaire – Restraint Scale; Van Strien, Frijters, Bergers, Defares, 1986).** Parents' completed the Restraint subscale from the Dutch Eating Behaviour Questionnaire (DEBQ-R; Van Strien et al., 1986) to assess dieting behaviour (e.g., 'Do you try to eat less at mealtimes than you would like to eat?'). Participants responded on a 5 point likert scale from 1 (never) to 5 (very often); with higher scores indicating a greater prevalence of that behaviour. This measure has been shown to display good internal

consistency, factorial validity and dimensional stability (e.g., Van Strien, Herman, Verheijden, 2009). Analysis of reliability within the present sample revealed an excellent Cronbach's  $\alpha$  of .92

### **Data Analysis**

Preliminary analysis of the data using Kolomogorov-Smirnov tests indicated the data was largely non-normally distributed, consequently where possible non-parametric statistics were used. After descriptive statistics were performed to evaluate the nature of the sample, the data was screened to assess any relationships between demographic factors and feeding variables. These analyses were carried out using a series of Mann-Whitney tests and two-tailed Spearman's rho correlations to ensure sufficient homogeneity to allow collapsing of the sample for the analysis. A series of Spearman's two-tailed correlation analyses revealed no significant correlations between child eating behaviour and the demographic variables of parent age, parent and child BMI, child birth order, maternal socioeconomic status and education level (all  $p < .05$ ). Therefore these demographic variables were not controlled for in further analysis. However, younger children were slower to eat ( $r = -.225$ ,  $p < .05$ ) and more fussy ( $r = -.229$ ,  $p < .05$ ) than older children. Mann-Whitney tests indicated that there were no statistically significant differences between male and female children in their satiety responsiveness, slowness in eating or emotional under-eating, or in their parents feeding practices. However, mothers reported significantly higher levels of food fussiness for male children ( $U = 854.00$ ,  $z = -2.48$ ,  $p = .013$ , two-tailed), therefore, where significant, both child age and gender were controlled for in further analysis.

Next, a combination of two-tailed partial correlations, controlling for age and gender, and two-tailed Spearman's rho correlations were used to explore the relationships between child eating behavior with parental feeding practices, child temperament and parental restraint. Finally, hierarchical multiple regressions (enter method) were performed to evaluate the contribution of parental feeding practices to predict child food avoidance eating behaviour after

controlling for child age, gender, temperament and maternal dietary restraint. Only the significant correlates identified in the correlation matrices were entered into the regression analyses. The use of multiple regressions was deemed satisfactory as inspections of the residuals demonstrated normality distributions and homoscedasticity (Field, 2005) and no multicollinearity (Bowerman & O'Connell, 1990; Myers, 1990).

## **Results**

### **Descriptive statistics**

Descriptive statistics for the questionnaires completed by caregivers are shown in Table 1. Mean scores for the CEBQ, CFPQ, EAS, DEBQ and are similar to other published data in similar samples (e.g., Mathieus & Tambs, 1999; Musher-Eizenman & Holub, 2007; Wardle et al., 2001; Van Strein, et al., 1986).

-----

Insert Table 1 here

-----

### ***Correlation Analyses; Relationships between child and maternal variables with child food avoidance eating behaviour***

Table 2 shows the correlations between child temperament, parental dietary restraint and parental feeding practices with child food avoidance eating behaviour

-----

Insert Table 2 here

-----

Mothers who reported more child food fussiness reported using significantly more restriction of foods for health reasons, less maternal monitoring of food intake and less encouragement to consume balance and varied food intake, and they reported a more emotional child temperament and higher levels of dietary restraint themselves. Mothers who reported that their child ate slowly reported using significantly more pressure to get their child to eat and that their child had a more emotional temperament. Mothers who reported more child emotional under-eating reported using significantly more pressure to get their child to eat, restriction of foods for health reasons, using food to regulate the child's emotional state and using food as a reward and reported less encouragement of a balanced and varied diet. Mothers who reported more child satiety responsiveness reported using significantly more pressure to get their child to eat and using food as a reward, less encouragement of a balanced and varied diet and they reported a more emotional child temperament and higher levels of dietary restraint themselves.

#### ***Predictors of child food avoidance eating behaviours***

Four hierarchical multiple regressions (enter method) were performed to evaluate the contribution of parental feeding practices to predict child food avoidance eating behaviours, after controlling for child age, gender, temperament and maternal dietary restraint where significantly related to the dependent variable of interest. Child age, gender and temperament were entered in step 1, parental dietary restraint was entered in step 2 and parental feeding practices were entered in step 3. Only significant correlates were used in these analyses.

***Predictors of maternal reports of child food fussiness.*** In step 1, child age, gender and emotionality significantly predicted maternal reports of child food fussiness: Adjusted  $R^2 = .17$ ,  $F(3, 93) = 7.684$ ;  $p < .001$ . In step 2, maternal dietary restraint significantly added to the regression: Adjusted  $R^2 = .26$ ,  $F(4, 92) = 9.33$ ,  $R^2$  change =  $.09$ ,  $p < .001$ . In step 3, maternal restriction of food intake, monitoring and low encouragement of balance and variety significantly added to the regression: Adjusted  $R^2 = .39$ ,  $F(7, 89) = 9.74$ ;  $R^2$  change =  $.13$ ,

$p < .001$ . The final model was significant and the child being male  $\beta = -.33$ ,  $t(87) = -3.82$ ,  $p < .001$ , and having a more emotional temperament  $\beta = .18$ ,  $t(87) = 2.16$ ,  $p < .05$ , and mothers reporting higher levels of dietary restraint themselves  $\beta = .34$ ,  $t(87) = 4.01$ ,  $p < .001$ , and higher levels of restriction of child food intake  $\beta = .25$ ,  $t(87) = 3.08$ ,  $p < .005$  and lower encouragement of balanced and varied food intake  $\beta = -.23$ ,  $t(87) = -2.66$ ,  $p < .01$  were significant individual predictors of child food fussiness.

***Predictors of maternal reports of child slowness in eating.*** In step 1, child age and emotionality significantly predicted maternal reports of child slowness in eating: Adjusted  $R^2 = .10$ ,  $F(2, 103) = 6.48$ ;  $p < .005$ . In step 2, maternal pressure to get their child to eat significantly added to the regression: Adjusted  $R^2 = .12$ ,  $F(3, 102) = 5.98$ ;  $R^2$  change =  $.02$ ,  $p = .001$ . The final model was significant and a more emotional child temperament  $\beta = .22$ ,  $t(102) = 2.36$ ,  $p < .05$  and mothers use of pressure to get their child to eat  $\beta = .20$ ,  $t(102) = 2.13$ ,  $p < .05$  were significant individual predictors of child slowness in eating.

***Predictors of maternal reports of child emotional under-eating.*** In step 1, child sociability significantly predicted maternal reports of child emotional under-eating: Adjusted  $R^2 = .05$ ,  $F(1, 104) = 6.14$ ;  $p < .05$ . In step 2, maternal pressure to eat, restriction of food intake for health reason, using food to regulate emotion, using food as a reward and poor provision of a healthy environment significantly added to the regression ( $R^2 = .20$ ,  $F(6, 99) = 4.32$ ;  $R^2$  change =  $.15$ ,  $p < .001$ ). Although the final model was significant only mothers use of pressure to get their child to eat  $\beta = .30$ ,  $t(99) = 3.29$ ,  $p = .001$  and using food as a reward  $\beta = .19$ ,  $t(99) = 2.01$ ,  $p < .05$  were significant individual predictors of child emotional under-eating.

***Predictors of maternal reports of child satiety responsiveness.*** In step 1, child emotionality significantly predicted maternal reports of child satiety responsiveness: Adjusted  $R^2 = .09$ ,  $F(1, 104) = 11.98$ ;  $p = .001$ . In step 2, maternal dietary restraint significantly to the

regression: Adjusted  $R^2 = .10$ ,  $F(2,103) = 7.031$ ,  $R^2$  change = .01  $p = .001$ . In step 3, pressure to eat, use of food as a reward and provision of a healthy environment significantly added to the regression: Adjusted  $R^2 = .17$ ,  $F(5,100) = 5.20$ ;  $R^2$  change = .07,  $p < .001$ . The final model was significant and a more emotional child temperament  $\beta = .24$ ,  $t(100) = 2.47$ ,  $p < .05$ , and maternal pressure to get their child to eat  $\beta = .23$ ,  $t(100) = 2.46$ ,  $p < .05$  were significant individual predictors of child satiety responsiveness.

### Discussion

The aim of this study was to examine the contribution of a broad range of maternal feeding practices in predicting parental reports of food avoidance eating behaviours in young children, after controlling for child temperament, and maternal dietary restraint which have previously been associated with feeding problems. As predicted, maternal reports of child food avoidance eating behaviours were broadly associated with maternal use of controlling feeding practices and the use of food for behaviour regulation, as well as with low encouragement of a balanced and varied food intake and low provision of a healthy food-related home environment. In the final regression models pressuring the child to consume more food at meals, restricting intake of less healthy foods for health reasons, using food as a reward and not encouraging well-balanced and varied food intake, were significant predictors of food avoidance eating behaviours after controlling for child emotionality and maternal dietary restraint.

Supporting the hypotheses and extending previous research linking parental pressure to eat with feeding problems and negative mealtime experiences (e.g., Harris & Booth, 1992; Sanders et al, 1993) maternal reports of pressuring their child to consume more food at meals predicted a slow eating rate, emotional under-eating, and satiety responsiveness. Whilst the cross-sectional nature of the study prevents inferences of cause and effect, previous research has found parental mismanagement of mealtimes and early feeding problems to be implicated in the development of further maladaptive feeding difficulties and negative mealtime interactions (Harris & Booth, 1992). This highlights the importance of studying the mealtime interactions of

parents and their children in non-clinical groups during early childhood before the onset of such problems.

Whilst pressure to eat predicted three out of the four food avoidance eating behaviours, mothers' restriction of their child's food intake with the purpose of limiting less healthy foods and sweets only predicted food fussiness. The use of restriction has previously been associated with overweight, overconsumption and obesogenic eating behaviours (e.g., Faith, Berkowitz, Stallings, Kerns, Storey & Stunkard, 2005; Fisher, Birch, Smiciklas-Wright, & Picciano, 2000). As fussy eating has been defined as consuming an inadequate variety of foods (e.g., Dovey, et al., 2008; Galloway, Lee & Birch, 2003; Smith et al., 2005), it is perhaps not surprising that parents of fussy eaters may restrict the child's preferred foods in an attempt to promote more varied and healthy dietary intake. However, research suggests this strategy often has the opposite effect with high levels of control being associated with a greater preference for restricted food (Fisher and Birch, 1999) and lower fruit and vegetable intake over time (Galloway et al., 2005), suggesting such strategies could in fact further exacerbate fussy and restrictive eating behaviours in the child.

This research also explored the relationship between child food avoidance eating behaviours and a broader range of feeding practices than have been previously reported. In partial support of the hypotheses, the use of food for behaviour regulation, which incorporates the use food to regulate child emotional states and to reward behaviour, was associated with emotional under-eating and satiety responsiveness. It has been suggested that if food is used for comfort, a child may develop a pattern of responding to emotional arousal with food intake (Bruch, 1973) and recent research has found parental use of food for emotion regulation to be implicated in emotional overeating (Blissett et al., 2010). It is likely that emotional or behavioural feeding by parents may interfere with the child's developing responsiveness to internal hunger and fullness signals, with these findings tentatively suggesting that this could also be implicated in under-consumption and food avoidance in response to emotional arousal, possibly through a similar pathway. However, these behaviours did not uniquely predict any of

the food avoidance behaviours with the final regression models, suggesting that other factors such as the child's temperament and feeding practices such as control contribute significantly more to the prediction of food avoidance.

An important aim of the current study was also to explore more adaptive feeding practices and their association with food avoidance eating behaviours. Partially supporting the hypotheses, promoting balance and varied food intake predicted reports of lower food fussiness and providing a healthy environment was associated with less emotional under-eating and lower satiety responsiveness. Previous research on exposure has found that parents who fail to expose their children to a wide variety of foods and textures, or do not allow adequate exposures, are likely to encounter rejection of food (Birch, 1999; Carruth et al., 2004) and in contrast that high exposure to foods may be an effective feeding practice as it fosters increased liking and higher consumption of exposed foods (Wardle, Herrera, Cooke & Gibson, 2003). Similarly, this research has found that parents who promote balanced and varied food intake for their child reported having children that were less fussy. This provides preliminary evidence of how more adaptive parental feeding practices could be important in preventing feeding problems and food fussiness and promoting more successful feeding interactions and outcomes.

Supporting previous research (e.g., Lindberg, Bohlin, Hagekull, & Thunström, 1994; Hagekull, Bohlin & Rydell, 1997) this study also demonstrated the contribution of inherent child characteristics such as age, gender and temperament in predicting reports of child food avoidance eating behaviours. Younger children and boys were found to be fussier than older children and girls and extending previous findings linking a difficult temperament and feeding problems (Farrow & Blissett, 2006; Hagekull, et al, 1997) an emotional child temperament in particular predicted food fussiness, slowness in eating and satiety responsiveness, suggesting it may be an important characteristic implicated in maladaptive eating behaviours. As temperament refers to individual differences in a person's emotional reactivity and regulation (Goldsmith, Buss, Plomin, Rothbart, Thomas, Chess, 1987) it is possible that a more emotional child may show heightened emotional reactivity within feeding interactions and thus be more

difficult within feeding interactions and more demanding in their food preferences. Given that early temperament characteristics have been found to be a risk factor for vulnerability to later eating problems (e.g., Martin et al., 2000) identifying associations between and temperamental traits and feeding disturbances at an early age marks a potentially useful tool for parents and healthcare professionals.

Although within the present study maternal dietary restraint was found to be associated with and significantly contributed to predicting child food fussiness and satiety responsiveness it was unrelated to slowness in eating, emotional under-eating, and was not significant in any of the final regression models, once the contribution of parental feeding practices was accounted for. This suggests that whilst maternal eating behaviour may be important, child emotionality and maternal feeding practices explain a greater amount of the variance in child food avoidance. This is in line with previous research has suggested that the contribution of maternal eating behaviour and psychopathology can be explained through their influence on maternal feeding practices, particularly through the association with elevated levels of control over the child's eating (Francis & Birch, 2005; Blissett et al., 2006).

There are a number of limitations to this study. Firstly, the study relies on maternal report of all constructs. However, several studies have demonstrated that maternal reports of feeding difficulties are reliable and accurately reflect independent observations (Cooper et al., 2004; Farrow & Blissett, 2005), and psychometric instruments allow the measurement of wider range of feeding practices than might be observed in single mealtimes. The cross sectional nature of the study also prevents conclusions about cause and effect, and future work would benefit from longitudinal designs incorporating observations of feeding interactions, where the interaction of fathers could also be explored.

In summary the findings of this study suggest that whilst an emotional child temperament and dietary restraint are implicated in food avoidance eating behaviours in young children, maternal feeding practices, predominantly the use of control during feeding contribute over and above these other predictors. The evident role of an emotional child temperament,

which emerged as a predictor across three of the four behaviours measured, highlights an inherent child characteristic that may represent a risk factor for feeding difficulties. However, the additional unique variance explained by maternal feeding practices, which represent an area that is potentially modifiable, highlights how the mealtime interactions of parents and their children could be targeted for intervention and the prevention of feeding difficulties during early childhood. This is particularly important as parental mismanagement of mealtimes and early feeding problems have been found to lead to further maladaptive feeding difficulties and negative mealtime interactions (Harris & Booth, 1992). Further investigation of non-clinical groups during early childhood may not only provide insight into the factors implicated in the aetiology and maintenance of feeding problems, but may also help to prevent the development of these problems that can persist through childhood into mid-adolescence (Mc Dermott et al., 2010; Kotler et al., 2001; Marchi & Cohen, 1990).

### References

- Ammaniti, M., Ambrozzi, A. M., Lucarelli, L., Cimino, S., & D'Olimpio, F. (2004). Malnutrition and dysfunctional mother-child feeding interactions: Clinical assessment and research implications. *Journal of the American College of Nutrition*, 23, 259–271.
- Ashcroft, J., Semmler, C., Carnell, S., van Jaarsveld, C. H. M., and Wardle, J. (2008). Continuity and stability of eating behaviour traits in children. *European Journal of Clinical Nutrition*, 62, 985–990.
- Blissett, J., Meyer, C., & Haycraft, E. (2006). Maternal and paternal controlling feeding practices with male and female children. *Appetite*, 47, 212–219.
- Blissett, J., Meyer, C., & Haycraft, E. (2007). Maternal mental health and child feeding problems in a non-clinical group. *Eating Behaviours*, 8, 311–318.
- Blissett, J., Haycraft, E. & Farrow, C. (2010) Inducing preschool children's emotional eating: relations with parental feeding practices. *American Journal of Clinical Nutrition*, 92, 359-365.
- Birch, L. L., Marlin, D., & Rotter, J. (1984). Eating as the 'means' activity in a contingency: Effects on young children's food preference. *Child Development*, 55, 532–539.
- Birch, L. L. (1999). Development of food preferences. *Annual Review of Nutrition*, 19, 41–62.
- Bowerman, B. L. and O'Connell, R. T., 1990. *Linear Statistical Models: An Applied Approach*, Second Edition, Duxbury Press, Belmont, California.
- Bruch, H. (1973). *Hunger awareness and individuation*. In: H. Bruch. (Ed.) *Eating disorders: obesity, anorexia nervosa, and the person within*. (pp. 44– 65). New York: Basic Books, Inc.
- Buss, A. H., & Plomin, R. (1984). *Temperament; Personality in children; Arousal (Physiology); Emotions; Temperament in children*. L. Erlbaum Associates. Hillsdale, N.J

- Cabanac, M. (1985). Preferring for pleasure. *American Journal of Clinical Nutrition*, 42, 1151–1155.
- Carper, J. L., Fisher, J. O., and Birch, L.L (2000) Young girls' emerging dietary restraint and disinhibition are related to parental control in child feeding. *Appetite*, 35, 121-129.
- Carnell, S., & Wardle, J. (2007). Measuring behavioural susceptibility to obesity: validation of the Child Eating Behaviour Questionnaire. *Appetite*, 48, 104–113
- Carnell, S., and Wardle, J. (2008a). Appetite and adiposity in children: Evidence for a behavioral susceptibility theory of obesity. *American Journal of Clinical Nutrition*, 88(1), 22-29.
- Carruth, B. R., Ziegler, P. J., Gordon, A., & Barr, S. I. (2004). Prevalence of “picky/fussy” eaters among infants and toddlers and their caregivers’ decision about offering new food. *Journal of the American Dietetic Association*, 104, 57–64.
- Chatoor, I., Egan, J., Geston, P., Menveille, E., & O’Donnell, R. (1988). Mother-infant interactions in infantile anorexia nervosa. *Journal of the American Academy of Child and Adolescent Psychiatry*, 27, 535–540.
- Chatoor, I., Ganiban, J., Hirsh, R., Borman-Spurrell, E., Mrazek, D.A. (2000) Maternal characteristics and toddler temperament in infantile anorexia. *Journal of the American Academy of Child & Adolescent Psychiatry*, 39, 743–751.
- Chatoor, I. (2002). Feeding disorders in infants and toddlers: Diagnosis and treatment. *Child and Adolescent Psychiatric Clinics of North America*, 11, 163–183
- Child Growth Foundation. (1996). *Cross sectional stature and weight reference curves for the UK*. London, United Kingdom: Child Growth Foundation.
- Cole, T. J., Bellizzi, M. C., Flegal, K. M. & Dietz, W. H. (2000) Establishing a standard definition for child overweight and obesity worldwide: international survey. *British Medical Journal*, 320, 1240-1246.

- Cooper, P. J., Whelan, E., Woolgar, M., Morrell, J., & Murray, L. (2004). Association between childhood feeding problems and maternal eating disorder: role of the family environment. *The British Journal of Psychiatry*, 184, 210-215.
- Coulthard, H., Blisset, J., & Harris, G. (2003). The relationship between parental eating problems and children's feeding behavior: A selective review of the literature. *Eating Behaviours*, 5(2), 103-115
- Coulthard, H., & Harris, G. (2003) Early food refusal: the role of maternal mood. *Journal of Reproductive Infant Psychology*, 21, 335- ??
- Dovey, T. M., Staples, P. A., Gibson, E. L., & Halford, J. C. G. (2008). Food neophobia and ‘‘picky/fussy’’ eating in children: a review. *Appetite*, 50, 181–193.
- Faith, M, S., Berkowitz, R.I., Stallings, V, A., Kerns, J., Storey, M., Stunkard, A, J. (2004). Parental feeding attitudes and styles and child body mass index: prospective analysis of a gene-environment interaction. *Pediatrics*, 114, 429–436.
- Farrow, C. V., & Blissett, J. M. (2005). Is Maternal Psychopathology Related to Obesigenic Feeding Practices at 1 Year? *Obesity Research*, 13(11)1999-2005.
- Farrow, C., & Blissett, J. (2006) Maternal Cognitions, Psychopathologic Symptoms, and Infant Temperament as Predictors of Early Infant Feeding Problems: A Longitudinal Study. *International Journal of Eating Disorders*, 39, 128–134
- Field, A. (2005). *Discovering statistics using SPSS* (Second Edition). London: Sage.
- Fisher, J. O., & Birch, L. L. (1999). Restricting access to palatable foods affects children’s behavioral response, food selection, and intake. *American Journal of Clinical Nutrition*, 69, 1264–1272.
- Fisher, J. O., Birch, L. L., Smiciklas-Wright, H., & Picciano, M. F. (2000). Breast-feeding through the first year predicts maternal control in feeding and subsequent toddler energy intakes, *Journal of the American Dietetic Association*, 100, 641–646
- Fisher, J. O., Mitchell, D. C., Smiciklas-Wright, H. & Birch, L. L. (2002) Parental

- influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *Journal of the American Dietetic Association*, 102 (1), 58-64
- Francis, L. A., & Birch, L. L. (2005). Maternal influences on daughters restrained eating behaviour. *Health Psychology*, 24(6), 548-554.
- Galloway, A. T., Lee, Y., & Birch, L. L. (2003). Predictors and consequences of food neophobia and pickiness in children. *Journal of the American Dietetic Association*, 103, 692-698
- Galloway, A. T., Fiorito, L. M., Lee, Y., & Birch, L. L. (2005). Parental pressure, dietary patterns and weight status among girls who are 'picky/fussy' eaters'. *Journal of the American Dietetic Association*, 105, 541-548.
- Goldsmith, H. H., Buss, A.H., Plomin, R., Rothbart, M. K., Thomas, A., & Chess, S. (1987). What is temperament? Four approaches. *Child Development*, 58, 505-529.
- Hagekull, B., Dahl, M. (1987) Infants with and without feeding difficulties: maternal experiences. *International Journal of Eat Disorders*, 6, 83-98
- Hagekull, B., Bohlin, G. & Rydell, A, M. (1997) Maternal Sensitivity, Infant Temperament, and the Development of Early Feeding Problems. *Infant Mental Health Journal*, 18 (1) 92-106
- Harris, G., & Booth, W. (1992). The nature and management of eating problems in pre- school children. In: P. Cooper and A. Stein, Editors, *Monographs in clinical pediatrics: Feeding problems and eating disorders in children and adolescents*, Harwood, Chur, Switzerland (1992), pp. 61-84.
- Hughes, S. O., Shewchuk, R. M., Baskin, M. I., Nicklas, T. A., & Qu, H. P. (2008) Indulgent Feeding Style and Children's Weight Status in Preschool. *Journal of Developmental and Behavioural Pediatrics*, 29(5), 403-410.
- Kotler, L. A., Cohen, P., Davies, M., Pine, D. S., M.D & Walsh, B. T. (2001)

- Longitudinal Relationships Between Childhood, Adolescent, and Adult Eating Disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, 40(12),1434-1440
- Kremers, S. P., Brug, J., de Vries, H., and Engels, R. C. M. E. (2003). Parenting style and adolescent fruit consumption. *Appetite*, 41, 43–50.
- Lindberg, L., Bohlin, G., & Hagekull, B. (1991) Early feeding problems in a normal population. *International Journal of Eating Disorders*, 10, 395- ??
- Lindberg, L., Bohlin, G., Hagekull, B., & Thunström, M. (1994). Early food refusal: Infant and family characteristics. *Infant Mental Health Journal*, 15, 262–277.
- Lindberg, L., Bohlin, G., Hagekull, B. & Palmerus. K. (1996) Interactions Between Mothers and Infants Showing Food Refusal. *Infant Mental Health Journal*, 17(4), 334-347
- Manikam, R., & Perman, J. (2000). Pediatric feeding disorders. *Journal of Clinical Gastroenterology*, 30, 34–46.
- Marchi, M., & Cohen, P. (1990). Early childhood eating behaviours and adolescent eating disorders. *Journal of American Academy of Child and Adolescent Psychiatry*, 29, 112–117.
- Martin, G. C., Wertheim, E. H., Prior, M., Smart, D., Sanson, A., & Oberklaid, F. (2000). A longitudinal study of the role of childhood temperament in the later development of eating concerns. *International journal of eating disorders*, 27(2),150-162.
- Mathiesen, K. S. & Tambs, K. (1999). The EAS temperament questionnaire: Factor structure, age trends, reliability and stability in a Norwegian sample. *Journal of Child Psychology and Psychiatry*, 40(3), 431-439.
- McDermott B. M., Mamun, A. A., Najman, J. M., Williams, G. M., O’Callaghan, M. J., & Bor, W. (2010). Longitudinal correlates of the persistence of irregular eating from age 5 to 14 years, 99 (1), 68–71
- Musher-Eizenman, D., & Holub, S. (2007). Comprehensive Feeding Practices

- Questionnaire: Validation of a New Measure of Parental Feeding Practices. *Journal of Pediatric Psychology*, 32, 960 - 972.
- Musher-Eizenman, D. R., de Lauzon-Guillain, B., Holub S. C., Leporc, E., & Charles, M. A., (2009). Child and parent characteristics related to parental feeding practices. A cross-cultural examination in the US and France. *Appetite*, 52(1),89-95
- Myers, R. (1990). *Classical and Modern Regression With Applications* (2nd ed.), Boston: PWS-Kent.
- Newman, J. and Taylor, A. (1992) Effect of a means-end contingency on young children's food preferences. *Journal of Experimental Psychology*, 64, 200–16.
- Nicholls, D., Chater, R., & Lask, B. (2000). Children into DSM don't go: A comparison of classification systems for eating disorders in childhood and early adolescence. *International Journal of Eating Disorders*, 28, 317–324.
- Orrell-Valente, J. K., Hill, L. G., Brechwald, W. A., Dodge, K. A., Pettit, G. S., & Bates, J. E. (2007) Just three more bites?: An observational analysis of parents' socialization of children's eating at mealtime. *Appetite*, 34(1), 37-45
- Pulkki-Raback, L., Elovainio, M., Kivimaki, M., & Raitakari, O. (2005). Temperament in Childhood predicts body mass in adulthood: the cardiovascular risk in young finns study. *Health Psychology*, 24, 307–315.
- Ramsay, M., Gisel, E. G., McCusker, J., Bellavance, F., Platt, R. (2002) Infant suckling ability, non-organic failure to thrive, maternal characteristics, and feeding practices: a prospective cohort study. *Developmental Medicine and Child Neurology*, 44, 405–414
- Reau, N. R., Senturia, Y. D., Lebailly, S. A., & Christoffel, K. K. (1996). Infant and toddler feeding patterns and problems: Normative data and a new direction. *Pediatric Practice Research Group. Journal of Developmental and Behavioral Pediatrics*, 17, 149-153.
- Sanders, M.R., Patel, R. K., Le Grice, B. & Shepherd, R. W. (1993) Children with

- Persistent feeding difficulties on observational analysis of the feeding Interactions of problem and non-problem eaters. *Health Psychology*, 12, 64–73
- Smith, A. M., Roux, S., Naidoo, N. T. R., & Venter, D. J. L. (2005). Food choices of tactile defensive children. *Nutrition*, 21, 14–19.
- Spruijt-Metz, D., Chaoyang, L., Cohen, E., Birch, L., & Goran, M. (2006). Longitudinal influence of mother's child-feeding practices on adiposity in children. *The Journal of Pediatrics*, 148(3), 314-320
- Stein, A., Woolley, H. & McPherson, K. (1999) Conflict between mothers with eating disorders and their infants during mealtimes. *British Journal of Psychiatry*, 175, 455–461.
- Van strien, T., Frijters, J. E. R., Bergers, G. P. A., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International journal of eating disorders*, 5(2), 295-315.
- Van Strien, T., Herman, P., & Verheijden, M. W. (2009). Eating style, overeating, and overweight in a representative Dutch sample. Does external eating play a role? *Appetite*, 52(2),380-387
- Viana, V., Sinde, S., & Saxton, J.C. (2008). Children's Eating Behaviour Questionnaire: associations with BMI in Portuguese children. *British Journal of Nutrition*, 100, 445–450
- Ventura, A. K. & Birch, L. L. (2008). Does parenting affect children's eating and weight status? *International Journal of Behavioral Nutrition and Physical Activity*, 5, 15-27.
- Wardle, J., Guthrie C, A., Sanderson, S., Rapoport, L. (2001) Development of the children's eating behaviour questionnaire. *Journal of Child Psychology and Psychiatry*, 42, 963–970.
- Wardle, J., Carnell, S. & Cooke, L. (2005) Parental control over feeding and children's

fruit and vegetable intake: How are they related? *Journal of the American Dietetic Association*, 105 (2), 227-232.

Wardle, J., Herrera, M. L., Cooke, L., & Gibson, E. L. (2003). Modifying children's food preferences: the effects of exposure and reward on acceptance of an unfamiliar vegetable. *European Journal of Clinical Nutrition*, 57, 341–348.

Webber, L., Hill, C., Saxton, L., Van Jaarsveld, C. H. M., & Wardle, J. (2009) Eating behaviour and weight in children. *International Journal of Obesity*, 33, 21–28

World Health Organisation. (1998). *Obesity: Preventing and managing the global epidemic, Report of a WHO consultation*, Geneva: World Health Organisation.

Wright, C. & Birks, E. (2000). Risk factors for failure to thrive: a population based study. *Child: Care, health and Development*, 26,1, 5-16.

Zabinski, M. F., Daly, T., Gregory, R. D., Norman, J., Rupp, J. W., Calfas, J. K., Sallis, J. F., & Patrick, K. (2006) Psychosocial Correlates of Fruit, Vegetable, and Dietary Fat Intake among Adolescent Boys and Girls. *Journal of the American Dietetic Association*, 106 (6), 814–82.

***TABLE 1: Descriptive and frequency statistics for child food avoidance eating behaviours, maternal feeding practices, child temperament and maternal dietary restraint***

		Mean	SD
Child Eating Behaviour	Food Fussiness	2.71	0.86
	Slowness in Eating	2.85	0.86
	Emotional Under-eating	2.72	0.91
	Satiety Responsiveness	2.87	0.66
Maternal Feeding Practices	Pressure	3.23	0.91
	Restriction for Weight	2.18	0.64
	Restriction for Health	3.43	0.91
	Monitoring	4.36	0.68
	Emotional Regulation	1.67	0.64
	Food Reward	2.62	1.16
	Balance & Variety	4.62	0.64
Child Temperament	Healthy Environment	4.06	0.81
	Emotionality	2.45	1.30
	Activity	3.77	0.60
	Shyness	2.40	0.79
Maternal Eating Behaviour	Sociability	3.60	0.66
	Restraint	2.73	0.87

SD = Standard Deviation

**TABLE 2:** *Two-tailed correlations between maternal feeding practices, child temperament and maternal eating behaviour and with child food-avoidance eating behaviours*

		<i>Child Eating</i>			
		Food Fussiness * a	Slowness in Eating * b	Emotional under eating * c	Satiety responsiveness *c
<i>CFPQ</i>	Pressure	.20	.24*	.36**	.25*
	Restriction Weight	-.02	-.08	-.05	-.05
	Restriction Health	.29**	.050	.20*	.07
	Monitoring	-.22*	-.09	-.05	-.06
	Emotion Regulation	.18	-.09	.25**	.11
	Food Reward	.14	.10	.30**	.21*
	Balance & Variety	-.27**	-.10	-.04	-.09
	Healthy Environment	-.16	-.09	-.24*	-.22*
<i>EAS</i>	Emotionality	.31**	.26**	.18	.32**
	Activity	-.04	-.121	-.18	-.04
	Shyness	.11	.124	.05	.15
	Sociability	.14	.046	.20*	.09
<i>DEBQ</i>	Restraint	.37**	.14	.10	.23*

a = Partial correlation controlling for age and gender; b = Partial correlation controlling for age;  
c = Spearman's rho correlation

\*  $p < 0.05$  \*\*  $p < 0.01$