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## How do mothers manage their preschool children's eating habits and does this change as children grow older? A longitudinal analysis

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### Abstract

The practices mothers adopt in relation to feeding their children have been identified as important predictors of children's quality of diet. However, most studies of the impact of these practices on quality of children's diets have been cross-sectional in design, limiting conclusions about change and causality. Previous research has called for qualitative exploration of the way these practices are used in a real-life setting. This study set out to address these gaps in knowledge.

At baseline, mothers recruited to a community-based intervention study and who had a preschool child, completed a questionnaire about their use of covert and overt control practices, child food neophobia and demographics. The quality of children's diets was assessed using a validated food frequency questionnaire. Both questionnaires were repeated with the mothers two years later. Complete data at both time points were available for 228 mother-child pairs. Four focus group discussions were conducted with 29 mothers of preschool children to explore their experiences of feeding young children.

Mothers who increased their use of overt control had children whose level of food neophobia also increased ( $P=0.02$ ). Mothers who used more covert control had children with better quality diets at both time points ( $P<0.01$ ) and mothers who increased their use of covert control over the two year follow-up had children whose diet quality improved ( $P=0.003$ ). These associations were independent of confounders such as mother's level of education. In the focus groups, mothers suggested that feeding young children was stressful and that control was often relinquished in order to reduce conflict at mealtimes.

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Supporting parents to adopt more covert techniques to control their children's eating habits may be an effective way of improving the quality of young children's diets.

## Keywords

Overt control; covert control; food neophobia; picky eating; longitudinal; diet

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## Introduction

Establishing a good quality diet in early life is important for optimal growth, development and both the short- and long-term health of an individual. While 'quality' of diet is a broad description, it is generally defined as "adherence to dietary recommendations" and describes the foods, rather than nutrients, that an individual consumes<sup>(1)</sup>. A good quality diet is characterised by high intakes of unprocessed, nutrient dense foods e.g. fruits, vegetables, whole-grains. In contrast, a poor quality diet is characterised by frequent intakes of foods high in fat, salt or sugar e.g. chips, white-bread and soft drinks<sup>(2)</sup>. Large UK studies have shown that there are disparities between children who have the best and poorest quality diets; children from more disadvantaged families tend to have the poorest quality diets<sup>(2;3)</sup>.

Maternal feeding practices are strategies a mother uses to manage her child's diet and have been the focus of a number of studies exploring influences on preschool children's quality of diet<sup>(4-7)</sup>. Many mothers have expectations about the types of food that they want, or don't want, their children to consume. Often this results in mothers adopting control strategies such as restriction of, or pressure to eat, certain foods<sup>(8)</sup>. Of all parental feeding practices, 'restriction' and 'pressure-to-eat' have been the most commonly studied. Restriction describes practices used to restrict a child's intake of types or amounts of food. Pressure to eat describes practices which involve strongly encouraging children to consume certain types or amounts of foods<sup>(4)</sup>. Both practices have been shown to be associated with children's quality of diet, although not in every study have they had the desired effect on children's food preferences. The majority of studies report similar findings, however there are a few that report inconsistencies in the associations. Increased use of restriction strategies has been shown to increase a child's preference for the restricted food<sup>(6)</sup>. In an experiment with 4-6 year old children Fisher *et al* found that the more a child's access to a food was restricted, the greater the child's preference for that food. Children subsequently chose to eat more of the restricted food when it was available. In contrast, a study by Gubbles *et al*, reported that increased use of restriction strategies was associated with lower consumption of the restricted foods (cookies, cakes, soft drinks) as well as increased consumption of fruits and vegetables<sup>(7)</sup>. Use of pressure to eat has also been shown to be negatively associated with young children's fruit and vegetable intake<sup>(5)</sup>. However, Coulthard *et al*, reported that parental use of pressure to eat had no significant impact on fruit or vegetable intake in preschool children<sup>(9)</sup>.

Ogden *et al*, suggest that the mixed findings about relationships between parental control practices and children's food consumption may reflect the complex nature of control strategies, which has not been captured by most commonly used measures<sup>(10)</sup>. They propose

that whilst it may be possible to control children's food intake by restricting undesirable foods and encouraging the consumption of healthy foods, it is also possible that mothers control what their children consume by managing their food environment. They may limit or increase their child's exposure to undesirable or desirable foods. It is this, more covert, strategy that is missed by existing measures of control practices<sup>(10)</sup>. Ogden and colleagues therefore developed an alternative assessment, in 2006, that encompasses both 'overt' and 'covert' control practices used by parents with their children. The concept of overt control encompasses those feeding practices such as pressure to eat and restriction. It involves limiting or encouraging the child's intake of foods in a way that can be detected by the child. Covert control describes the management of the child's food environment in order to control intake that may go undetected by the child. The measure of both overt and covert control has been used in only a few studies to date. Ogden *et al*, assessed the role of both control styles and their effects on children's snacking behaviour<sup>(10)</sup>. They found that parents who reported using more covert control methods had children who consumed fewer 'unhealthy' snacks. Parents who reported using more overt control, had children who were more likely to consume 'healthy' snacks. When Brown *et al* examined the impact of overt and covert control practices on the diets of young children; they also found that mothers who used covert control methods had children who consumed fewer unhealthy snacks. In addition, they reported that mothers' use of both overt and covert control was associated with children consuming more fruit and vegetables. This suggests that use of both overt and covert control practices may have beneficial effects on children's quality of diet <sup>(11)</sup>.

Research examining the relationship between parental control practices and children's quality of diet has also explored the role of child food neophobia. Food neophobia is a reflection of the reluctance of a child to try new foods<sup>(12)</sup>. It has been shown that increased food neophobia is associated with poorer quality diets in young children<sup>(13)</sup>. Research on the role of neophobia in the relationship between control practices and children's quality of diet has produced mixed results. In a cross-sectional study of parents with preschool children, Wardle *et al*, showed that higher levels of parental control over children's eating habits were associated with higher levels of child food neophobia. In a univariate model, both higher levels of control and neophobia were associated with lower fruit and vegetable consumption by children. When placed in a multivariate model, however, along with parental fruit and vegetable consumption the effect of parental control was no longer significant<sup>(5)</sup>, suggesting that the effect of parental control practices on children's quality of diet may be partly mediated through the effect of children's food neophobia. Brown and colleagues have also assessed the cross-sectional association between parental control practices and child food neophobia <sup>(11)</sup>. They found the latter to be lower in children whose mothers used covert control practices and higher in children whose mothers used more pressure to eat. In a more recent study, parental control practices were found to partially mediate the relationship between infant feeding beliefs when children were 4 months old and the prevalence of child food neophobia when the children were aged 2 years <sup>(14)</sup>. Control practices and neophobia were assessed at the same time point in this study, however, which prevents understanding of the nature of the relationship between child food neophobia and parental feeding practices. Each of the studies reported here has concluded that longitudinal studies are required to explore this relationship further <sup>(5)</sup>. In addition, Wardle *et al* stated that qualitative research

exploring motivations for parental feeding practices would be a valuable addition to the literature. The present study was designed address these gaps in the literature. The use of mixed methods is becoming increasingly popular in health research. It acknowledges that there are multiple ways of making sense of factors and takes account of their social context<sup>(15)</sup>. A mixed methods approach was therefore adopted using the framework described by Dures *et al*<sup>(16)</sup>.

The study set out to explore mothers' use of overt and covert control practices at two time points in early childhood, to examine the role of food neophobia in predicting changes in control practices, and to look at associations between these factors and children's quality of diet. Specifically, this paper addresses the following questions: (1) How does overt and covert control use change as children get older? (2) What predicts change in control practices? (3) How do changes in use of overt and covert control impact on children's quality of diet? and (4) What do mothers say about controlling their children's eating habits?

## Methods

### Design

The study used a cohort design with data collected at baseline and repeat data collected at follow-up two years later. Focus group discussions were conducted with parents attending Children's Centres 6 months after the follow-up survey had been completed

### Participants

Participants in the quantitative survey were mother-child pairs taking part in a sub-study of the Southampton Initiative for Health (SIH). The SIH was a community-based intervention study which aimed to improve the diets and lifestyles of women of child-bearing age. At baseline 348 mothers in the SIH, with a child aged 2-5 years were recruited, of these 66% (n=228) were followed up two years later. Data presented in this paper are from the 228 mother-child pairs. Although the participants were enrolled in an intervention during the study period this was not designed to influence their use of overt and covert control. It was designed to improve maternal diet and lifestyle, however, analyses of the intervention showed no differences in the mothers' quality of diet in the intervention and control groups at follow-up<sup>(17)</sup>. Additional analyses confirmed that there were no differences in change in the variables of interest for this study between the intervention or control group at baseline and follow-up (data not shown). Therefore data from the intervention and control participants were combined for these analyses.

### Procedure

Between December 2009 and May 2010, mothers who had been recruited to the SIH, had a 2-5 year old child and had provided contact details were telephoned by trained interviewers and asked if they would be willing to complete a questionnaire, over the telephone, about the diet and lifestyle of their preschool child. Further details on the procedure for the baseline survey have been described elsewhere<sup>(18)</sup>. Two years post baseline, between October 2011 and February 2012, mothers were contacted again via telephone. Mothers were reminded that they had taken part in the study previously and asked if they were willing to complete

another questionnaire. Consent to take part in the follow-up study was obtained verbally, over the telephone. The interviewers adhered to a strict study protocol at both time points. At the beginning of the phone call, the interviewer read out a participant information sheet and answered any questions that arose. During the completion of the questionnaire the interviewers used prompts, to help standardise responses to the questionnaire. For instance, when completing the food frequency questionnaire (FFQ) prompts included a list of the foods included and excluded in each of the food groups in the FFQ.

## Materials

**Assessment of children's diet quality**—Children's quality of diet was assessed using a validated FFQ<sup>(18)</sup> administered to the mother, which asked how often in the last three months her child had consumed 20 food and drink items. Responses were 'never'; 'less than once per month'; '1-3 times per month'; 'between 1-7 times per week' or 'more than once per day. If any food or drink items were consumed more than once per day then the number of times was recorded. The 20 food items in the FFQ were those that characterised the 'prudent' dietary pattern and contributed most to the prudent diet score in the analysis of data from 3 year old children in the Southampton Women's Survey collected using a 80-item FFQ<sup>(2)</sup>. A high score represents a 'prudent diet' characterised by high intakes of fruit and vegetables, wholemeal bread and water. Low scores represent a diet with high intakes of crisps, white bread, low-calorie soft drinks and processed meat. A prudent diet score was calculated for each child using the standardised frequency of consumption of each of the 20 foods in the FFQ, multiplied by the coefficient for that food produced by principal components analysis of the 80-item FFQ<sup>(2)</sup>. The same approach has been used to calculate prudent diet scores from a 20-item FFQ in women<sup>(19)</sup>. Children's prudent diet scores were standardised to have a mean of zero and a standard deviation of one.

## Covert and overt control

Parental use of covert and overt control methods was measured using the scale developed and validated by Ogden and colleagues<sup>(10)</sup>. Participants were asked how often, on a five-point Likert scale from 'never' to 'always', they carried out behaviours indicative of covert and overt control styles. The measure contains 10 items, five of which relate to covert control and five of which relate to overt control. Responses were summed for the five covert control items and five overt control items separately, which provides each participant with a covert and an overt control score, both ranging from 0-20. A higher score represents more frequent use of each of the types of control style. Chronbach's alphas for data generated by completion of these scales in this study were 0.76 and 0.75 for the covert and 0.60 and 0.70 for the overt control scales at baseline and follow-up respectively.

## Child food neophobia

The Child Food Neophobia Scale assesses how willing a child is to try novel and unknown foods<sup>(12)</sup>; children with higher levels of neophobia being less willing to try new foods<sup>(13)</sup>. It was developed as a ten-item tool but, following the procedure established in previous studies<sup>(20)</sup>, this study used a reduced six-item version as four of the items were deemed inappropriate for preschool children. Parents were asked to indicate how much they agree

with statements relating to their children's reaction to novel foods. Example items included 'my child doesn't trust new foods' and 'if my child doesn't know what's in food he/she won't try it'. Responses were recorded on a four-point Likert scale from 'strongly disagree' to 'strongly agree' and were coded from 1 to 4 respectively. Two items required reverse scoring, and then responses were summed to provide an overall score ranging from 6-24. A higher score represents higher levels of child food neophobia. The Chronbach's alpha for data generated by this scale was 0.89 at baseline and follow-up.

### Other assessments

Information about the characteristics of mothers was available as part of their participation in the main SIH study. This included demographics and household composition.

### Focus group discussion methods

Participants in the focus groups were not recruited from amongst SIH study participants but were sampled from the same demographic group of women. Participants were recruited from amongst mothers with at least one preschool child who accessed a Children's Centre in Southampton, Gosport or Havant, with similar levels of deprivation. Compared to the UK as a whole, Southampton was ranked 81 out of 326 local authorities on the Index of Multiple Deprivation 2010 (with 1 being the most deprived) <sup>(21)</sup>.

A purposive sampling strategy was adopted to recruit mothers of preschool children who would be willing to discuss and share their experiences of feeding young children. Children's Centres were instrumental in assisting with the recruitment of participants for the focus groups, through existing parent fora and support groups. The inclusion criteria for the study were that participants had at least one child who was of preschool age and eating solid foods (18 months -5 years).

Focus group discussions took place between February and April 2013. Before each session, participants had the opportunity to review the participant information sheet, and ask any questions. Participants signed a consent form and completed a short demographic questionnaire. Ground rules were discussed with the group regarding confidentiality, freedom of expression, and respect for each other. There was a moderator (MJ) and observer for each focus group. A discussion guide was developed to facilitate discussion within the groups, whilst still allowing new themes to emerge. Each focus group was audio-recorded using a digital recorder and then transcribed verbatim. All names used in the discussions were changed during transcription to ensure anonymity. Immediately after each focus group, the moderator and observer reflected on the discussions and shared observations.

### Statistical Analysis

Scatter plots of covert and overt control scores at baseline against those at follow-up were used to illustrate change in individuals' scores between baseline and follow-up. Wilcoxon matched paired tests were used to assess difference in the change of overt and covert control scores between baseline and follow-up. The covert and overt control scores at follow-up were regressed on those at baseline and the residuals were used to summarise change, a procedure which takes into account regression to the mean. Spearman rank correlations were

used to assess trends in children's median weekly consumption of the foods included in the FFQ with mothers' covert control score and children's neophobia score. In order to assess the maternal and childhood characteristics associated with change in control practices, control at follow-up was regressed on control at baseline and on the characteristics of interest<sup>(22)</sup>. Finally to assess effects of change in control on characteristics of interest, child neophobia at follow-up was regressed on neophobia at baseline and residual change in overt control. Then children's quality of diet score at follow-up was regressed on quality of diet score at baseline and residual change in covert control score. All multivariable models were adjusted for mother's level of education, age and number of children.

### Analysis of focus group data

Transcripts of the audio-recordings were read and reread by two researchers who discussed the best approach to the data, bearing in mind the purpose of the study. Sub-sections of all transcripts were double-coded by both researchers to check interrater reliability. Data were sorted into themes. A coding frame corresponding to the overarching themes was developed to allow for summarising and indexing the opinions expressed in each of the transcripts. Researchers met after each round of coding to discuss themes and codes arising from the data. These themes and sub-themes were depicted in a thematic map, describing the way in which the themes and sub-themes identified in the analysis are hypothesised to work together<sup>(23)</sup>. It is created as the analysis develops and is a tool to guide the interpretation of the results, but is not created *a priori* to guide the analysis.

## Results

The characteristics of the 228 mother-child pairs at baseline and follow-up are displayed in Table 1. At baseline, the mean age of the children was just over three years and the mothers' was nearly 33 years, 35% of mothers had left education at 16 years old with General Certificate of Secondary Education (GCSE) level qualifications or lower; and 41% of mothers reported receiving benefits (excluding child tax credits).

### How does use of overt and covert control styles change as children get older?

Figure 1 shows baseline overt control scores plotted against overt control scores at follow-up. The dashed line shows where the regression line would lie if there had been no change in the scores over the two years. Figure 2 shows the same for covert control scores. These figures show that many of the data points do not sit on the line of no change and therefore there was change in mother's use of overt and covert control styles between baseline and follow-up. For the whole group these changes were not significant ( $P=0.7$  and  $P=0.1$  for overt and covert control respectively). However, as the data show that individual scores did change, sub-group analyses were carried out to explore the predictors and consequences of these changes.

### What predicts change in use of control strategies?

None of the demographic or child characteristics were associated with change in covert control. However, regression analysis showed that food neophobia in children was associated with use of overt control at both baseline and follow-up. At both time points, higher food

neophobia scores were associated with more use of overt control practices ( $\beta=0.04$   $P<0.001$ ,  $\beta=0.05$   $P<0.001$ , at baseline and follow-up respectively). Baseline child neophobia scores did not predict change in use of overt control; however change in use of overt control practices over the period of follow-up did predict change in child neophobia scores. Mothers who increased their use of overt control strategies over the period of follow-up were significantly more likely to have a child with higher neophobia scores at follow-up ( $\beta=0.15$ ,  $P=0.02$ ). This association remained significant after adjusting for children's neophobia score at baseline ( $\beta=0.12$ ,  $P=0.03$ ). Increasing use of overt control strategies by mothers was unrelated to how neophobic the child was when first assessed.

### **How does use of overt and covert control impact on children's quality of diet?**

Over the two year follow-up period children's mean quality of diet score decreased ( $P=0.03$ ). The relationships between use of overt and covert control, child food neophobia, and children's quality of diet at baseline and follow-up are displayed in Table 2. The table shows that mothers who used more covert control strategies at both time points had children with better quality diets at both time points. For each one-point increase in covert control score, the child's prudent diet score increased by 0.05SD at both baseline and follow-up. In contrast, there was no relationship between use of overt control strategies and children's quality of diet. Children with higher scores on the food neophobia scale, however, were more likely to have poorer quality diets ( $\beta = -0.07SD$ ) at both baseline and follow-up.

Differences in children's consumption of individual foods were explored according to covert control and neophobia scores. This showed that the differences in quality of diet score according to mother's use of covert control were being driven by differences in snack food and beverage consumption (data not shown). There were significant trends with covert control score, at both time-points, which showed that children whose mothers used less covert control consumed crisps, cakes and biscuits, and soft drinks more often, and drank water less often, than children whose mothers used covert control more often (all  $p<0.05$ ). Differences in prudent diet score according to children's food neophobia, however, were being driven by differences in vegetable and fruit consumption. Children who had higher scores for neophobia ate vegetables and fresh fruit less often than children with lower scores (all  $P<0.03$ ).

The association between change in mothers' covert control score and children's quality of diet at follow-up remained significant after controlling for children's quality of diet at baseline. This showed that change in covert control use was associated with change in children's quality of diet score. Mothers' who increased their use of covert control practices over the two year period, tended to have children with improved quality of diet ( $\beta = 0.03SD$ ,  $P=0.003$ ). This association was independent of mother's level of education, age and number of children.

### **What do mothers say about controlling their children's eating habits?**

In focus group discussions with mothers about the food choices they make for their young children, control strategies emerged as a recurrent theme. Mothers identified many different techniques they used to control their children's eating habits, most of which reflected overt



rather than covert styles of control. Examples of overt control methods they described included hiding foods they did not want their children to have in cupboards out of their reach, only allowing them to have undesirable foods if they had eaten their main meal, and using less desirable food as a reward for good behaviour.

Mothers described feeding their children as challenging and stressful. Children's general behaviour and fussy eating or neophobic tendencies seemed to be the main issues.

“The thing is when you've got loads of challenging behaviours, food really becomes the bottom of the chain. As long as they do eat, you really give up on the whole fighting with food. You think right, as long as my child is eating, 'cos I mean in my house I've got children that attack each other, are disrespectful and trash the home. So really one more fight about food, I'm not up for it” (FG1)

“Because I find it very hard, you know. Time and time every mealtime if you have a big to do and a big thing, then she will push her plate away and she will have a real tantrum and she won't eat it. And that, really, well, it does get to me” (FG3)

As part of the discussions about children's neophobia and fussy eating, mothers described using two types of strategies – either overt style control or they relinquished control all together. Examples of overt styles of control discussed were bribing children with a sweet food if they ate their main meal, or telling them that the food on offer was the only food they could have.

“It's easy if you say to them as well, 'look, you eat your dinner, or you eat the majority of your dinner, you'll get a nice, like, a pudding or something after” (FG4)

“...If he doesn't eat it, then he doesn't have anything else to eat. But he just won't even try it. He just chucks it everywhere. He just won't touch it.” (FG3)

Others gave up exercising control all together and instead cooked separately for each child in order to accommodate their preferences. In this situation, the children appeared to be in control.

“You see something basic like a shepherd's pie. With my lot, I've got two that won't eat mash so they have mince with boiled potatoes. I've got one who'll only eat pasta so he just has pasta any way. So technically the only people that really eat shepherd's pie is me and my partner, so I cook a big thing like that and it's just hopeless” (FG2)

Discussions about covert control were much less frequent. When it was mentioned, it was clear that mothers used covert control techniques only to limit foods that they did not wish their children to consume. They did not discuss using the same techniques to increase their children's exposure to foods they did wish them to eat.

Moderator “so if you wanted to limit the amount they ate of anything particular what kinds of things would you do??”

“Wouldn't have it in the house” (FG1)

“If I don't want them to have it, I just won't buy it” (FG2)

If mothers were using this covert strategy to limit access to undesirable foods, it would explain why the differences in the food consumption of children whose mothers used covert control most or least frequently were seen in snack foods and beverages rather than other foods. There were some discussions, however, about how these strategies were undermined by other adults such as fathers and grandparents.

“My mum’s terrible. She’ll give him chocolate biscuits and all that just before I’ve served dinner. Chocolate biscuits and then he won’t have his dinner because he’s full up on biscuits” (FG3)

“I don’t buy it but their dad does” (FG1)

Overall, the discussions reflected how mothers used different control strategies to manage their children’s eating habits, with differing levels of success. It was clear that feeding young children was often stressful, and mothers tended either to use overt control techniques or to relinquish control all together in order to limit conflict. There was less discussion about use of covert style strategies.

## Discussion

### Summary of findings

The survey data showed no group tendency for mothers to either increase or decrease their use of overt or covert control as their children aged. There was, however, individual change in use of overt and covert control practices and these changes had consequences for children’s food neophobia and quality of diet. Mothers who had increased their use of overt control over the two year follow-up period tended to have children with higher levels of neophobia at follow-up. Importantly this association remained significant after controlling for child’s neophobia score at baseline, indicating that increased use of overt control was associated with an increase in child’s neophobia score independent of how neophobic their child was to start with. Though using an overt control style was unrelated to children’s quality of diet at either baseline or follow-up, a higher child food neophobia score was associated with poorer quality diet at baseline and at follow-up. Children who were more neophobic tended to eat less fruit and vegetables in particular.

In contrast, more use of covert control was associated with better quality children’s diets at both baseline and follow-up, as was the change in use of covert control. Over the two year follow-up children’s diet quality in the whole cohort declined. However, mothers who increased their use of covert control over the two years had children whose quality of diet improved, even after taking baseline quality of diet into account. Children whose mothers exercised more covert control tended to eat fewer snacks such as crisps, sweets and cakes and drank more water.

Finally, in focus group discussions, mothers described using many more overt than covert means of controlling their child’s diet. Where mothers did use covert means of control this was focused on limiting the consumption of unhealthy snack foods. The discussions highlighted that feeding young children was stressful for mothers and that the most important priority was often to reduce conflict, rather than to ensure a good quality diet.

Control methods were often adopted or relinquished in order to reduce conflict during these challenging feeding situations.

## Interpretation

Use of overt or covert control was not associated with mother's age or educational attainment. This contrasts with previous research which has suggested that older mothers tend to use more overt styles of control and mothers with higher levels of education tend to use more covert styles of control<sup>(11)</sup>. In the study reported in this paper, mothers who used more covert control also tended to use more overt control although the reverse relationship was not observed. The implication of this is that mothers who exercise more control over their children's eating habits in general are more likely to use covert strategies. This observation is supported by a study of Australian mothers in which use of overt and covert control styles were positively correlated with one another<sup>(24)</sup>.

This is the first study to describe changes in use of overt and covert control techniques as children age. We found a longitudinal association between using an overt style of controlling children's diet and child food neophobia. In a cross-sectional study by Brown *et al*, higher child food neophobia was not associated with mothers use of more overt control but it was associated with higher levels of 'pressure to eat'<sup>(11)</sup>. However, in a study by Mitchell *et al*, which assessed predictors of controlling feeding practices, overt control and pressure to eat were shown to be positively correlated<sup>(24)</sup>, confirming that pressure to eat is likely to be one of the dimensions which is captured by a measure of overt control. We found that increases in mothers' use of overt control were associated with increases in children's food neophobia, which in turn was associated with children having poorer quality diets. Types of overt control, such as pressure to eat, may therefore have a paradoxical effect in which the mother is adopting a control strategy in order to encourage her child to have a better quality of diet but is actually exacerbating the child's dislike of the foods she wants the child to eat. Previous research has shown that children who displayed more picky eating behaviours tended to have poorer quality diets and mothers who used more pressure to eat<sup>(25)</sup>. Although some researchers argue that food neophobia and picky or fussy eating are distinct concepts<sup>(26)</sup>, others have reported that neophobia measures are problematic in their ability to differentiate between neophobia and general picky eating<sup>(27)</sup>. Therefore in our study, although we used the neophobia scale, it is possible that the results are also describing children with picky eating tendencies and thus these findings are generalisable to families with children who are neophobic as well as those who exhibit more general picky eating.

One possible interpretation of the findings of the present study is that overtly controlling their eating habits causes children to become more neophobic or picky. In support of this an experimental study by Galloway showed that children who were pressured to eat whilst eating soup consumed significantly less than those who were not pressured, and in addition the children who were pressured made many more negative comments about the food, suggesting that pressure to eat had a negative effect on children's liking for that food<sup>(28)</sup>. It is probable, however, that a feedback loop operates in which mothers respond to their children's neophobia with overt control techniques which leads to negative mealtime interactions which may, in turn, exacerbate children's neophobic responses. Children's

eating behaviours develop from their early social interactions surrounding feeding<sup>(29)</sup>. And it is generally accepted that children are predisposed to have a preference for sweet and salty tastes and reject those that are sour or bitter<sup>(30)</sup>. Savage *et al* suggest that children's likes and dislikes for foods which have a less intrinsic allure are more likely to be determined by the social contexts in which they experience them<sup>(29)</sup>. If a food, given to a child for the first time, is rejected and the response of the mother is to place pressure on the child to eat it, then this is likely to result in a negative mealtime environment. The child may then associate that food with negative emotion and thus exhibit more neophobic tendencies towards the food next time it is offered. Data presented in this paper would support this explanation.

The other key finding from this paper is that increases in maternal use of covert control, over the follow-up period, were associated with improvements in their children's quality of diet. Research has shown that people's food choices are heavily influenced by environmental cues and by what is immediately available<sup>(31)</sup>. If the only foods available and accessible to children are those that their mothers want them to eat, then these foods are more likely to be eaten. Wyse *et al* reported a study of the relationship between children's home food environment characteristics and their diet and showed that having fruit and vegetables available at child's height in the home was associated with increased consumption of these foods<sup>(32)</sup>. Taken at face value, the findings of the present study would suggest that use of covert control strategies is an effective way of improving children's diet quality.

### Public Health Implications

Whilst further research in larger cohorts is required to confirm the findings of this study, there are important insights for future interventions and public health initiatives. Increasing mothers' use of covert control may represent a feasible way of making improvements to young children's quality of diet. Not to buy undesirable foods and not to take children to restaurants that sell undesirable foods are fundamentally simple messages to convey. In reality, however, for parents to adopt these strategies so that their children make unconsciously healthier choices will be challenging. Our focus group discussions suggested that mothers find feeding their children very stressful and that achieving a healthy diet for their children was very difficult. Few of them described using covert control strategies. Use of covert control requires strategic decision making by the mother, in as far as, when shopping for food, she must feel able to make conscious decisions to avoid purchasing undesirable foods that may be abundant in food stores. In addition, she must feel able to ignore the demands of her children and other family members who may be asking for these types of foods. In a previous paper on the same cohort it was shown that mothers who used more covert control tended to be more psychologically resilient, in as far as they had higher levels of self-efficacy, felt more in control, had a greater sense of well-being and gave food a higher priority in life<sup>(18)</sup>. Together these two papers suggest that interventions should be supportive and tailored towards empowering mothers to feel able to use more covert than overt control as a way of encouraging their children to have healthier diets.

### Strengths and limitations

A particular strength of this study is that it is the first longitudinal study of mothers' use of overt and covert control, child food neophobia and children's quality of diet. It therefore

begins to fill a knowledge gap identified by previous researchers<sup>(5)</sup>. The study has limitations, however, which should be acknowledged. FFQs may be prone to measurement error, typically overestimating intakes, although they have been shown to effectively rank children according to their quality of diet<sup>(33)</sup>. It is unlikely that error in the assessment of diet would explain the findings in this study because, measurement error often, but not always, reduces associations rather than amplifies them<sup>(34)</sup>. Focus group discussions rely on participants' reported memories, which may differ from actual experiences, and may be driven by ideas of social desirability, especially when asked to talk about an emotive subject such as their children. However, the use of mixed methods strengthens this study as the qualitative findings provided the context for, and aided the explanation of, the quantitative survey findings, and confirmed some of the conclusions from the quantitative study. In addition, the qualitative data provided insights that will help with the translation of these findings into future interventions aimed at changing maternal feeding practices. The study sample was drawn from Children's Centres in Southampton, Gosport and Havant, which tend to operate in more disadvantaged areas in the towns and cities they serve. Whilst the sample size was limited, and cannot be assumed to be representative of mothers with young children in the UK as a whole, mothers in this study represented a wide range of demographics indicated by their educational attainment and number of children. In addition, and despite being drawn from a hard-to-reach population, a follow-up rate of 66% was achieved and there were no significant differences in educational attainment between those lost to follow-up and those who remained in the study.

## Conclusion

This study has begun to address an important gap in the literature, through a longitudinal assessment of maternal overt and covert control over children's food choices, and how these control techniques are associated with children's characteristics and quality of diet. The longitudinal data have allowed exploration of change and causality in a way that is currently unique to the literature. Qualitative exploration helped illustrate the findings from the surveys. Further research is required to replicate these results in larger studies, with more follow-up time points in order to explore ideas of causality.

Eliciting change in people's behaviour is challenging, and there is growing consensus that behaviour change interventions should be flexible, individually tailored, and supportive, rather than prescriptive, in order to empower participants to make changes<sup>(35)</sup>. Interventions and initiatives aimed at improving children's quality of diet need therefore to be delivered in a way that encourages parents to identify their own solutions to the problems they face feeding their children, and hence give them a sense of control over the issue. To support parents to adopt more covert techniques to control their children's diets, by not purchasing less healthy food, or by avoiding restaurants/cafes which sell them, whilst at the same time increasing their child's access and exposure to healthier foods, may be an effective way of improving the quality of diet of young children in the future.

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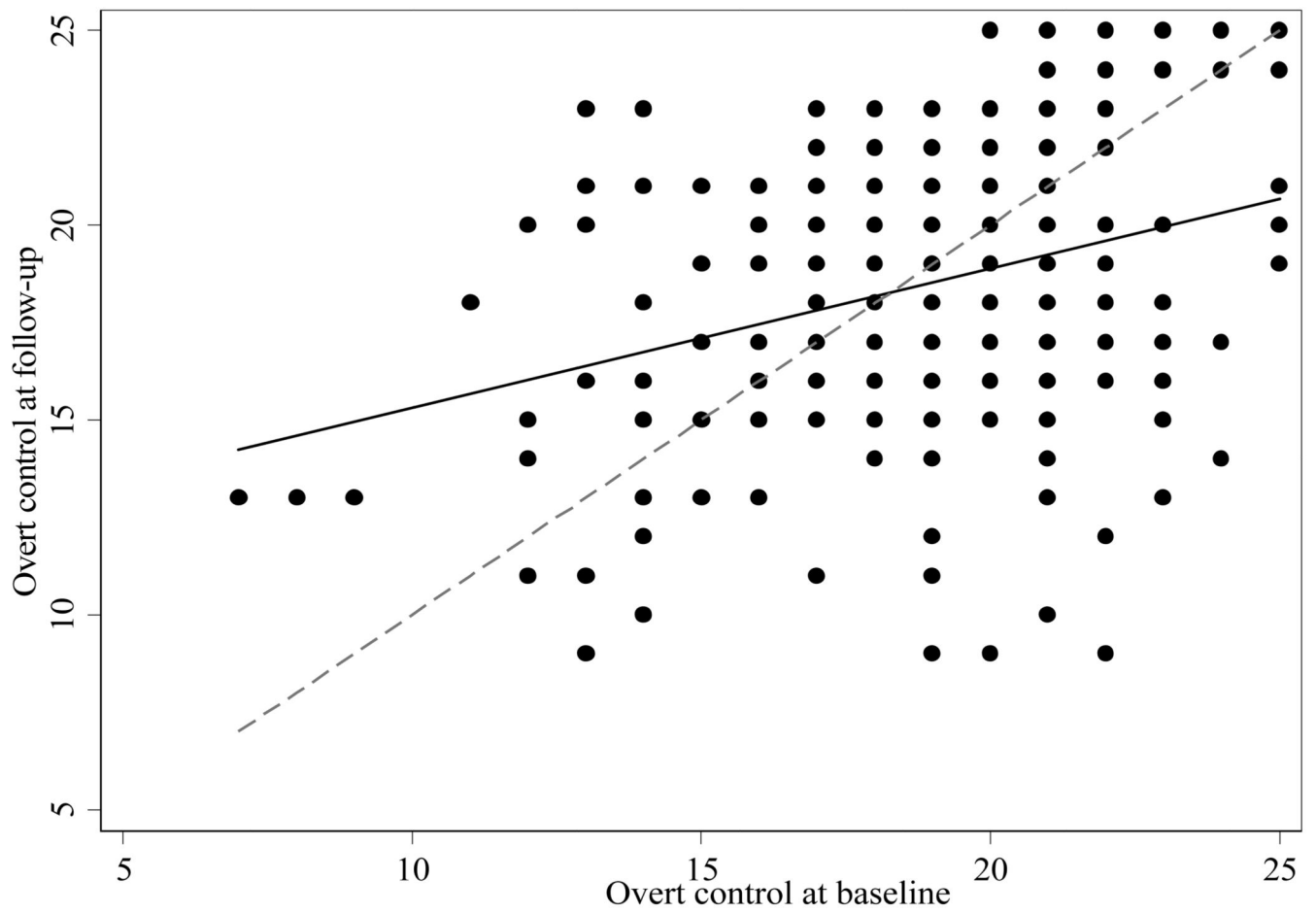
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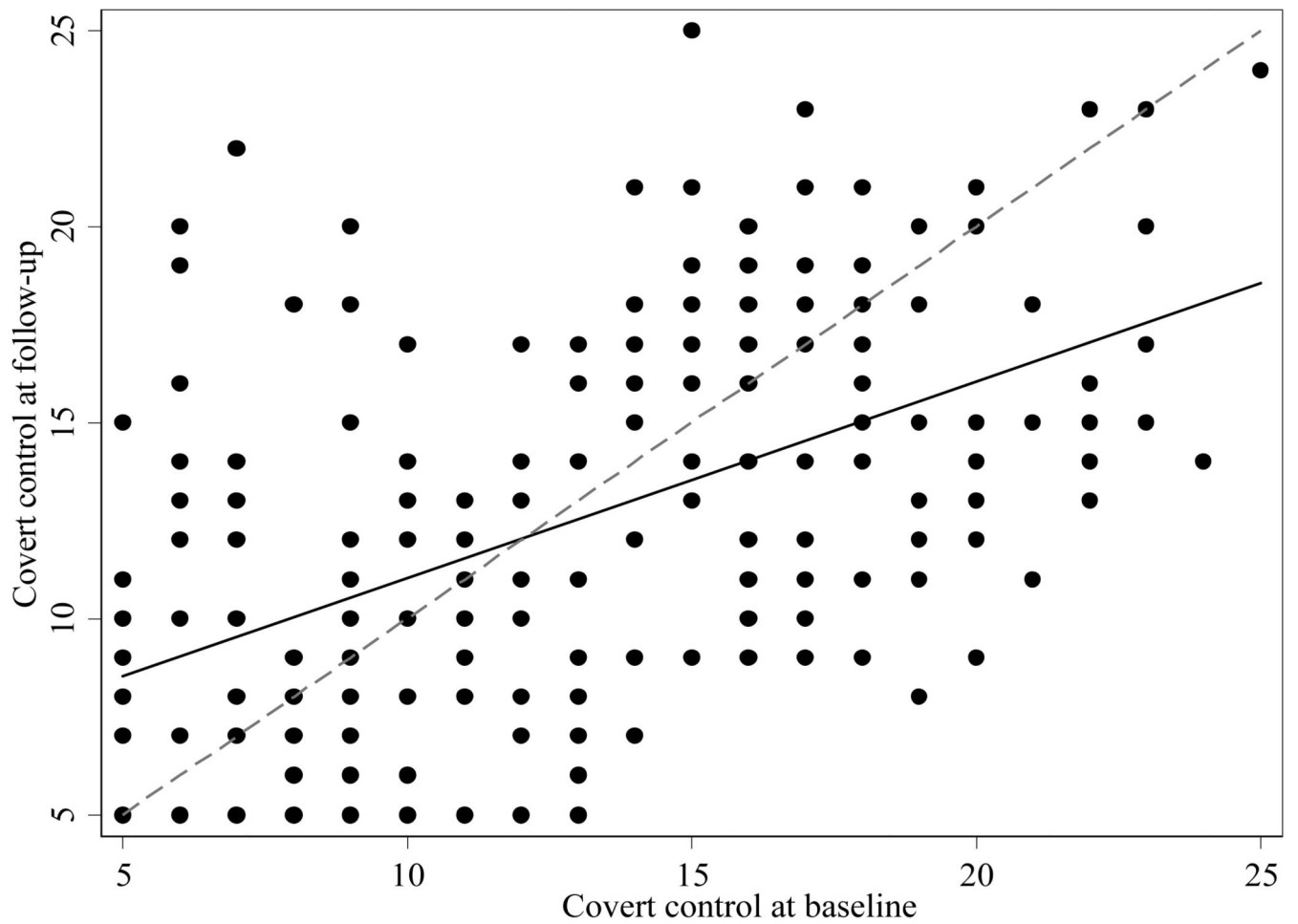
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**Figure 1.** Changes in overt control – scatter plot showing baseline overt control score (x axis) and follow-up overt control score (y axis). The solid line shows the regression line for the change in overt control, the dashed line indicates where the points would lie if there had been no change





**Figure 2.** Changes in covert control – scatter plot showing baseline covert control score (x axis) and follow-up covert control score (y axis). The solid line shows the regression line for the change in covert control, the dashed line indicates where the points would lie if there had been no change

**Table 1**

Characteristics of the 228 mother-child pairs at baseline and follow-up

Characteristic	Baseline	Follow-up
Child age (mean(SD))	3.4 (0.9)	5.1 (0.9)
Child gender (n(%))		
Male	112 (49)	-
Child birth order (n(%))		
1 <sup>st</sup>	127 (56)	-
2 <sup>nd</sup>	68 (30)	-
3 <sup>rd</sup>	33 (14)	-
Child neophobia score (median(IQR))	14 (12-17)	15 (13-17)
Children's quality of diet score (mean(SD))	0.1 (1)	0 (1)
Mother's age (mean(%))	32.8 (5.1)	35 (5.0)
Number of children in the house (n(%))		
1	46 (20)	38 (17)
2	129 (57)	128 (56)
3+	52 (23)	62 (27)
Mothers educational attainment (n(%))		
GCSE *	79 (35)	-
>GCSE	149 (65)	-
Mother's benefit receipt † (n(%))		
No	135 (59)	136 (66)
Yes	93 (41)	71 (34)
Household food insecurity † (n(%))		
Food secure	193 (85)	175 (85)
Food insecure	34 (15)	32 (15)
Mother's overt control score (median(IQR))	19 (17-21)	19 (16-21)
Mother's covert control score (median(IQR))	13 (9-17)	12 (6-16)

† This information was only available for 207 of the mothers at follow-up

\* General Certificate of Secondary Education (GCSE)

**Table 2**

Associations between overt and covert control, child food neophobia and changes in overt and covert control, and children's quality of diet at baseline and follow-up. Figures in bold reached statistical significance

<b>Quality of diet at baseline</b>	
	<u>Beta coefficient (95% CI)</u>
Overt control score baseline	0.00 (-0.03, 0.04)
Covert control score baseline	<b>0.05 (0.02, 0.07)</b>
Child's neophobia score baseline	<b>-0.07 (-0.10, -0.04)</b>
<b>Quality of diet at follow-up</b>	
Overt control score follow-up	0.01 (-0.02, 0.04)
Covert control score follow-up	<b>0.05 (0.02, 0.07)</b>
Child's neophobia score follow-up	<b>-0.07 (-0.11, -0.04)</b>
Change in overt control score	0.00 (-0.03, 0.04)
Change in covert control score	<b>0.04 (0.01, 0.07)</b>