

**Increasing vegetable consumption in early childhood: Parents
as facilitators**

By

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Abstract

This thesis aimed to investigate the potential to increase young children's vegetable consumption by using caregivers as facilitators. This was achieved in two parts. Part I set out to investigate whether parent led interventions using three known successful methods of offering can be effective for increasing children's acceptance of a disliked vegetable. Three studies were conducted for Part I. The first tested the efficacy of these interventions, the second investigated the role of individual factors in intervention success, and the third examined the longitudinal efficacy of such interventions over two, six and 12 months. The findings suggested that parent led home-based interventions may be successful for increasing children's acceptance of disliked vegetables in the short-term, and that such interventions may be more successful for children who are more sociable and less fussy eaters. While these interventions may not be successful for sustained long-term changes, there was a lack of statistical power for these analyses and further studies with larger samples are required. Part II of the thesis sought to investigate the wider variety of methods which caregivers use to offer vegetables to their children, as well as the possible barriers to offering. These studies worked towards informing the design of future interventions as well as providing information for caregivers on achieving a healthful diet in their children. This was achieved via two studies which used qualitative and quantitative methods. One study used focus groups to gather a comprehensive report of caregivers' methods of offering, as well as caregivers' perceived influences on how and whether they offer their child vegetables. Methods of offering vegetables formed three main categories: active/behavioural methods, passive methods, and food manipulations. The influences on offering which caregivers perceived formed four categories: information, cost, caregiver factors, and child factors. These methods and influences were then assessed in a large scale cross-sectional study. This study examined which methods caregivers perceive as successful for encouraging consumption of vegetables, as well as assessing predictors of offering vegetables and children's vegetable consumption. Caregiver factors predicted reoffering of rejected vegetables while a combination of caregiver and child factors predicted children's consumption of vegetables. A number of discrepancies were found between methods caregivers perceived as successful and those which were associated with greater consumption of vegetables. As food fussiness was identified as a significant factor in children's consumption of vegetables, a final study investigated whether children categorised as fussy or not fussy with vegetables differed on a number of caregiver and child factors. Differences were found

between these groups on both caregiver and child factors. Using a mixed methodology, the research in this thesis investigates possibilities for increasing vegetable consumption in early childhood and highlights the central role of caregivers in this process. Together, these findings suggest utility of whole family interventions aimed at increasing vegetable consumption, as well as providing caregivers with information on how best to offer vegetables to children of this age.

In memory of Professor Jane Wardle

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Publications and presentations derived from this thesis

Peer reviewed publications

- Holley, C.E., Haycraft, E. & Farrow, C. (2015). 'Why don't you try it again?' A comparison of parent led, home based interventions aimed at increasing children's consumption of a disliked vegetable. *Appetite*, 87, 215-222. <http://dx.doi.org/doi: 10.1016/j.appet.2014.12.216>
- Holley, C.E., Farrow, C. & Haycraft, E. (Under consideration). Investigating offering of fruits and vegetables amongst caregivers of preschool age children: A qualitative study. *Child: Care, Health and Development*.
- Holley, C.E., Haycraft, E., & Farrow, C. (In press). Investigating the role of parent and child characteristics in the efficacy of a vegetable consumption intervention. *Appetite*.

In preparation

- Holley, C.E., Farrow, C. & Haycraft, E. (in preparation). If at first you don't succeed: Methods used by caregivers to offer vegetables to preschool age children.

Oral presentations

- Holley, C.E., Haycraft, E. & Farrow, C. (2015). The role of individual characteristics in the efficacy of interventions for increasing children's acceptance of a disliked vegetable. Oral presentation delivered at the British Feeding and Drinking Group Annual Meeting, Wageningen, Holland, 3-4 April 2015.
- Holley, C.E., Farrow, C., & Haycraft, E. (2014). Exploring parent and child factors in the efficacy of interventions aimed at increasing children's acceptance and liking of a disliked vegetable. Oral presentation delivered at the International Feeding Disorders Conference, UCL Institute of Child Health, London, UK, 4-5 November 2014.

Poster presentations

Holley, C.E., Haycraft, E. & Farrow, C. (2014). Investigating the efficacy of parent-led repeated taste exposure, incentives and modelling interventions at increasing children's acceptance of a disliked vegetable. Oral presentation delivered at the British Feeding and Drinking Group Annual Meeting, Portsmouth, UK, 3-4 April 2014.

Holley, C.E., Haycraft, E. & Farrow, C. (2014). Investigating the efficacy of repeated taste exposure programmes with incentive and modelling elements aimed at increasing children's acceptance of a disliked vegetable. Poster presentation delivered at the Health and Life Sciences Annual Student Conference, Loughborough University, UK, 17 February 2014.

Holley, C.E., Haycraft, E. & Farrow, C. (2013). "Why don't you try it again?" A comparison of repeated exposure tasting programmes aimed at increasing liking and acceptance of a disliked vegetable. Poster presentation delivered at the Health and Life Sciences Annual Student Conference, Loughborough University, UK, 13 May 2013.

Holley, C.E., Haycraft, E. & Farrow, C. (2013). "Why don't you try it again?" Investigating whether incentives and parent-modelling can increase the efficacy of a repeated taste exposure programme aimed at increasing children's acceptance of a disliked vegetable. Poster presentation delivered at the British Feeding and Drinking Group Annual Meeting, Loughborough University, UK, 4-5 April 2013.

Holley, C.E., Haycraft, E. & Farrow, C. (2013). "Why don't you try it again?" A comparison of four parent-led exposure based interventions aimed at increasing acceptance of a disliked vegetable. Poster presentation delivered at the Loughborough University Research Conference 2013, Loughborough University, UK, 7 March 2013.

Chapter 1: Introduction

Introduction

1.1 Introduction to the chapter

This chapter starts by considering the importance and health benefits of vegetable consumption, before discussing current vegetable consumption statistics with particular reference to early childhood. Next, a number of parent and child influences on vegetable consumption will be outlined, before three possible mechanisms for increasing children's consumption of vegetables are presented. The overarching aim of this thesis will then be outlined along with a list of more specific research aims to be covered and details of the chapter in which these will be addressed.

1.2 Why is vegetable consumption important?

Obesity is arguably one of the biggest public health threats of our time, with more than 40,000,000 children under the age of five overweight or obese globally (World Health Organisation, 2014), and one in five reception age children in the UK measuring as overweight or obese (Health and Social Care Information Centre, 2014). Furthermore, obesity is associated with a catalogue of serious chronic diseases and cancers, as well as disability and decreased quality of life (Health and Social Care Information Centre, 2015).

Excess weight in childhood has been associated with an increased likelihood of cardiovascular disease risk factors, with one study suggesting that overweight children are more than twice as likely to have elevated cholesterol (Freedman, Dietz, Srinivasan, & Berenson, 1999), and that 58% of overweight children have at least one risk factor for cardiovascular disease (Freedman et al., 1999). Furthermore, childhood obesity has been associated with insulin resistance syndrome, a major risk factor for the development of type two diabetes (Srinivasan, Myers, & Berenson, 2002) and, in severe cases, arterial wall stiffness (Tounian, Aggoun, & Dubern, 2001).

Diets rich in fruits and vegetables can not only lower children's caloric intake and reduce the risk of obesity (McCrory & Fuss, 1999), but can also serve to prevent against many non-communicable diseases (e.g., American Institute for Cancer Research & World Cancer Research Fund International, 1997; Cox, Whichelow, & Prevost, 2007; Southon, 2000; Vecchia, Decarli, & Pagano, 1998). For example, consumption of carotenoid fruits and vegetables has been shown to significantly increase oxidation resistant low-density-lipoprotein, lowering individuals' risk of developing cardiovascular disease (Southon, 2000). Other research states that

adequate fruit and vegetable consumption may reduce the risk of cardiovascular disease development by 20 to 40% (Klerk, Jansen, Veer, & Kok, 1998). High vegetable intake has also been associated with a decreased likelihood of heart attacks and stable angina (Vecchia et al., 1998), with raw and leafy green vegetables thought to be particularly protective against cardiac events (Klerk et al., 1998). A review from The American Institute for Cancer Research and World Cancer Research Fund International (1997) suggested that a diet rich in fruits and vegetables (400+g/day) could prevent at least 20% of all cancers and the World Health Organisation (2015) asserts that low fruit and vegetable intake is one of the five leading behavioural and dietary risk factors for cancer development. There is also some evidence that a diet rich in fruits and vegetables may play a protective role against the development of bronchitis and asthma (e.g., Vecchia et al., 1998), cataracts (e.g., Jacques & Chylack, 1991), hypertension (Appel & Moore, 1997), and stroke (Klerk et al., 1998).

Although much of this research implicates both fruits and vegetables in disease protection and prevention, it is known that whilst increasing fruit consumption has health benefits, fruits are also high in sugar. As a calorific compound, excess sugar consumption is a major contributor towards overweight and obesity (Kuhnle et al., 2015), as well as concurrent type two diabetes. Furthermore, some research suggests that fructose consumption activates the digestive system in a different way to glucose, so that it does not stimulate insulin or leptin release (see Elliott, Keim, Stern, Teff, & Havel, 2002, for a review). This in turn can result in weight gain and metabolic consequences, as well as an increased risk of precursors to diabetes.

As summarised above, research suggests that vegetable consumption can provide a wide range of health benefits and seems to protect against a number of diseases. Furthermore, vegetables have much lower sugar content than fruits and, as such, increasing vegetable consumption is thought to be more desirable than increasing consumption of fruits. With this in mind, this thesis focuses on increasing consumption of vegetables alone, rather than fruits and vegetables.

1.2.1 *Current statistics on vegetable consumption*

Research suggests that both adults and children in the UK are consuming less than the government recommendation of five portions of fruit and vegetables a day (Public Health England & Food Standards Agency, 2014), with only 9% of children aged 11 to 18 achieving this quota. Research into children's consumption of vegetables reported that of 277 foods parents listed as disliked by children, 46% were vegetables while just

8% were fruits (Cashdan, 1998), and that children's consumption of vegetables is far lower than that of fruits (Cockroft & Durkin, 2005). Furthermore, recent research suggests that when fruit juice is included in classifications, vegetable consumption is half that of fruit consumption amongst 4 to 10 year-olds (Public Health England & Food Standards Agency, 2014). Together, this research highlights the low consumption of vegetables in many children and reasserts that vegetable consumption is a more appropriate target for interventions than fruit.

1.2.2 *Why focus on vegetable consumption in children?*

It is known that eating behaviours which are established in early childhood carry through childhood and into adulthood (e.g., Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2007; Northstone & Emmett, 2008). With this in mind, it seems logical to focus on increasing vegetable consumption in early childhood, where the maximal benefits of a diet rich in vegetables could then be experienced across the lifespan. Statistics on preschool children's fruit and vegetable consumption in the UK are extremely limited, most likely in part because there are no fixed recommendations of what constitutes a portion size for children. The Children's Food Trust (2015) suggests a good portion size guide for primary school aged children is at least half an adult 80g portion and so a preschool age child's portion would likely fall below this 40g target. Research from Lennox, Olson, and Gay (2011) states that the average UK 1.5 to 3 year-old child consumed 72g of vegetables per day, which seems to fall far short of suggestions of 200g of fruit/vegetables per day which can be deduced from The Children's Food Trust (2015) recommendations. Strikingly, one study suggests that as few as 16% of preschool children may be eating fruits and vegetables on five or more occasions a day, with as many as 39% eating no vegetables (Cockroft & Durkin, 2005). However, until portion size recommendations are fixed and widely known, gathering adequate data on preschool children's intake is difficult. Although there are no government authorised portion sizes for children, lay-person resources have suggested that portion sizes which are given as a visual amount (e.g. $\frac{1}{2}$ to 2 tablespoons of peas; Infant and Toddler Forum, 2013) rather than a weight, may be more useful for food providers. With research suggesting that consumption of vegetables is low amongst children (Cockroft & Durkin, 2005) and that increasing intake would confer health benefits, research should focus on methods which might help to achieve this.

1.3 Influences on vegetable consumption in children

To work towards increasing children's consumption of vegetables, knowledge of the parent and child factors which influence consumption is imperative. A number of these

will be discussed in this chapter, including the role of caregivers as gatekeepers of feeding, caregivers' child feeding practices, children's food neophobia, children's eating behaviours, and children's temperament.

1.3.1 Gatekeepers of feeding

In early childhood, children rely on their caregivers to provide the foods necessary for adequate nutrition (McCaffree, 2003). This primary role in child feeding may be undertaken by parents, grandparents or other relatives, child minders or other childcare professionals. Furthermore, caregivers play a central role in teaching children about nutrition, as well as in children's development of healthy eating behaviours (e.g., Gibson, Wardle, & Watts, 1998; Pearson, Biddle, & Gorely, 2009; Powell, Farrow, & Meyer, 2011). It is known that in order for vegetables to be consumed, they must be available, with availability being one of the strongest predictors of children's vegetable consumption (see Jago, Baranowski, & Baranowski, 2007, for a review). With young children reliant on their caregivers to make vegetables available, caregivers are a necessary central figure in research aimed at increasing children's vegetable consumption and so will be focused on within this thesis.

1.3.2 Caregivers' child feeding practices

In addition to caregivers' roles in making healthy foods available, caregivers' child feeding practices are another important factor linked to children's vegetable consumption. Feeding practices are specific strategies which caregivers use in an attempt to alter or maintain their child's eating behaviour (Ventura & Birch, 2008). These can be broadly grouped into two categories: maladaptive controlling feeding practices which can unintentionally increase children's food avoidance and unhealthy food choices; and, adaptive feeding practices which typically promote children's healthy food choices and consumption. Much of the research into the influence of feeding practices on child outcomes has focused on more controlling feeding practices such as pressure to eat and restriction, while research into the effects of more adaptive feeding practices is relatively sparse.

Controlling feeding practices have been associated with children's vegetable intake, where a higher use of these feeding practices is related to lower consumption of vegetables amongst children (Vereecken, Rovner, & Maes, 2010). More specifically, control over children's eating behaviour has been associated with both higher neophobia and lower consumption of vegetables amongst children (e.g., Burt, Boddy, & Bridgett, 2015; Wardle et al., 2005). Furthermore, in a study by Brown & Ogden (2004)

children whose parents exerted greater control over their child's diet reported higher intake of both healthy and unhealthy snacks. It is possible that parental control over children's diets may teach them to overconsume even in the absence of control. Such maladaptive feeding practices may also encourage children to eat according to external cues, such as prompts, rather than internal cues such as hunger. Another example of this is parents' use of food to regulate emotion regulation in their child, such as giving a child a biscuit when they are upset. The notion of this leading to external eating is supported by Blissett, Haycraft and Farrow (2010) who found that parents' use of food in emotion regulation was associated with greater eating in the absence of hunger among 3 to 5-year-old children.

Pressure to eat is often used by caregivers to encourage their children to eat particular foods or to eat more of a food. While this feeding behaviour is usually implemented with positive intentions, research suggests that using this practice may be detrimental to children's eating behaviour and health. Galloway, Fiorito, Francis, and Birch (2006) experimentally investigated the effect of using pressure to encourage children to eat on their concurrent consumption of soup. They found that children consumed significantly more soup when they were not pressured to eat, indicating a backfiring effect of pressure to eat. This reasserts the notion that being subjected to pressure to eat can contribute towards maladaptive eating behaviours in children.

Another controlling feeding practice is restriction, which is used by caregivers in an attempt to make their child's diet healthier. This can include restricting unhealthy items, or restricting the amount children eat to prevent them from consuming too much food (Musher-Eizenman & Holub, 2007). However, research suggests that greater restriction of palatable foods is related to higher energy intake as well as higher body mass in 5 year-old children (Birch & Fisher, 2000), though not all research supports this notion (Carnell & Wardle, 2007). Higher use of restriction with 5 year-old children has been found to be predictive of higher eating in the absence of hunger at 7 and 9 years of age (Birch, Fisher, & Davison, 2003). Furthermore, children who were overweight at the age of 5 and whose parents implemented high levels of restriction had the highest level of eating in the absence of hunger at the age of 9, as well as demonstrating the largest increases in eating in the absence of hunger from 5 to 9 years old (Birch et al., 2003).

Although there is a large body of research (as outlined above) suggesting associations between children's eating and use of controlling feeding practices, it should be noted that causality remains unclear. While it is possible that the use of controlling feeding

practices contributes to problematic eating behaviours, it is important to acknowledge the alternative possibility that caregivers use more controlling feeding practices with children who are difficult or fussy eaters. This notion is asserted by Farrow and Blissett (2008) who reported conflicting findings about causality in their study. Although use of restriction at 1 year of age predicted children's weight at 2 years of age, use of pressure to eat was negatively correlated with weight at birth, 1 year, and 2 years. This suggests that while use of restriction may have a causal impact on child weight, use of pressure to eat may be used by parents with infants who are born lighter or who grow more slowly than their peers. Wardle et al. (2005) also support the idea of controlling feeding practices being a response to lower consumption rather than a cause of it, where although parental control predicts fruit and vegetable intake, this is not the case once neophobia is taken into account, where higher use of control is also positively associated with children's neophobia. It is also possible that these relationships may have a cyclical effect or may vary according to the age of children. Regardless of causality, it seems that use of controlling feeding practices can be associated with less healthy diets in children.

There are other more adaptive parenting practices which appear to be more successful for achieving a healthy diet in children. These include: modelling healthy food intake, encouraging balance and variety, involving children in food choice and preparation, teaching children about nutrition, and creating a healthy food environment. These practices are indicative of a more flexible parent feeding style, where both parent and child make decisions about the child's eating and these practices have been positively associated with children's vegetable intake (Vereecken et al., 2010).

Parental modelling of healthy eating behaviour (that is, parents exhibiting healthy eating behaviours in front of their child) has been significantly correlated with greater fruit and vegetable consumption in a large sample of 9 to 12 year-old American school children (Cullen, 2001) as well as in a large sample of preschool and school-age children (Palfreyman, Haycraft, & Meyer, 2014). A study from Young, Fors, and Hayes (2004) also found that 10 to 14 year-olds' *perception* of their parents' modelling of healthy eating was significantly related to their greater fruit and vegetable consumption. However, parental modelling can have a negative influence on children's eating as well as a positive one. The exerted influence depends upon which foods are being consumed, so that unhealthy eating habits are transmitted as well as the healthy ones. This is supported by research which has found that mothers' intake of high-energy drinks, sweet and savoury snacks are positively associated with children's intake of

these foods (Campbell, Crawford, & Salmon, 2007; Palfreyman et al., 2014). Furthermore, a large number of studies have found a strong association between parent and child food intake (e.g., Campbell, Crawford, & Salmon, 2007; Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002; Palfreyman et al., 2014; Rossow & Rise, 1994; Wardle et al., 2005), including vegetable intake, although it is acknowledged that there are likely factors additional to modelling in this association. Together, this research suggests an important role of parental modelling and eating habits in the formation of children's habits.

Another practice used to influence children's eating is creating a healthy home environment by making healthy food available. It is known that children consume more of foods when they are available (e.g., Neumark-Sztainer, Story, Perry, & Casey, 1999), with research asserting that this also applies to fruits and vegetables (Hanson, Neumark-Sztainer, Eisenberg, Story, & Wall, 2005; Hearn et al., 1998). Moreover, the availability of fruits and vegetables in the home environment has been found to moderate the relationship between children's perceptions of their parents' modelling and children's vegetable consumption, highlighting the importance of the availability of vegetables for increasing children's vegetable consumption.

1.3.3 Food neophobia

Neophobia is classified as the fear of and refusal to eat new or unknown foods (Birch & Fisher, 1998) and is derived from Rozin's concept of the '*omnivore's dilemma*' (Rozin & Vollmecke, 1986; Rozin, 1979). While infants will accept most food indiscriminately (as they are fed by their caregiver), newly ambulatory children begin to reject new and unknown foods. Rozin's (1979) research proposes that this behaviour has an evolutionary mechanism to protect young children from poisoning themselves with new items they find in their environment, rather than 'safe' foods which are provided or screened for them by caregivers (Birch, Gunder, Grimm-Thomas, & Laing, 1998; Cashdan, 1998). Children progress beyond this neophobic response to like and consume foods through a process of '*learned safety*' (Kalat & Rozin, 1973). Here, repeated ingestion of a food does not result in negative gastrointestinal consequences and thus children learn that it is safe to eat.

1.3.3.1 Food neophobia and vegetable consumption

To fulfil its protective role, neophobic food rejection often occurs before foods have been tasted and is primarily based on visual aspects of foods. Here, children refuse green vegetables on the basis of their appearance (Harris, 1993), where their

appearance may be indicative of them containing secondary compounds which can be toxic (Cashdan, 1998). It is also known that children naturally reject bitter tasting foods such as green vegetables (McBurney & Gent, 1979), with it theorised that this is to avoid children accidentally consuming poisonous plants, which can be indicated by bitter taste (Cashdan, 1998). Indeed, neophobia has been found to be a strong predictor of 2 to 6 year-old's consumption of vegetables (Wardle et al., 2005), supporting the idea that vegetables are particularly likely to induce neophobic responses in young children and that this may at least partly contribute to low levels of vegetable consumption seen in children.

1.3.4 Children's eating behaviours

Children's general eating behaviours may be another factor related to children's consumption of vegetables. There are numerous behaviours which children exhibit in relation to eating, all of which can be considered on a spectrum. Broadly speaking, these can be put into two groups: *food approach* and *food avoidance* behaviours. Food approach behaviours include how responsive a child is to food cues, their enjoyment of food, whether or not they overeat in response to emotions, and their desire for drinks. Conversely, food avoidant behaviours include how responsive a child is to fullness cues (satiety responsiveness), how fussy they are with food, whether or not they undereat in response to emotions, and how slow they are at eating. Research into the impact of children's eating behaviours has consistently found that food approach behaviours are positively associated with children's weight while food avoidant behaviours are negatively associated with weight amongst primary school aged children in the UK (Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009), Portugal (Viana, Sinde, & Saxton, 2008), and the Netherlands (Sleddens, Kremers, & Thijs, 2008). Furthermore, overweight children have shown stronger food responsiveness and weaker satiety responsiveness than leaner children (Sleddens et al., 2008). This is in line with the notion that children who are high in food responsiveness are more susceptible to external food cues such as the sight of food, which can result in eating in the absence of hunger and subsequent weight gain (Wardle, Guthrie, Sanderson, & Rapoport, 2001). Equally, children who are high in satiety responsiveness are likely to make decisions about stopping eating based on internal cues, such as their level of satiety, and are less susceptible to environmental food cues (Wardle et al., 2001).

Although research into the direct impact of children's eating behaviours on their consumption of vegetables is limited, Galloway, Fiorito, Lee, and Birch (2005) have found that children who are picky or fussy eaters consume significantly fewer

vegetables than their non-picky counterparts. Children's enjoyment of food has also been found to be a significant predictor of children's consumption of vegetables, where children who enjoy food more consume significantly more vegetables than children who have low enjoyment of food (Cooke et al., 2004). Thus, children's general eating behaviours are likely to be an important determinant of their consumption of vegetables.

1.3.5 Children's temperament

A further possible influence on children's consumption of vegetables is their temperament. Schaffer (2006) defines temperament as "personal characteristics that are biologically based, are evident from birth onwards, are consistent across situations and have some degree of stability" (p.70). It has been suggested that child temperament may be related to why some children develop eating problems over others, as well as being linked to children's Body Mass Index (BMI; calculated by dividing weight in kilograms by height in meters squared), the different parenting practices which are used, and children's vegetable consumption.

Child temperament can be measured on several dimensions but two commonly used dimensions are emotionality and sociability (Buss & Plomin, 1984). Child emotionality is indicated by behaviours such as becoming upset easily and crying. Greater emotionality has been implicated in maladaptive eating behaviours in childhood, such as lower enjoyment of food, greater emotional over and under eating, slowness in eating and food fussiness (Haycraft, Farrow, Meyer, Powell, & Blissett, 2011), as well as the development of later eating concerns (Martin et al., 2000). In a longitudinal study by Martin et al. (2000), children who were more emotionally negative at 3 to 4 years of age demonstrated significantly higher drive for thinness and body dissatisfaction, as well as scoring higher on bulimic symptomology, at the age of 12 or 13. When combined with low effortful control (defined as self-regulatory control over external stimuli), high negative emotionality has been associated with young adults (aged 18 to 24) having a greater number of eating disorder symptoms. Together, this research suggests that the influence of child temperament on eating behaviours tracks through to adolescence.

Child sociability can be exemplified by how a child chooses to play, such as whether they choose to play with other children or on their own. Low child sociability has been associated with lower initial acceptance of novel foods (Moding, Birch, & Stifter, 2014). Furthermore, less sociable children have been shown to have a higher prevalence of feeding difficulties (Pliner & Loewen, 1997).

Research indicates that child sociability and emotionality may exert combined effects on children's eating. Correlations have been found between children's emotionality as well as shyness (being less sociable) with indicators of neophobia (unwillingness to try new foods; Pliner & Loewen, 1997) and picky eating at both 2 and 4.5 years of age (Hafstad, Abebe, Torgersen, & Soest, 2013). Although some authors have found no direct association between child temperament and BMI (Haycraft et al., 2011), children's emotional temperament has been implicated in children becoming overweight, by mediating the relationship between child and parent overweight status (Agras, Hammer, McNicholas, & Kraemer, 2004). Lower sociability in combination with greater emotionality can be characterised as 'difficult' child temperament. This difficult temperament has been associated with negative mealtimes as well as food refusal (Farrow & Blissett, 2006). Furthermore, a higher prevalence of feeding difficulties have been observed in children with difficult temperament (Pliner & Loewen, 1997), with toddlers with infantile anorexia being described by their caregivers as more difficult and negative than a control group (Chatoor, Ganiban, Hirsch, Borman-Spurrell, & Mrazek, 2000). This suggests that children's temperament may well influence their eating behaviour or indeed the way in which they are fed by caregivers.

1.3.5.1 *Children's temperament and vegetable consumption*

While research has examined the links between child temperament and their eating behaviours in general, there has been very limited research into the impact of children's temperament on their consumption of vegetables, specifically. However, research conducted by Vollrath and Stene-Larsen (2012) found support for a role of temperament in children's vegetable consumption. In this study, children's temperament measured at 18 months of age significantly predicted their consumption of vegetables at the age of 3 and 7 years old. Here children who were more surgent (sociable and active) were almost twice as likely to consume two or more portions of fruit and vegetables a day at the age of 3, with every unit increase in surgency doubling the likelihood of children consuming fruits and vegetables at the age of 3. Conversely, each unit increase in children's level of externalizing temperament (categorised by hyperactivity and aggression) halved the chances of them consuming fruits and vegetables at the age of 3. Such research serves to indicate that temperament may be a factor which is linked to children's vegetable consumption, or their willingness to try new foods.

1.4 Methods for Increasing Children's Consumption of Vegetables

Section 1.2 of this chapter has shown that while vegetable consumption has numerous health benefits, intake in early childhood is typically very low. A number of the potential parent and child influences on children's consumption of vegetables have been considered (section 1.3), and now some of the possible ways of increasing children's vegetable consumption will be outlined. Three mechanisms which have been the focus of much previous research in this area will be discussed: repeated exposure; parental role modelling; and, use of rewards.

1.4.1 *Repeated exposure*

Zajonc's (1968) Mere Exposure Hypothesis suggests that an individual's attitude towards a stimulus will be improved through mere exposure to the stimulus. This notion can be applied to the development of liking and acceptance of foods, thought to take place through the previously discussed process of 'learned safety'. Research evidence supports Zajonc's notion, indicating that repeated exposure to a food can be used to transform disliked or unfamiliar foods into accepted or even liked foods (Hendy et al., 1999).

Familiarity of foods can be an important influence on child's food choices and consumption. Wardle, Guthrie, Sanderson, and Rapoport (2001) investigated patterns in children's food preferences with a sample of 200 twin pairs. They found that how much a food was liked by the sample of children was positively related to how familiar the children were with the food. Relatedly, Cooke and Wardle (2005) found that foods which have been tried less often by children tend to be less liked by children. Familiarity not only affects the consumption of familiar foods, but also the consumption of new foods. Pliner and Pelchat (1986) found that mothers who reported previously offering their child a greater variety of foods during day to day life also reported that their child was more likely to try new foods. This suggests that familiarising children with vegetables could be a valid pathway for increasing liking of vegetables, with repeated exposure an ideal mechanism for achieving familiarity.

Fundamental support for repeated exposure has been documented in both adults (e.g. Pliner, Pelchat, & Grabski, 1993; Pliner, 1982) and children (Sullivan & Birch, 1990, 1994). In infants, just one exposure to the taste of a novel food has been shown to dramatically increase subsequent intake and liking of that food (Sullivan & Birch, 1994) and there is evidence that this effect can generalise to other, similar foods (Birch, Gunder, Grimm-Thomas, & Laing, 1998). In 2 year-olds, between five and 10

exposures have been shown to increase liking for novel fruits and cheeses (Birch & Marlin, 1982; Birch et al., 1998), while 15 exposures were required to increase 3 to 4 year-olds' preferences for sweetened, salted or plain tofu and no generalisation was seen (Sullivan & Birch, 1990). This calls into question the generalised effect of repeated exposure, which requires further research to establish.

1.4.1.1 *Exposure and vegetables*

With specific reference to vegetable consumption, one survey study has suggested that the introduction of vegetables early in weaning is associated with greater consumption of vegetables between 2 and 6 years of age (Cooke et al., 2004). Importantly, the number of presentations necessary for acceptance of a novel food decreases as the number of novel foods previously introduced increases (Skinner, Carruth, Bounds, & Ziegler, 2002a; Williams, Paul, Pizzo, & Riegel, 2008), suggesting that the introduction of a few novel foods may facilitate acceptance of further novel foods. This finding may extend to vegetable consumption, where after one novel vegetable is introduced, each successive vegetable which is introduced might be accepted more readily. If this were to be the case, it could suggest that interventions aiming to increase the consumption of one particular vegetable may have broader effects on consumption than merely on the target vegetable.

Support has been found for the real-world application of repeated exposure to increase consumption of disliked and novel vegetables in a number of studies. Lakkakula, Geaghan, Zanovec, Pierce, and Tuuri (2010) found that after a programme of repeated tasting once a week for 10 weeks, children's liking for three out of four previously disliked vegetables increased and, for the majority of children, liking and acceptance of these vegetables occurred after eight or nine exposures. In the home setting, children who experienced 14 consecutive days of parent led exposure to a disliked vegetable showed significant increases in acceptance and liking of the target vegetable compared to both a no-treatment control group and a group given information on healthy eating (Wardle, Cooke, et al., 2003). Although supportive of the effects of repeated exposure, these findings should be treated with caution. Parents and children in the repeated exposure group were required to keep a vegetable diary to record their tastings, where children were asked to use stickers of facial expressions to indicate whether they liked the vegetable after each tasting. This diary, complete with the stickers, may have formed a reward element which could have had an impact on children's liking and consumption additional to the repeated exposure. Furthermore, parental modelling was suggested to parents as a method to achieve tasting. Therefore, this repeated

exposure group may have been influenced by the rewards and parental modelling also involved in the daily tastings.

A further study by Wardle, Herrera, Cooke, and Gibson (2003) also demonstrated positive findings for the use of repeated exposure. Here, children assigned to an eight day repeated exposure programme showed significant increases in liking and consumption of a target vegetable post intervention compared to both a no-treatment control group and a group who received tangible rewards for tasting. Again, this was not a pure test of repeated exposure, as children in all groups experienced modelling by the experimenter who demonstrated tasting. Cooke et al.'s (2011) school-based comparison of tangible reward, social reward, repeated exposure, and a no-treatment control group can provide some insight. After the 12-day intervention period, children in the repeated exposure group showed significant increases in acceptance and liking of a previously disliked vegetable compared to children in the no-treatment control group. However, at three month follow-up these increases were no longer apparent. There is a general lack of longitudinal data to support or refute the use of repeated exposure for long-term behaviour change. Whilst Caton et al. (2013) found that repeated exposure is effective at increasing preschool children's intake of a novel vegetable including at five week follow-up, further longitudinal studies are necessary.

Together, research into the effects of repeated exposure suggests that during childhood, the number of exposures necessary for increased liking and consumption of a novel food varies. This may be a function of some individuals entering a neophobic phase, which begins between 18 and 24 months of age (Dovey, Staples, Gibson, & Halford, 2008), resulting in a greater number of exposures being needed. As highlighted by Mitchell, Farrow, Haycraft, and Meyer (2013), despite the body of research evidence pointing towards the importance of repeated exposure, this finding has not translated into health guidelines. Although the need for repeated exposure is well encapsulated in World Health Organisation (WHO), European Union (EU), and American guidelines, all of which target practitioners, no information is given to caregivers on how to achieve sufficient exposure to a healthy variety of foods. With this in mind, research into the efficacy of methods which parents/caregivers can use to help their children to taste previously rejected vegetables must be investigated. This should be done with the intention of producing realistic and real-world recommendations on which methods to use, thereby minimising the stress many parents experience whilst attempting to help their child to achieve a healthy diet rich in vegetables.

1.4.2 Modelling

In addition to repeated exposure, modelling may be a successful method to help children to taste disliked foods such as vegetables. Modelling is defined as a process of observational learning, where encouragement and facilitation of behaviours results in them becoming habitual (Bandura, 1977). Bandura's (1977) Social Learning Theory states that observers are most likely to imitate the behaviour of others when they admire or like the model, see the model being rewarded for performing the behaviour, when they themselves are rewarded for imitating such behaviour, and when there are multiple models. In everyday situations peers, friends, parents, adults, siblings and authority figures can all serve as role models, although the effects that these different groups exert may vary.

Peer modelling has been shown to be an effective method for increasing children's acceptance of disliked foods. Peer modelling of consumption of a disliked food can result in a child initially choosing a preferred food but shifting their choices to a previously disliked food after three days of observing a peer model's food choice (Birch, 1980). This effect has also been observed in adults, where viewing pictures of adult models showing pleasure whilst eating a food disliked by the adult observer significantly increased the observer's subsequent desire to eat the food (Barthomeuf, Rousset, & Droit-Volet, 2009). Peer models can be effective at increasing children's acceptance of novel foods as well as disliked foods (Hendy, 2002). Observing fictional online confederates choosing a food unknown to the target child has been shown to result in significantly increased choice of this food by the target child (Barthomeuf et al., 2009; Bevelander, Anschütz, & Engels, 2012). Furthermore, significantly greater consumption of a novel blue food has been seen when children were exposed to positive peer models consuming the novel blue food than when no modelling was experienced (Greenhalgh et al., 2009). However, in terms of interventions aimed at increasing children's consumption of vegetables, the provision of 'confederate' peer models would be logistically difficult. Though methods such as those used by Birch (1980) are possible, finding children to serve as role models who have preferences for fruits and vegetables over less healthy options would in all likelihood prove difficult. Here, the most effective solution seems to be the creation of fictional peers, such as the 'Food Dudes' (Horne, Lowe, Fleming, & Dowey, 1995; see section 1.4.3.2.1). The 'Food Dudes' programme has produced several promising findings and seems to be effective (Horne et al., 2011; Lowe, Horne, Tapper, Bowdery, & Egerton, 2004). However, such programmes are costly to develop and implement, not to mention exclusive because they are implemented in phases within schools, and are only

available to schools whose council will fund such a programme. Together, this research challenges the feasibility of peer models for increasing children's consumption of vegetables.

Adult models, such as teachers, have also been shown to be effective at increasing children's consumption of disliked and novel foods (Addessi, Galloway, Visalberghi, & Birch, 2005; Harper & Sanders, 1975), with preschool teachers rating modelling as the most effective of five teacher actions at increasing acceptance of a new food (Harper & Sanders, 1975). However, previous research has found that teacher modelling is no more effective than simple exposure as a way to promote children's acceptance of a new food (Hendy et al., 1999). This discrepancy can be explained by Hendy and Raudenbush's (2000) finding that in order for teacher modelling to be effective, it is necessary for the teacher to show enthusiasm, rather than silently modelling consumption. However, it should be noted that when a competing peer model was introduced modelling a negative reaction to the target food, the enthusiastic teacher model was no longer effective at increasing consumption amongst the observing children (Hendy & Raudenbush, 2000). This highlights one of the biggest problems with designing school-based interventions for increasing children's vegetable consumption, as negative reactions from other children in the target group can exert a strong influence over other members.

Parental modelling has been suggested as a potentially successful method for increasing fruit and vegetable consumption in children, with a number of studies supporting this (e.g., Gregory, Paxton, & Brozovic, 2011; Harper & Sanders, 1975; Palfreyman, Haycraft, & Meyer, 2014; Pearson et al., 2009; Tibbs et al., 2001; see also section 1.3.2). Parental modelling exerts its effect through three major functions: by cueing similar responses to those observed in the model (imitation); by increasing behaviours which are viewed as having positive consequences or decreasing behaviours viewed as having negative consequences; and, by providing a reference for what constitutes adequate performance, influencing the observers' self-regulation of behaviour (Rosenthal & Bandura, 1978; Tibbs et al., 2001). Caregivers have a prime opportunity to model eating behaviours to their child in the home environment.

1.4.2.1 *Parental modelling and children's healthy eating*

Parental modelling of eating healthy foods has consistently been positively associated with increased fruit, juice and vegetable consumption in children (e.g., Palfreyman et al., 2014; Pearson et al., 2009), as well as lower levels of food fussiness and higher

interest in food among pre-schoolers (Gregory, Paxton, & Brozovic, 2010). Parental modelling has also been associated with lower parental intake of dietary fats and increased fruit and vegetable consumption (Tibbs et al., 2001), suggesting parents who model more are also healthier. However, cause and effect should be considered here as it is possible that parents who have healthier diets naturally model, rather than their modelling behaviours resulting in healthier eating. Mothers who perceive there to be positive consequences from their modelling behaviours have been shown to report greater fruit, vegetable and salad intake in themselves and their children (Palfreyman et al., 2014).

Taken together, this research suggests that if modelling is a valid mechanism for increasing children's consumption of fruit and vegetables, not only is the implementation of parental modelling important, but also educating parents about the benefits of such behavioural techniques in order to maximise the benefits of modelling. Parental modelling minimises the detrimental effects of competing models, is economic, and has the added benefit of increasing parental intake of fruit and vegetables. For these reasons, parental modelling appears to be an effective way to increase children's vegetable consumption at home and its use should be recommended to parents/caregivers.

1.4.3 Rewards

Rewards or incentives are another method which could be used to encourage children to achieve the tastings necessary to acquire liking of vegetables. Although the use of rewards is a practice frequently reported as being used by parents (e.g. Birch & Fisher, 1998; Moore, Tapper, & Murphy, 2007), the efficacy of rewards for increasing children's tastings and consequent consumption of a novel or disliked food is widely contested. Rewards can be divided into social rewards, such as praise, and tangible rewards, such as stickers or small toys. It is thought that tangible rewards, especially food rewards, may detract from the intrinsic reward of a food by suggesting that extrinsic reward is necessary. This is hypothesised to produce an undermining or 'over-justification' effect (self-determination theory; Deci, Koestner, & Ryan, 1999), although this notion has been challenged by some (e.g., Cameron & Pierce, 1994; Cooke, Chambers, Añez, & Wardle, 2011).

Early research from Birch, Birch, Marlin, and Kramer (1982) supports the notion of an 'over-justification' effect. Here, 12 preschool children's liking of fruit juice, for which

consumption was rewarded with a play activity, was compared to that of an equally liked juice consumed the same number of times without reward (12 presentations across a three week period). It was found that children's liking for the rewarded juice significantly decreased, while preferences for the non-target juice remained stable.

With this in mind, social rewards may be a viable alternative to tangible rewards for increasing consumption of disliked foods, where children are less aware of the means-end contingency. This is because, while tangible rewards are often offered in advance of the behaviour, in the form of incentives, social rewards are more frequently spontaneously delivered (Deci et al., 1999).

Several studies have compared the efficacy of social rewards to tangible rewards. Birch, Marlin, and Rotter (1984) ran a study in which children received either social or tangible rewards for tasting an unfamiliar milk-based drink. Contrary to prediction, liking for the drink decreased in both the praise and tangible reward groups. Though this study used a small sample and only measured liking, it served to stifle further research into the potential positive effects of reward in this area for some time. Having said this, programmes involving mixed reward elements have been researched and showed promise for increasing children's choice of healthy snack foods as well as for increasing vegetables consumption (e.g., Cooke, Chambers, Añez, & Wardle, 2011; Lowe, Dowey, Horne, & Murcott, 1998; Stark, Collins, Osnes, & Stokes, 1986).

1.4.3.1 *Rewards and vegetable consumption*

Wardle, Herrera et al. (2003) conducted a school-based study to investigate the potential of rewards to be an effective tool for increasing acceptance and liking of a previously disliked vegetable. Here, 5 to 8 year-olds assigned to eight sessions of repeated exposure showed significantly larger increases in consumption of previously disliked vegetables than the no-treatment control group, while those subjected to eight sessions with sticker rewards for tasting did not show a significant increase in consumption or liking post intervention. However, some research suggests a potentially significant role for reward beyond that of repeated exposure in increasing consumption.

Hendy et al. (1999) compared the efficacy of five teacher actions at increasing consumption of novel vegetables using a sample of 64 pre-schoolers assigned to one of five conditions over three mealtimes: tangible reward (in the form of food); modelling (of consumption by a teacher); choice offering (where children were offered the target food by the teacher); insisting (where the teacher insisted the child eats the target food); and repeated exposure (the control group). Here, tangible reward produced a

significantly bigger increase in consumption of the novel vegetable than the repeated exposure group. However, it should be noted that repeated exposure is known to take a greater number of exposures than three to exert an effect on consumption, especially amongst this age group who are likely to have a stronger neophobic response to novel foods (e.g., Lakkakula et al., 2010).

Cooke et al. (2011) furthered previous research comparing social and tangible rewards, this time by examining their efficacy for increasing liking and consumption of a disliked vegetable in a sample of 422 2 to 6 year-old children. Children were assigned to receive either tangible rewards, social rewards, mere exposure, or to a no-treatment control group. Over a 12 trial acquisition phase, liking and intake increased significantly in all experimental groups, while intake increased significantly more in the tangible reward group than the exposure alone group. Though increases in liking were sustained over three months, increases in intake were only maintained in the tangible and social reward groups. In a similar study, Remington, Añez, Croker, Wardle, and Cooke (2012) compared the efficacy of tangible reward and social reward separately to that of a no-treatment control group in a sample of 140 3 to 4 year-olds in the home setting. While the use of tangible rewards led to significantly greater liking and consumption of a novel vegetable than in the control group, increases in intake in the social reward group were intermediate and not significant. At three month follow-up intake and liking remained significantly higher in the tangible reward group than the control group, with liking and intake in the social reward group not being significantly different from that of the control group. Though this research suggests that, contrary to self-determination theory, tangible rewards have efficacy above and beyond that of social reward, further research would benefit from including a mere exposure group in order to determine the effect of social or tangible reward above that of mere exposure.

1.4.3.2 Interventions examining multiple methods and vegetable consumption

Multiple methods programmes including rewards have also shown promise for increasing children's vegetable consumption. Lowe, Dowey, Horne, and Murcott (1998) found that 28 children aged 5 to 6 who were enrolled in a 16 day intervention phase showed a significant increase in consumption of fruits and vegetables, compared to during an initial 12 day **baseline** phase of visual exposure; an increase maintained after a six month follow-up period. Owing to the nature of the intervention, it is impossible to extrapolate the effect of the reward element (comprised of both social and tangible rewards) from the modelling component that the programme is also based

around. Furthermore, the authors chose to use visual exposure rather than using repeated exposure whereby the child is offered a taste of the food, as has been done in other studies (e.g., Cooke, Chambers, Añez, & Wardle, 2011). With it known that mere visual exposure is ineffective at increasing food consumption (Birch & Marlin, 1982) a repeated exposure phase would have been a more challenging comparison than a visual exposure phase. This said, this study indicated a promising new rewards and modelling based intervention for increasing children's consumption of vegetables called the 'Food Dudes'.

1.4.3.2.1 *'Food Dudes'*

The 'Food Dudes' is a video based intervention which aims to increase fruit and vegetable consumption in children using three main techniques: taste exposure; peer-modelling; and, contingent rewards (Lowe et al., 1998). The programme centres on a series of videos of the 'Food Dudes', super-hero older child characters who are fighting to save the world from the evil 'Junk Punks', who are attempting to rid the world of fruits and vegetables (Tapper, Horne, & Lowe, 2003). The 'Food Dudes' harness their powers by eating fruit and vegetables. When doing so, they encourage the viewing children to join them in doing the same taste exposure, stating how enjoyable it is (enthusiastic peer modelling), and promising rewards if they do so (contingent rewards). These videos vary sequentially, so that over a period of time the children's consumption of several different fruits and vegetables is targeted. The programme also targets fruits and vegetables more broadly by using category terms (fruit or vegetable) as well as naming specific items (e.g., raspberry or broccoli). Letters from the 'Food Dudes' are also used to remind the children of the fruits and vegetables they should be eating, as well as the rewards they will receive for doing so, thus entrenching the contingent reward component.

The 'Food Dudes' programme was originally tested in the home environment with a small sample of 5 to 8 year-olds (N=4), whose pre-intervention consumption of fruit and vegetables was identified by parents as very low (Lowe et al., 1998). In the initial 18 days, daily tastings of target fruits and vegetables took place at snack time with rewards for tasting on each following day. During the following ten weeks, rewards were tapered to be given once a week. Post intervention, fruit and vegetable consumption showed large and significant increases, which were maintained at six months follow-up.

The programme has also shown significant effects when run in primary schools. An initial experiment with 5 to 6 year-olds (N=26) targeted consumption of fruits and vegetables concurrently presented at snack time (Lowe et al., 1998). Consumption and liking of both fruits and vegetables significantly increased, with these increases maintained at two and six month follow-up. Consumption of sweet and savoury snack foods was significantly decreased at six month follow-up, suggesting that the snack fruits and vegetables were replacing unhealthy alternatives. Another study conducted in a different sample of children also aged 5 to 6 (N=28) showed that the efficacy of their initial protocol could be further enhanced by extending the intervention period to 16 days (Lowe et al., 1998). Here, significant and substantial increases in consumption of both fruits and vegetables at school were observed post-intervention and maintained at six months follow-up. This finding was further supported in a large sample study (N=402) of 4 to 11 year-olds across England and Wales (Lowe et al., 2004). A small subset of parents in this study confirmed that there was also a significant increase in the number of portion of fruits and vegetables consumed at home on weekdays (Tapper et al., 2003).

The effectiveness of the programme has similarly been shown in a nursery setting (Horne et al., 2011). Fruits and vegetables were presented on 30 consecutive weekdays to 14 children in the intervention group, resulting in significant and large increases in consumption of fruits and vegetables including not only those specifically targeted by the intervention but also others not mentioned by the peers. On average, children achieved three-fold increases in consumption, which were sustained at six month follow-up.

The programme has not only proved effective in UK schools, but also the Republic of Ireland and the US. In the Republic of Ireland, the programme was adapted to target consumption of fruits and vegetables provided as part of a packed lunch rather than at snack time (Horne et al., 2008). Post intervention, children consumed significantly more of the fruit and vegetables provided by their schools as well as those included in lunch boxes. Furthermore, at 12 month follow-up, parents were providing significantly more lunchbox fruit and vegetables than at baseline, while their children's increased consumption of these foods remained significant. A questionnaire based evaluation of the Irish rollout of the intervention was performed by the first 44 schools to participate (Delaney, Kelleher, & Wall, 2006). Ninety-four percent of parents reported children were eating at least one more portion of fruit or vegetable at home than before the intervention, with 85% of parents reporting that their children had asked them to buy

more fruit and vegetables since the intervention. This evaluation suggested that the intervention also increased intake in 88% of parents.

A pilot study of the 'Food Dudes' in a school in the US with 6 to 11 year-olds (N=253) has yielded promising results, with significant increases in both fruit and vegetable consumption post intervention (Wengreen, Madden, Aguilar, Smits, & Jones, 2012), though follow-up data are not yet available to confirm whether these effects are as long lasting as those found in the UK and Ireland.

In summary, research so far suggests that the 'Food Dudes' programme not only has the ability to increase children's liking and consumption of fruits and vegetables, and also parents' consumption of fruits and vegetables, but also parental provision of fruits and vegetables, as well as altering the foods which children choose to eat. To date, the programme has been administered in several school areas in the UK: 7500 pupils in Dudley; 6600 pupils in Walsall; 1250 pupils in Solihull; 9000 pupils in Coventry; and 1590 schools in Ireland (234,677 pupils) (Food Dudes, 2013). A modified version of the programme using shorter intervention and maintenance phases and more interactive maintenance phases (i.e. including whole class rewards) has also been rolled out to 210 schools in Glasgow and piloted in schools in Forth Valley (Clarke, Ruxton, Hetherington, O'Neil, & McMillan, 2009). The 'Food Dudes' programme is now widely acclaimed, receiving UK and Ireland government funding and winning numerous awards across the UK, Ireland and the US.

1.4.3.2.1.1 Evaluation of the 'Food Dudes'

While preliminary findings for use of the 'Food Dudes' programme in the home and nursery environment seem positive, these studies use an extremely small sample. In order for the 'Food Dudes' programme to be validated for these environments, significant effects with larger samples must be shown. Studies into the 'Food Dudes' programme as a tool for use in schools suggest it to be widely effective and extremely valid, with adequate samples and repeated positive effects. However, it is currently only available to schools that can fund the programme. For this reason the programme has become somewhat exclusive and an economic alternative for parents to administer within the home environment may be a viable alternative for those currently missing out. It should also be noted that longitudinal findings of the 'Food Dudes' programme are not entirely positive. Although children's lunchtime consumption of fruits and vegetables was significantly higher than that of the control group at three months post-intervention,

this was only amongst those children who ate lunches provided by schools, indicating that the 'Food Dudes' programme may not alter provision of fruits and vegetables. Furthermore, 12 months post-intervention lunchtime consumption was no higher amongst the intervention group than the control group (Upton, Upton, & Taylor, 2013), indicating that effects on consumption may not be lasting.

1.5 Overall summary of the literature

Evidence presented within this chapter highlights that many children are not consuming sufficient vegetables (Public Health England & Food Standards Agency, 2014) and that this has significant implications for an individual's health, both in childhood (e.g., Freedman et al., 1999) and later in life (e.g., Vecchia et al., 1998). It is also evident that there are a number of child and parent factors which play an important role in children's consumption of vegetables.

It is acknowledged that caregivers are regarded as the gatekeepers of children's eating and food provision, where children rely on caregivers for adequate nutrition (McCaffree, 2003). The child feeding practices which parents employ appear to be related to children's consumption of vegetables. Feeding practices which are described as more controlling, maladaptive practices have been associated with lower child consumption of vegetables while more child-centred, adaptive feeding practices have been linked with higher consumption (Vereecken et al., 2010).

Many children experience a phase of neophobia, which results in them rejecting new foods or foods which they perceive as potentially harmful (Birch & Fisher, 1998), with green vegetables being particularly commonly refused (Cashdan, 1998). Children's eating behaviours are also related to children's consumption of vegetables. Children who are fussier eaters have been found to have lower consumption of fruits and vegetables than less fussy children (Galloway et al., 2005), while children who enjoy food more tend to eat more vegetables (Cooke et al., 2004). Children's temperament has also been shown to be associated with their consumption of vegetables, with different traits being positively and negatively linked to vegetable consumption. It has been suggested that children who are more emotional or shy consume fewer vegetables (Vereecken et al., 2010), while more externalising children consume fewer fruits and vegetables (Vollrath & Tonstad, 2011). Conversely, children who are more active and sociable have been found to consume significantly more fruits and vegetables (Vollrath & Tonstad, 2011).

Given that vegetable consumption in children is so low and that improving children's diets is a public health priority (World Health Organisation, 2015b), some potential methods of increasing children's consumption of vegetables have also been discussed. Repeated exposure to vegetables can be used to achieve liking and acceptance of foods, whereby repeated ingestion leads to 'learned safety' (Kalat & Rozin, 1973). Numerous studies support the assertion that repeated exposure is effective for increasing children's acceptance and liking of disliked vegetables (e.g., Cooke et al., 2004; Wardle, Herrera, et al., 2003; Wardle, Cooke, et al., 2003). However, with it known that not all exposures to a food lead to tasting, other additional methods may be required to achieve the tastings necessary to reach acceptance. Two such methods have been discussed, with both parental modelling (e.g., Palfreyman et al., 2014) and use of rewards showing promise (e.g., Blissett & Haycraft, 2011; Cooke et al., 2011).

Although successful school-based interventions which combine all of these methods have been implemented (e.g., Lowe et al., 1998), the financial viability of these interventions is questionable. As such, simple home-based alternatives could prove to be a legitimate, cost-effective alternative. Indeed, home-based studies have been conducted which investigate the efficacy of repeated exposure (e.g., Wardle, Cooke, et al., 2003) and rewards (e.g., Corsini, Slater, Harrison, Cooke, & Cox, 2013), which have shown promising results. However, no study has compared the efficacy of such interventions with and without the inclusion of parental modelling, or explored the parent and child factors which might be related to the intervention's success. Furthermore, the majority of previous studies in this area have focused on increasing vegetable consumption in school age children. With this in mind, this thesis aims to increase vegetable consumption in the crucial preschool years, in order to achieve maximal benefits to health across the life course

1.5.1 Aims of the thesis

The overarching aim of this thesis is to investigate possible ways of increasing vegetable consumption in preschool children, with an emphasis on parents/primary caregivers as facilitators (see Figure 1.1. for an overview of the possible pathways which will be investigated). This aim will be addressed in two parts: first, by investigating a possible intervention for parents to implement and exploring its long-term efficacy; second, by gathering information on the effective methods naturally used by parents with a view to using this to help improve available information for parents aimed at increasing children's vegetable consumption.

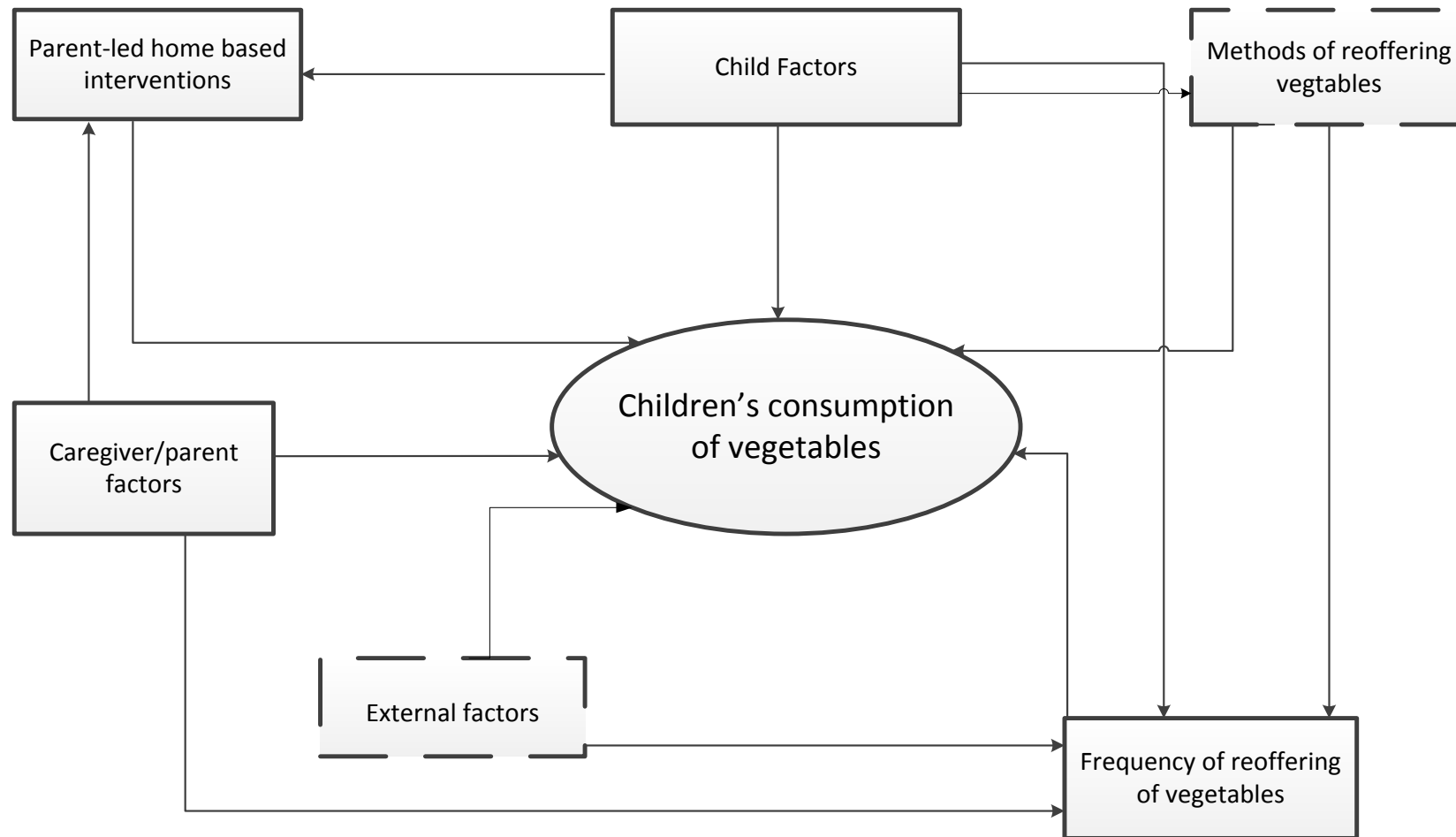
This thesis has a number of specific aims which are listed below, along with the relevant chapter number.

Part I

1. To investigate the efficacy of a parent led home-based intervention for increasing children's consumption and liking of a disliked vegetable (Chapter 3).
2. To investigate whether parent and child factors play a significant role in the outcome of a parent led home-based intervention (Chapter 4).
3. To investigate whether increases in liking and consumption of vegetables resulting from a parent led home-based intervention can be maintained longitudinally (Chapter 5).

Part II

4. To investigate which methods caregivers use to offer vegetables to their children (Chapters 6 & 7).
5. To investigate caregivers' perceived barriers to offering vegetables to their children (Chapter 6).
6. To investigate which methods of offering vegetables caregivers use and perceive as successful (Chapter 7).
7. To investigate whether caregivers' reoffering of vegetables are related to child, caregiver, or external factors (Chapter 7).
8. To investigate the relationships between children's consumption of vegetables and child, caregiver and external factors (Chapter 7).
9. To explore differences between children who are fussy and not fussy with vegetables on a number of caregiver and child factors (Chapter 8).



— — — Denotes factors to be determined within the thesis

Figure 1.1: Model to show possible pathways tested within this thesis between children's consumption of vegetables and a number of parent, child and external factors.

Chapter 2: Methodology

Methodology

2.1 Introduction

This chapter will outline and explain the methods used throughout this thesis. First, the various study designs used in the thesis will be outlined, followed by explanation of the research samples employed and the recruitment procedures used. Next, the procedure used for each study will be described, followed by a description of the measures used in these studies. Finally, the quantitative and qualitative methods of data analysis which have been utilised will be summarised.

2.2 Study designs used in this thesis

A large body of research has investigated increasing children's consumption of vegetables and influences on children's consumption, which has been summarised in Chapter 1. The previous research has used a variety of methods, the most feasible and appropriate of which will be used in this thesis to investigate the aims previously defined (see section 1.1.7). These methods are described below.

2.2.1 *Experimental (intervention)*

Previous research by Remington, Añez, Croker, Wardle, and Cooke (2012) compared 12 days of repeated exposure with tangible rewards, and repeated exposure with social rewards, to a control group for increasing children's acceptance of a disliked vegetable. This study was conducted within the home environment and was parent led, providing the opportunity for development of further interventions which can provide a cost effective alternative to school-based interventions such as the 'Food Dudes' (Lowe et al., 1998; Tapper et al., 2003). Although Remington et al.'s (2012) study suggests that exposure paired with tangible rewards are successful methods for getting children to eat a disliked vegetable, the study design could be improved upon with the inclusion of a repeated exposure group as well as a control group. This would allow intervention effects to be unpacked more stringently. Previous research also suggests that parental modelling may be a successful tool for achieving tasting of disliked foods amongst children (Harper & Sanders, 1975; Palfreyman et al., 2014). For these reasons, an intervention study was designed (Chapters 3-5). Study 1 (a) of this thesis (Chapter 3) used an experimental study design to test a 14 day intervention aimed at increasing children's consumption of a disliked vegetable. This study had a mixed design, with intervention type as a between subjects variable and vegetable consumption as a within subjects variable. Four experimental conditions were used (repeated exposure;

repeated exposure and modelling; repeated exposure and rewards; or repeated exposure and modelling and rewards), allowing the effects of each component of the intervention to be compared to each other and to a control group.

Study 1(b) (Chapter 4) investigated the impact of individual parent and child differences on the success of these interventions, which is something that is very limited previous research has attempted to do (Caton et al., 2014). Established, validated questionnaires were employed to assess relevant parent and child factors (see descriptions below), all of which were completed by parents. Although such measures are subjective and open to bias, they allow for easy collection of data and allow retention of participants who may have withdrawn had more intrusive methods of assessment been implemented.

2.2.2 Longitudinal

In order for interventions to be deemed successful, resultant changes in behaviour must be sustained across time. Study 1 (c) (Chapter 5) investigated whether long-term behaviour changes (measured at two, six and 12 months post-intervention) could result from the 14 day interventions tested in study 1. A key issue in longitudinal research is participant retention. Although a number of studies in this area have achieved high participant retention (e.g., Corsini, Slater, Harrison, Cooke, & Cox, 2013; Remington et al., 2012; Wyse et al., 2012), it is known that high attrition rates can be a problem in longitudinal experimental research. Participants were over-recruited to Study 1 with this in mind.

2.2.3 Qualitative (focus group study with thematic analysis)

To address the aims of Study 2 (Chapter 6), a qualitative approach was employed, enabling caregivers to report freely, rather than being confined to giving answers based on previously researched constructs, or the opinions of researchers and healthcare professionals. Data were collected through focus groups, with the aim of informing a subsequent questionnaire study.

2.2.4 Self-report questionnaires

Chapter 7 aimed to explore how often parents are prepared to offer their child vegetables, the methods of offerings that parents use, as well as how frequently caregivers use these methods, and the perceived barriers to parental offering. Although previous research has examined associations between a number of feeding practices and children's eating behaviour (e.g., Ventura & Birch, 2008) and even vegetable

consumption (e.g., Melbye, Øgaard, & Øverby, 2013; Vereecken, Legiest, De Bourdeaudhuij, & Maes, 2009), this research has been confined to the limited methods which are included in current validated measures. Furthermore, these measures have often been designed by researchers and clinicians, with minimal input from parents. With this in mind, Study 3 (Chapter 7) drew on the findings from the previous qualitative study (Chapter 6) to identify a wide array of methods of offering as well as barriers to offering specifically focusing on encouraging young children to eat vegetables. A large scale questionnaire study (Chapters 7 & 8), using newly developed as well as previously validated measures, was then conducted in order to generate data with the potential to inform future interventions as well as to tailor information provided for parents on achieving a healthful diet in their child. Chapter 8 also drew on this large scale questionnaire data, to explore differences between the methods of offering used by parents of fussy children compared with those used by parents of not fussy children.

2.3 Research samples

Between the ages of two and eight years old, many children enter a phase known as neophobia, where they reject new foods (Birch & Fisher, 1998). Given that consumption of vegetables is often particularly low for children in the neophobic phase (e.g., Cooke, Carnell, & Wardle, 2006), children from two years old were the focus of the studies reported on in this thesis. More specifically, preschool age children were recruited as they are more likely to spend a significant amount of time with their parents/primary caregivers, making them ideal candidates for home-based parent led vegetable interventions. Furthermore, it is known that eating behaviours established in early childhood track through to later childhood and into adulthood (e.g., Lytle, Seifert, Greenstein, & McGovern, 2000; Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2007). Previous research suggests that vegetable consumption can protect against childhood illnesses, such as respiratory symptoms (Antova, Pattenden, & Nikiforov, 2003) and cancer (Maynard, Gunnell, Emmett, Frankel, & Davey Smith, 2003). Therefore, given that the research in this thesis focuses on increasing vegetable consumption in the early stages of childhood, children of preschool age were the focus in order that the health benefits of increasing vegetable consumption in early childhood can be maximised across childhood.

The studies reported in this thesis utilised both primary caregivers and parents. Although it is believed that whoever the gate-keeper is they assume the same role of central responsibility over child feeding, for each study whether samples are caregivers or parents and the numbers of each are carefully described.

Sample sizes were determined on the basis of Cohen's (1992) power calculations (see Table 2.1). Each of these sample size calculations was performed on the basis of detecting particular effect sizes. For studies 1a and 1c it was deemed desirable to detect a large effect, which would represent a substantial alteration in children's consumption of the target vegetable and would allow a logistically feasible sample size. For studies 1b, 3a and 3b possible detection of a medium effect was selected. For these studies, multiple variables were investigated, with it likely that several of these might be associated with the outcome variables rather than any one exerting a large effect. In an effort to maintain statistical power whilst accounting for potential attrition, the Study 1 sample size was over-recruited by a minimum of 50% per condition. All studies in this thesis were adequately powered with the exception of Study 1(b) where, owing to high participant attrition, sample size was smaller than anticipated.

Table 2.1: Breakdown of participant numbers per chapter, including recommended sample size

Study	Chapter	Recruited from	n children	n parents	Cohen's suggested sample size ^a
1a	3	Toddler groups across Leicestershire	135	135	80 dyads ^b
1b	4	Toddler groups across Leicestershire	90*	90*	85 ^c
1c	5	Toddler groups across Leicestershire	41**	41**	80 dyads ^b
2	6	Various advertisements	0	17	n/a ^d
3a	7	Various advertisements, preschools and toddler groups	0	297	177 ^e
3b	8	Various advertisements, preschools and toddler groups	0	134	100 ^f

* Experimental dyads from Study 1a; ** Dyads from Study 1a available at follow-up

^a Sample size indicated is the largest sample size required for the various statistical tests run to test the aims of the study

^b Sample needed to detect a large effect in analysis of variance with alpha set at .05

^c Sample needed to detect a medium effect in correlation analyses with alpha set at .05

^d Sample size was determined when no new information was being generated in the focus groups (saturation), as indicated by Braun and Clarke (2006)

^e Sample needed to detect a medium effect in regression analyses with alpha set at .05

^f Sample needed to detect a medium effect with alpha set at 0.01

2.4 Recruitment procedure

Prior to each of the studies in this thesis commencing, ethical permission was granted by Loughborough University's Institutional Review Board.

2.4.1 Experimental parent-child dyads

Parent-child dyads were recruited from 20 toddler groups across Leicestershire, UK. Groups were found via adverts on a parenting website (www.netmums.com) and group leaders were contacted via telephone, email or mail for permission to attend the groups (for an example email see Appendix A). The research was presented to group leaders as a study to investigate the different ways that parents can help children to eat their vegetables. Recruitment was informal, with each parent with a child aged 2 to 4 approached by the researcher in person and invited to participate.

2.4.1.1 *Attrition*

A total of 136 dyads consented to take part in the intervention study and participated in the baseline session. Twenty one of the dyads failed to complete the intervention, with a number of reasons given (e.g., some dropped out of the study due to illness, some parents were unable to follow the protocol for other reasons, and some parents were not able to attend the post-intervention session). This left a final sample of 115 dyads.

2.4.2 ***Qualitative study (caregivers)***

Caregivers were recruited online via social media and an advertisement on an online noticeboard. Posters and flyers on University noticeboards were also used, as well as adverts in local newspapers (the Leicester Mercury and Loughborough Echo). Thirteen caregivers were recruited using a poster which had the tagline ‘Do you have a child aged 2-4?’ with the description ‘we’d love to hear about your experiences of getting your child to eat fruits and vegetables, both good and bad’, while five further caregivers were recruited via a poster which had the tagline ‘Do you have a 2-4 year-old who doesn’t like vegetables?’ and the description ‘We’d love to hear about your experiences of trying to get your child to eat fruits and vegetables’ (see Appendix B). This second recruitment poster was implemented to ensure caregivers of a child who refuses/avoids eating vegetables were represented in the focus groups. Twenty-one caregivers expressed an interest in participating in a focus group and 17 actually participated in the study, with 5 focus groups being conducted which ranged in size from two to five caregivers.

2.4.3 Questionnaire study (caregivers)

Caregivers were recruited from a number of toddler groups across Leicestershire. Toddler groups were located via the parenting website Netmums, and group leaders contacted for consent for recruitment at each group. Caregivers were approached individually at toddler groups and the study was described to them as a short, one off questionnaire investigating how caregivers offer vegetables to their children, and asked if they would like to participate. Additional caregivers were also recruited through the University using posters and flyers on University noticeboards, as well as an advertisement on an online notice board (see Appendix C for an example). Social and local media outlets were also utilised, including adverts in both the Leicester Mercury and Loughborough Echo newspapers and a short radio interview on BBC radio Leicester. Caregivers recruited in these ways were directed to an online questionnaire which had been set up using Bristol Online Surveys (<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>). A total of 303 caregivers were recruited for this study.

2.4.4 Inclusion/exclusion criteria

Caregivers were required to have a child aged two to four years old in order to participate in the studies in this thesis. It is noted that caregivers of children approaching two who expressed an interest in participating were also included. For Study 1 (Chapter 3-5) parents who were recruited were required to be able to adhere to the intervention protocol of daily offerings of the target vegetable outside of a mealtime every day for 14 consecutive days. For Studies 2 and 3 (Chapters 6,7 & 8), caregivers who were recruited were required to be present at the majority of their child's mealtimes and to be involved with their child's feeding, so that they had a good insight into their child's eating behaviours. Where utilised, caregivers were required to fulfil the central role in child feeding in order to contribute towards this research. Parents/caregivers were also required to have a good understanding of English in order to be able to participate.

2.5 Procedures

The procedures implemented in the studies reported on in this thesis are outlined below.

2.5.1 *Experimental (Chapters 3-5)*

2.5.1.1 *Target vegetable assignment*

Parents of 2 to 4 year-old children who were the target of the experimental intervention completed a baseline session at the toddler groups from which they were recruited. This intervention aimed to increase children's liking and consumption of a disliked vegetable over a period of 14 days. In order for an appropriate target vegetable to be assigned, parents were asked by the researcher to rank a list of six raw vegetables (cherry tomato, baby corn, cucumber, sugar snap peas, celery, and red pepper) in order of their own and their child's preference, with one being the one they each like best and six being the one they like least. The vegetable ranked fourth for the child was allocated as the target vegetable for the intervention, avoiding those ranked fifth or sixth to allow for both positive and negative shifts in liking (Cooke et al., 2011). Because some conditions required parents to model eating the vegetable, it was ensured that no child was assigned a vegetable their parent strongly disliked in order to minimise the confounding effects of parental preferences. Children's dislike of the target vegetable was confirmed during a baseline session with the researcher (see section 2.6.1.3. below). Target vegetables were washed and chopped and served in their raw form in 30g portions. This portion size represents more than an age-appropriate portion for children of this age (Infant and Toddler Forum, 2013; NHS Choices, 2009), thereby reducing the possibility of ceiling effects caused by the child eating the entire portion.

2.5.1.2 *Familiarisation*

Before the testing session commenced, the researcher talked to children to familiarise them with the protocol of the session and what would be involved. This process was facilitated using a brief child-friendly information sheet, which was largely comprised of pictures (see Appendix D). Children were also familiarised with a three-point smiley faces rating scale. Next, children were shown the target vegetable in its whole form and asked to name it. Children who could not name the vegetable were told its name, and the vegetable was placed on the table in front of them.

2.5.1.3 *Baseline session*

Parents were asked to complete a questionnaire pack including the Comprehensive Feeding Practices Questionnaire (CFPQ; Musher-Eizenman & Holub, 2007; Appendix E), the Emotionality Activity Sociability Temperament survey for children (EAS; Buss & Plomin, 1984; Appendix F) and the Children's Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson, & Rapoport, 2001; Appendix G). The pack also contained demographic questions (see Appendix H).

Children completed the test session with the researcher at a small table in the corner of the toddler group. Each child was also asked if they would like their parent to come to the table as well, in which case the parent joined the researcher. Children were given a small plastic pot containing 30g of their target vegetable chopped into single bite sized pieces (~2.5g). The children were asked to remove the lid of the pot and, after confirming what was inside, try a piece of the target vegetable. Reluctant children were gently encouraged by the researcher to first choose a piece to pick up, then to lick the piece and, if possible, to progress to biting or eating the piece. In an effort to increase their willingness to try the vegetable, children were not pressured to swallow the piece, so as to avoid causing stress to the children. Whether each child tasted the vegetable (defined as licking, sucking, biting or chewing) was then recorded by the researcher.

Next, children were asked "Do you like [name of vegetable]?". They were then asked to rate their liking of that vegetable using a three-point smiley faces scale (which had one face corresponding to 'yummy', 'ok' or 'yucky'). After this, children were told that they could eat as much as they wanted of the portion of the vegetable, and a free eating session commenced. This session was terminated when the children said that they did not want any more or when they left the test table or after five minutes had expired. The target vegetable was then removed and re-weighed to measure consumption; including pieces which were tasted but not consumed (i.e. licked or chewed but rejected).

2.5.1.4 *Intervention groups*

Participants from each of the 20 recruitment centres were systematically allocated as a group (clusters) to one of four experimental conditions: 1. repeated exposure; 2. modelling and repeated exposure; 3. rewards and repeated exposure; or 4. modelling, rewards and repeated exposure. This method of assignment was chosen to prevent discussion of the study methods between parents in different intervention groups. Parents in all intervention groups were instructed to offer their child a small piece of the

target vegetable each day outside of a mealtime for 14 consecutive days, using the protocol for the condition to which they were assigned (for an example protocol, see Appendix I). Parents in the repeated exposure condition (1) were instructed to simply neutrally offer their child a small piece of the target vegetable without eating it themselves and without reacting to tasting. Parents in the modelling and repeated exposure condition (2) were instructed to eat a small piece of the target vegetable in front of their child and respond positively, e.g. “oh this [name of vegetable] is really nice!”. They were then asked to offer their child a small piece of the vegetable immediately afterwards, but to remain neutral regardless of whether their child tried a piece of the vegetable. Parents in the rewards and repeated exposure condition (3) were asked to neutrally offer their child a small piece of the target vegetable, telling them that if they try a piece they can choose a sticker from a sheet provided for the study. These stickers varied from different happy facial expressions to pictures of happy looking animals. These parents were also instructed to praise their child with a phrase such as “well done, you tried your [name of vegetable]!” and to tell their child that they were receiving a sticker because they tried the vegetable. Finally, parents in the modelling, rewards and repeated exposure condition (4) were instructed combine all of the components used in conditions 2 and 3. Parents in all conditions were instructed to offer in their assigned manner for the entire 14 day period, and to record the success of the protocol in a ‘tasting diary’ (see Appendix I). Here, parents were asked to record whether they completed each daily offering. The diary also included a daily manipulation check (e.g. ‘Did you stay neutral?’ in the repeated exposure group) as well as a record of whether each offering resulted in a tasting (defined as contact with the mouth, including licking, sucking, biting and chewing, where swallowing was not necessary).

2.5.1.5 *Fourteen day follow-up consumption and liking*

Immediately post-intervention, parent-child dyads attended a follow-up session at the toddler group they attended at baseline. To maximise retention, the researcher offered to hold follow-up sessions in alternative locations at the convenience of the participants (i.e. not necessarily in toddler groups, sometimes in participant homes). This session was identical in format to the baseline session, in order to allow comparison of liking and consumption of the targeted vegetables pre and post-intervention. Parent and child height (cm) and weight (kg) were also measured and parents gave their completed tasting diaries to the researcher. Parents were also asked to complete a shorter version of the baseline questionnaire, this time only including the CEBQ and CFPQ.

2.5.1.6 *Two, six and twelve month follow-up*

These sessions followed the same protocol as the pre and post intervention sessions, with children's liking and consumption of the target vegetable assessed whilst parents completed a short questionnaire including the CEBQ and the CFPQ. Dyads were met for follow-up sessions at whichever location was most convenient for them. Due to the study duration many participants were no longer attending toddler groups or had returned to work once their children reached school age (which, across the study duration, numerous children within the sample did) resulting in a high level of participant attrition across the duration of the longitudinal study.

2.5.2 Qualitative (Chapter 6)

Focus groups were conducted at Loughborough University, facilitated by one moderator (the doctoral candidate). The sessions were digitally recorded. The moderator used a set of standardised open ended and closed questions in all of the focus groups (see Chapter 6), which were written by the research team after a thorough review of the relevant literature. The focus group questions aimed to address two main research questions: (1) What methods do caregivers use to encourage their children to eat vegetables?; (2) What factors influence how and whether caregivers present vegetables to their child? Although data were collected in relation to fruit and vegetables, only responses relating to vegetable consumption were analysed and reported on in this thesis. After all of the focus group questions had been asked, caregivers were invited to complete a short demographic questionnaire. This asked about caregiver and child age, ethnicity, and whether the child had been hospitalised for feeding problems.

2.5.3 Questionnaire (Chapters 7 & 8)

Caregivers recruited from advertisements were directed to the online study questionnaire by hyperlink (<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>). Caregivers recruited from toddler groups were issued with a paper version of the questionnaire pack which they were asked to complete during the toddler group session to maximise completion but were also given the alternative of completing it online. All caregivers were informed that the questionnaire would take approximately 10-15 minutes to complete and were directed to additional information about what constitutes an age-appropriate portion of vegetables for their child in order to aid completion of the questionnaire. Completion of each item of the online questionnaire was optional, allowing caregivers to leave sections blank in the same way that caregivers completing the paper version could.

2.6 Questionnaire measures used within this thesis

This section outlines the questionnaire measures which were used to measure caregiver and child variables which were of interest in this thesis.

2.6.1 Validated caregiver-report questionnaire measures

Where possible, pre-existing validated questionnaire measures which have previously shown good internal reliability were adopted for the studies reported on in this thesis. When more than one validated questionnaire or subscale was available to measure the study constructs, shorter measures were chosen to minimise participant burden and encourage participation.

2.6.1.1 Comprehensive Feeding Practices Questionnaire (CFPQ; Musher-Eizenman & Holub, 2007; Appendix X)

Parents' and caregivers' child feeding practices were measured using the CFPQ, a 49-item questionnaire measuring 12 different feeding practices, six of which were utilised in this thesis. The first of these subscales, Encourage Balance and Variety, investigates how much parents do this in relation to their child's diet (four items, e.g. *"I encourage my child to eat a variety of foods"*). The second of these is, Healthy Environment, which assesses how much of a healthy food environment parents provide for their child (four items, e.g. *"Most of the food I keep in the house is healthy"*). The third is Involvement, a subscale measuring how much parents encourage their child to take part in meal planning and preparation (three items, e.g. *"I involve my child in planning family meals"*). The fourth is Modelling, which measures parents' use of role modelling to encourage their child to eat healthy foods (four items, e.g. *"I show my child how much I enjoy eating healthy foods"*). The fifth subscale is Pressure to Eat, which measures how much parents use pressure or force to get their child to eat meals or particular foods (four items, e.g. *"If my child says, 'I'm not hungry,' I try to get him/her to eat anyway"*). The final subscale used was Teaching about Nutrition, investigates the degree to which parents' educate their child about nutrition in their diet (three items, e.g. *"I discuss with my child the nutritional value of foods"*). All six of these subscales were used in Study 1(b) (Chapter 4) and all but Teaching about Nutrition in study 3 (chapter 7). The Teaching About Nutrition subscale was excluded from study 3 as it did not map on to the methods derived from Study 2 as being used by caregivers to offer vegetables to their children. Items are responded to on a five-point likert scale with responses for questions one to 13 ranging from 'never' to 'always' and questions 14 to 49 ranging from 'disagree' to 'agree'. Mean scores are generated for each subscale,

with possible scores between one and five. Higher scores indicate greater use of the feeding practice. This measure has been validated amongst a UK sample of parents of 3 to 6 year-olds (Powell et al., 2011) and American 2 to 8 year-olds as well as being shown to have good test-retest reliability (Musher-Eizenman & Holub, 2007).

2.6.1.2 *EAS Temperament survey for children (EAS; Buss & Plomin, 1984; Appendix F)*

Child temperament was assessed using the EAS. The EAS comprises 20 items measuring four subscales of child temperament, each of which has five items. Two of these subscales were used in this thesis: Sociability (e.g. “*Child likes to be with people*”), and Emotionality (e.g. “*Child cries easily*”). Parents were asked to state how characteristic of their child each statement is on a five-point likert scale. Mean scores were then calculated for each subscale, with possible scores ranging from one to five. Higher scores on each subscale represent higher levels of that trait. The EAS is a valid measure of young children’s temperament as reported by parents (Mathiesen & Tambs, 1999) and has previously been shown to be reliable with UK parents of young children (e.g., Haycraft, Farrow, Meyer, Powell, & Blissett, 2011).

2.6.1.3 *Children’s Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson, & Rapoport, 2001; Appendix E)*

The CEBQ was used to assess children’s eating behaviours. It is a 35 item parent self-report questionnaire measuring eight different dimensions of children’s eating behaviour. It has eight subscales, which have been grouped into two constructs (Webber et al., 2009): *food approach* behaviours which may be associated with overeating and obesity (as measured by the Food Responsiveness, Enjoyment of Food, Desire to Drink and Emotional Overeating subscales) and *food avoidant* behaviours which may be associated with underweight (as measured by the Satiety Responsiveness, Slowness in Eating, Food Fussiness and Emotional Undereating subscales). Five of these subscales were used in this thesis. In Study 1 (b) Food Responsiveness (five items, e.g. “*My child’s always asking for food*”), Enjoyment of Food (four items, e.g. “*My child enjoys eating*”), Satiety Responsiveness (five items, e.g. “*My child gets full up easily*”), and Food Fussiness (six items, e.g. “*My child enjoys tasting new foods*”) were used. For Study 3 Food Responsiveness, Enjoyment of Food, Food Fussiness and Slowness in Eating (four items, e.g. “*My child eats slowly*”) were utilised. Children’s speed of eating was raised by caregivers in Study 2 as impacting on their consumption of vegetables, and so the Slowness in Eating subscale was included in Study 3 in place of the Satiety Responsiveness subscale used in Study 1 (b).

Parents were asked to respond to each statement using a five-point likert scale ranging from never to always, and mean scores for each subscale were calculated. Scores range from one to five, with higher scores indicating higher frequency of that behaviour. The CEBQ has demonstrated good internal validity and test-retest reliability by the original authors (Wardle et al., 2001) as well as amongst other UK samples of 4 to 10 year-olds (Ashcroft, Semmler, Carnell, van Jaarsveld, & Wardle, 2008) and 3 to 8 year-olds (Powell et al., 2011).

2.6.1.4 *Brief Food Frequency Questionnaire (FFQ; Adapted from Cooke, Wardle, & Gibson, 2003; Appendix J)*

The FFQ is a parental self-report measure which was designed to assess parents' and children's dietary intake across a number of food groups. It can be used to assess fruit and vegetable consumption in both parents and their children. This measure has been successfully used previously to assess fruit and vegetable consumption in two to six year-old children (Cooke et al., 2003; Wardle, Carnell, & Cooke, 2005). In this FFQ, consumption is assessed by asking 'How often do you eat the following items?' and 'How often does your child eat the following items?'. Six food groups are listed 1) Fruit (fresh or tinned); 2) Vegetables (including salad items but not potatoes); 3) Meat or fish (any kind); 4) Cakes biscuits, sweets or chocolate; 5) Rice, potatoes or pasta; and 6) Eggs. The focus of this thesis was vegetable consumption, so an adapted version of the FFQ was created and utilised in Study 3 (chapters 7 & 8). All other food categories and responses were removed and vegetable categories were expanded. Possible responses were altered to refer to portions rather than just frequency of consumption so as to allow for measurement of vegetable intake. Responses range from 1 to 8 and correspond to: Never/Rarely (1); One or two portions a week (2); 3-4 portions a week (3); 5-6 portions a week (4); one portion a day (5); Two portions a day (6); Three portions a day (7); and, Four or more portions a day (8). The food categories were changed for study three to 1) Raw vegetables (e.g. carrot sticks, celery); 2) Cooked vegetables (including sweet potatoes but not potato); and 3) Salad (e.g. tomatoes, lettuce). These three distinct categories were included to ensure that consumption of all forms of vegetables was reported. The total weekly intake of parents and children could then be assessed by summing these responses. Children's total vegetable consumption was calculated from these three categories, where caregivers' responses per category were summed and converted into equivalent portions per week. To achieve this, responses were recoded to the number of portions each score represented. For example, responses of 'never/rarely' were assigned a score of 0, responses of 'one or two portions a week' were assigned a score of 1.5 and so on up to

'four or more portions a day' being scored 28. Children's total weekly vegetable consumption was then calculated by summing caregivers' responses for all categories.

2.6.2 Newly developed caregiver-report items

A number of questionnaire items were created for the purposes of this thesis, as suitable validated alternatives could not be found. These items are detailed in Appendix K to N. As these were individual items which tap simple constructs born out of the results of the qualitative study (see Chapter 6), these items did not go through a validation process but instead were checked for caregiver comprehension in a small pilot study. This pilot study identified a small number of possible ambiguities in the meaning of single item questions, therefore a second question was written for some constructs to ensure all relevant responses were gathered.

2.6.2.1 Caregivers' use of methods of offering vegetables (see Appendix K)

Questions were written to gather data on caregivers' use of a number of methods of offering, with responses scored on one of two scales. A five-point likert scale ranging from never to always was used for items assessing: covert restriction (*"Encourage your child to eat vegetables by avoiding presenting them alongside other more tempting foods"*); compromise/flexibility (two questions, e.g. "I compromise with my child on the order in which they eat their meal (e.g. dessert first/at same time as main meal)"; and non-food rewards (*"Offer your child a non-food reward (e.g. a sticker or a trip to the park) if he/she eats her vegetables"*). A five-point likert scale, this time with responses ranging from disagree to agree, was used for answers to items assessing: normalising offering (*"It is important that my child thinks vegetables are a normal part of a meal"*); presenting vegetables in different forms (*"I try preparing vegetables in different ways to encourage my child to eat them"*); and threats (two questions; e.g., *"I tell my child that if they do not eat their vegetables they cannot do something they enjoy (e.g. play with a certain toy)"*). Scores were obtained for each individual item, ranging from one to five. Where constructs were measured with more than one item (e.g., compromise/flexibility) a mean score was calculated.

2.6.2.2 Caregivers' frequency of use of, and perception of success of, methods of offering vegetables (Appendix L)

Caregivers were asked to report how often they used a number of methods to encourage their child to eat vegetables (with responses ranging from 'never' to 'always') as well as whether they perceived that these practices work (i.e. are successful for

encouraging their child to eat a vegetable, responded to as 'yes' or 'no'). These methods were '*modelling (e.g. eating vegetables in front of your child)*', '*giving food as a reward (e.g. offering dessert or sweets if children try a vegetable)*', '*other rewards (e.g. stickers, toys, play) if children try or eat a vegetable*', '*threats (e.g. "you'll go to bed" or "you can't watch television")*', '*encouragement or pressure (e.g. "eat up", "one more bite")*', '*games (e.g. "who can eat their vegetables fastest?")*', '*involving your child (e.g. cooking, preparing, choosing vegetables)*', '*hiding vegetables (e.g. sauce, flavour or chopping up really small)*', '*compromise (e.g. letting your child eat their dessert first)*' and '*offering vegetables in different forms*'. Scores were obtained for the frequency with which each individual item was used, ranging from one to five, and for whether or not each method was perceived as being successful, coded as yes=one, no=two.

2.6.2.3 Influences on offering of vegetables (Appendix M)

A number of items were also developed by the research team to assess the impact of potential influences on caregiver offering of vegetables. These possible influences were: cost ("*I do not offer my child vegetables they don't like because of the cost*"), waste ("*I do not offer my child vegetables they don't like because of the waste involved*"), time ("*I do not offer my child vegetables they don't like because it takes so much time to buy and prepare them*"), child mood ("*The mood that my child is in influences whether I offer them vegetables they don't like*"), tantrums ("*I do not offer my child vegetables they dislike to avoid tantrums*"), child hunger ("*How hungry my child is influences whether I offer them vegetables they don't like*"), avoiding frustration ("*I do not offer my child vegetables they don't like as it frustrates me when they do not eat them*"), caregivers' acceptance of their child's eating of vegetables (2 questions, e.g. "*I do not offer my child vegetables they don't like as I am satisfied with the other vegetables they eat*"), and caregivers' own tastes ("*Offer your child vegetables that you do not eat yourself*"). These questions were scored on five-point likert scales anchored from disagree to agree with the exception of the question regarding the influence of parents' own tastes, which was scored from never to always. Scores were obtained for each individual item, ranging from one to five. Where acceptance was measured with more than one item a mean score was calculated.

2.6.2.4 Assessing caregiver feeding of vegetables: frequency of reoffering and difficulty experienced (Appendix N)

Two general questions were generated to assess caregivers' experiences of feeding vegetables to children. Caregivers were asked the degree to which they have difficulty getting their child to eat vegetables (measured on a four-point likert scale ranging from

never to always). Caregivers' perception of how much difficulty they have getting their child to eat vegetables was then used to categorise children as 'fussy' (children who were rated as 'often' or 'always' having difficulty) or 'not fussy' (children who were rated as 'never' having difficulty), allowing for assessment of differences between these groups (Chapter 8). Caregivers were also asked how many times on average they would re-offer their child a vegetable which the child had rejected on a previous occasion, with response options on a scale 12 point scale from zero to 10+ times. Raw scores from this item were used in analyses, with 10+ scored as 11.

2.6.3 Child and caregiver demographic measures

In all studies reported on in this thesis, caregivers were asked to provide their own and their child's gender and date of birth. Caregivers were also asked to provide their ethnicity, their highest level of education, and their current or most recent occupation as previous research suggests that these factors are linked to child feeding (e.g., Crouch, O'Dea, & Battisti, 2007; Hughes, Power, Orlet Fisher, Mueller, & Nicklas, 2005). For Studies 2 and 3, caregivers were also asked to state their relationship to the child who was the focus of the study (see Appendix H for example demographic questions).

2.6.4 Height and weight measurements

For the experimental Studies in this thesis (1a, 1b and 1c; Chapters 3-5), caregiver and child height and weight were measured post-intervention. Parent consent was provided before these measurements were taken and all children also provided verbal assent to being weighed and measured by the researcher. During the post-intervention testing session, caregivers and children were asked to remove their shoes and their weight was measured using Salter electronic scales, to the nearest 0.1kg. Height measurements were taken using a tape measure, to the nearest 0.5cm. Although potentially slightly more accurate, a Leicester height measure was not used as it was unfeasible to transport this alongside the other apparatus (test foods, electronic scales, participant materials) to the various test session locations using public transport. Instead, due diligence was used to ensure height measurements were as accurate as possible. However, as neither parent nor child BMI was a primary outcome of any of these studies, this method was deemed to be sufficiently accurate. For child participants, heights and weights were converted into age and gender adjusted BMI z scores (Cole, Freeman, & Preece, 1995; Freeman et al., 1995). Parent height and weight data were used to calculate BMI scores by dividing weight in kgs by height in m².

2.6.4.1 *Smiley faces scale (Birch, Zimmerman, & Hind, 1980; Appendix O)*

As in previous studies with children (e.g., Corsini, Slater, Harrison, Cooke, & Cox, 2013; Remington, Añez, Croker, Wardle, & Cooke, 2012; Wardle, Herrera, Cooke, & Gibson, 2003) children's liking of the intervention study target vegetable was measured using a three-point smiley faces scale (Birch et al., 1980). This scale comprises three stylised, gender neutral faces, one with a broad smile to represent 'yummy, I like it!', one neutral to represent 'ok', and one with a downturned mouth to represent 'yucky, I don't like it!'. The smiley faces rating scale is seen as a more reliable measure of liking than pure verbalisations in preschool children (Blissett, Haycraft, & Farrow, 2010; Weisberg, & Beck, 2010).

2.7 General data analysis strategy

2.7.1 *Quantitative methods*

2.7.1.1 *Hypothesis testing*

Due to the directional nature of the hypotheses in all quantitative chapters, one-tailed analyses were run (Chapters 3-5 and 7).

2.7.1.2 *Levels of significance*

For the experimental studies (Study 1 (a) and (c); Chapters 3 and 5), an alpha level of $p < .05$ was used. For questionnaire studies (Study 1(b) and 3; Chapters 4, 7 and 8), where multiple tests were conducted, a more stringent alpha of $p < .01$ was used to minimise the likelihood of type I errors.

2.7.1.3 *Normality of data*

Normality of the quantitative data within this thesis was assessed using Kolmogorov-Smirnov tests as well as via skewness and kurtosis analyses and eye-balling of histograms. This revealed that several of the experimental outcome variables were non-normally distributed, as were caregiver BMI and child age data (Chapters 3 and 5) and most of the questionnaire subscales (Chapters 4, 7 & 8). Consequently, non-parametric tests were performed where appropriate, apart from where no non-parametric analyses were available and the data were strong enough for parametric tests (e.g. ANOVA).

Tests of difference

For Studies 1a and 1c (Chapters 3 & 5), repeated measures ANOVAs were used to assess whether there were significant differences in changes in consumption between

the groups across the intervention period. Potential differences between intervention group consumption were investigated using Kruskal Wallis analyses in separate pre intervention and post intervention consumption analyses. Mann-Whitney U analyses were used to assess whether, post intervention, participants in each condition significantly increased their consumption in comparison to the control group. Chi-square analyses were used to determine differences in liking (a categorical variable) of the target vegetable between groups, both pre and post intervention.

In order to assess whether caregivers' general feeding practices, methods of offering or children's general eating behaviour differed according to the difficulty caregivers have with feeding their child vegetables, two groups were created (Study 3b, Chapter 8). This was achieved by comparing caregivers who reported never having difficulty with getting their child to eat vegetables (categorised as 'not fussy') and caregivers who often or always had problems getting their child to eat vegetables (categorised as 'fussy'), which was assessed with the question "Do you have difficulty getting your child to eat vegetables?". Mann-Whitney U analyses were then performed to assess whether each group differed on the number of reofferings of rejected vegetables caregivers made, the amount of vegetables consumed by children per week, the frequency of each method of offering vegetables used by caregivers, the general feeding practices used by caregivers, and children's general eating behaviours.

2.7.1.4 *Tests of association*

To assess whether it was necessary to control for parent and child age and BMI in Study 1b (Chapter 4), preliminary one-tailed Spearman's correlations were run between parent and child age and BMI/BMIz with the study variables. Relevant age and BMI(z) data were then controlled for in any analyses using subscales with which they were found to be significantly associated. To investigate associations between child temperament, eating behaviours and parental feeding practices and pre-intervention vegetable consumption, post-intervention consumption, consumption change, and the total number of tastings children achieved across the intervention period, one-tailed Spearman's correlations (or partial correlations, where appropriate) were used.

For Study 3 (Chapter 7), preliminary one-tailed Spearman's correlations were run between parent and child age with the study variables to evaluate whether it was necessary to control for these factors in further analyses. Age variables were then controlled for in any analyses using subscales with which they were found to be

significantly associated. One-tailed Spearman's correlations (or partial correlations, where appropriate) were used to investigate associations between (1) caregiver reoffering of rejected vegetables as well as (2) children's vegetable consumption and caregiver factors (including methods of offering vegetables and feeding practices) and perceived influences on offering (including children's eating behaviours).

2.7.1.5 *Regression analyses*

To assess which factors could best predict success of the interventions in Study 1b (Chapter 4), a binary variable was created for intervention success. Here, any increase in children's consumption of the target vegetable across the intervention period was counted as success, while no increase or a decrease in consumption was counted as unsuccessful. Significant correlates of each intervention outcome measure were then entered into a forced entry, one-tailed logistic regression model predicting success.

To assess which factors could best explain the variance in, and which were the best predictors of, both caregivers' reoffering of rejected vegetables and children's consumption of vegetables (Study 3a, Chapter 7), stepwise regression analyses were performed. Child age was entered in the first block of each regression using the enter method. All significant correlates of each outcome variable (caregiver reoffering or child consumption) were then entered in a second block using the stepwise method.

2.7.2 *Qualitative methods*

Focus groups were chosen over one-to-one interviews as the interaction among group members reduces the interaction between the researcher and the individual group members, thereby minimising the effect of the researcher on the data collected and giving more attention to participants' perspective and experience (Madriz, 2000). Focus groups were audio recorded and the recordings were transcribed verbatim by the researcher. Transcribed data were analysed using thematic analysis and following the steps outlined by Braun and Clarke (2006). Although data were collected in relation to fruit and vegetables, only responses relating to vegetable consumption were analysed and reported on in this thesis, in line with the study and thesis aims. Both inductive and deductive methods were adopted, allowing themes to be applied from the questions asked as well as new themes to be identified within the transcripts. Themes were assessed using a semantic approach, where themes are identified within the explicit meaning of the data, and not by examining the latent underlying features of these themes, resulting in a rich description of the data set (Braun & Clarke, 2006).

Initially all transcripts were read and re-read to fully immerse the researcher in the data, while primary thoughts and concepts were noted. Next, the process of coding themes and subthemes was undertaken. First, interesting features within the data were assigned codes which meaningfully described something of the subject. Second, the full list of codes was collated and sorted into groups representing potential themes, with groups being solidified through a recursive process of combining and separating groups. The result of this was an organised set of themes all of which were distinct from each other whilst forming a meaningful structure. To facilitate reflection and reconciliation of the themes identified, discussion of the coded items was held within the research team. These discussions were used to qualify the trustworthiness of the analysis, in combination with a second researcher performing an analysis on 20% of the transcripts. This method of assessment has been widely used and is acknowledged as appropriate for such a thematic analysis (Yardley, 2008).

Part I: Investigating possible parent led home-based interventions for increasing children's consumption of disliked vegetables.

Chapter 3: ‘Why don’t you try it again?’ A comparison of parent led, home-based interventions aimed at increasing children’s consumption of a disliked vegetable

This chapter has been published in *Appetite* as: Holley, C., Haycraft, E. & Farrow, C. (2014). ‘Why don’t you try it again?’ A comparison of parent led, home based interventions aimed at increasing children’s consumption of a disliked vegetable. *Appetite*, 87, 215-222.

The study and findings reported on in this chapter were also delivered as an oral presentation:

Holley, C.E., Haycraft, E. & Farrow, C. (2014). Investigating the efficacy of parent-led repeated taste exposure, incentives and modelling interventions at increasing children’s acceptance of a disliked vegetable. Oral presentation delivered at the British Feeding and Drinking Group Annual Meeting, Portsmouth, UK, 3-4 April 2014.

Although the content of Chapter 3 is largely the same as in the published paper, the formatting and presentation have been altered to be consistent with the rest of this thesis.

‘Why don’t you try it again?’ A comparison of parent led, home-based interventions aimed at increasing children’s consumption of a disliked vegetable.

3.1 Introduction

Childhood obesity is one of the biggest public health challenges of the 21st century, with more than 40 million children under the age of five being overweight or obese globally (World Health Organisation, 2014). As part of a healthy lifestyle, adequate vegetable consumption is known to provide numerous benefits including preventing obesity and chronic disease (Heidemann et al., 2008; Maynard et al., 2003; Vioque, Weinbrenner, Castelló, Asensio, & Garcia de la Hera, 2008). However, many adults and children are failing to consume the recommended UK quota of five portions of fruit and vegetables a day (e.g., Guenther, Dodd, Reedy, & Krebs-Smith, 2006; Lennox, Olson, & Gay, 2011). Given that eating behaviours track through childhood into adulthood (e.g., Lytle, Seifert, Greenstein, & McGovern, 2000; Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2007), effective interventions aimed at increasing vegetable consumption early in childhood are required.

The development of liking and acceptance of foods is influenced by numerous factors, such as how palatable foods are, their nutritional content, and their associated emotional experience (e.g. party or reward foods versus everyday foods) (e.g., Birch, Zimmerman, & Hind, 1980; Mikula, 1989; Mobini, Chambers, & Yeomans, 2007; Steiner, 1979). One theory behind acquisition of liking and acceptance of foods is ‘learned safety’, where repeated ingestion of an unfamiliar food without negative gastro-intestinal consequences leads to increased acceptance of that food (Kalat & Rozin, 1973). Furthermore, if positive consequences are experienced (such as satiety), preference may develop for that food (Kalat & Rozin, 1973). In this way, repeated exposure can be used to transform disliked or unfamiliar foods into accepted (Pliner & Loewen, 1997) or even liked (Lakkakula et al., 2010) foods. Previous research suggests that in order to increase liking of novel foods in 2 year-olds, between five and 10 exposures may be necessary (Birch, Birch, Marlin, & Kramer, 1982; Birch, Gunder, Grimm-Tomas, Laing, & Grimm-Thomas, 1998), while 15 exposures may be required to increase preferences among 3 to 4 year-olds (Sullivan & Birch, 1990). Vegetables are commonly disliked by children (e.g., Cashdan, 1998; Skinner, Carruth, Bounds, & Ziegler, 2002) and a body of evidence supports the use of repeated exposure to increase children’s liking of vegetables (e.g., Ahern, Caton, Blundell, & Hetherington,

2014; Caton et al., 2013; Hausner, Olsen, & Møller, 2012; Wardle, Herrera, Cooke, & Gibson, 2003; Wardle et al., 2003). Although this is promising evidence for the use of repeated exposure to transform children's dislike of vegetables, persuading children to repeatedly try previously rejected vegetables may prove difficult. Indeed, many parents do not continue to expose children to foods once they have been rejected (Birch, McPhee, Shoba, Pirok, & Steinberg, 1987), where the number of exposures necessary to alter a child's preferences is more than parents offer. Combining other methods with repeated exposure may help to encourage parents to repeatedly offer, in turn improving children's liking and acceptance of vegetables. With this in mind, it would be valuable to explore techniques which may be used alongside repeated exposure to facilitate tasting and improve the likelihood of increasing children's intake of previously refused vegetables.

One technique that could be used alongside repeated exposure is modelling. Modelling occurs through a process of observational learning, where encouragement and facilitation of behaviours results in them becoming habitual (Bandura, 1977). Peer modelling of eating behaviour has been shown to be effective at increasing children's acceptance of novel healthy foods (Hendy, 2002) as well as altering children's food choices (Birch, 1980). Parental modelling of healthy eating has also been associated with children's subsequent consumption of fruits and vegetables (Draxten, Fulkerson, Friend, Flattum, & Schow, 2014; Gregory et al., 2010; Palfreyman et al., 2014). Parental modelling has been shown to significantly increase children's willingness to try an unfamiliar food compared to when children were simply offered the unfamiliar food (Harper & Sanders, 1975), suggesting that parental modelling could indeed be a successful method for increasing children's willingness to taste novel or disliked foods.

In addition, the use of contingent non-food rewards may be another strategy which can be used to aid children's liking of new or previously refused foods. One contingent reward or incentive that is often used with young children is a sticker. The use of stickers as rewards has been shown to be successful at increasing consumption of healthy snack foods in eight children aged between 3 and 6 (Stark et al., 1986). Furthermore, non-food rewards have proved to be a successful component of repeated exposure interventions aimed at increasing children's consumption of disliked or novel vegetables in both the school (Añez, Remington, Wardle, & Cooke, 2013; Cooke et al., 2011; Hendy, Williams, & Camise, 2005) and home environments (Corsini, Slater, Harrison, Cooke, & Cox, 2013; Remington, Añez, Croker, Wardle, & Cooke, 2012). Although these programmes generally describe the rewards given as tangible rewards

(e.g., stickers or a small toy), such reward systems inevitably have a social reward element entrenched within them (i.e. praise).

Previous research has investigated the use of these techniques (repeated exposure, modelling and non-food rewards) in combination to increase children's liking and consumption of vegetables. Interventions using these techniques within a school-based setting have already generated successful results. For example, the Bangor Food Research Unit's 'Food Dudes' programme (Lowe et al., 1998), which combines peer modelling, rewards and exposure, has been rolled out in schools across the UK and Ireland. Although successful at increasing children's liking and consumption of vegetables in the short-term (e.g., Horne, Lowe, Bowdery, & Egerton, 1998; Horne et al., 2011; Lowe et al., 1998; Lowe, Horne, Tapper, Bowdery, & Egerton, 2004; Tapper, Horne, & Lowe, 2003), the 'Food Dudes' and other similar programmes rely on local government funding and whole school sign-up, making such programmes inaccessible for many families. Home-based parent led interventions provide an alternative to such programmes (Fildes, van Jaarsveld, Wardle, & Cooke, 2013). Similar research about parent led interventions in the home setting has been conducted (e.g., Añez et al., 2013; Corsini et al., 2013; Remington et al., 2012), and these studies suggest that repeated exposures incentivised with rewards can be effective at increasing children's consumption of a disliked vegetable. The current study builds on this research by further investigating whether parental modelling can be used to increase children's liking and acceptance, and how this may interact with rewards.

The present study concerns a home-based intervention, grounded in the principles of rewards, modelling and repeated exposure. It aimed to evaluate the intervention's success at increasing children's liking and consumption of a previously disliked vegetable. Four intervention conditions were tested. All of these conditions used repeated exposure, with one testing the effect of just repeated exposure (Condition 1), one testing modelling paired with repeated exposure (Condition 2), one testing rewards paired with repeated exposure (Condition 3), and one comprising all of these methods (modelling, rewards and repeated exposure; Condition 4). The fifth condition was a no-treatment control group (Condition 5). It was predicted that children who participated in the all methods condition (comprising modelling, rewards and repeated exposure; 4) would show significant increases in both liking and consumption of a previously disliked target vegetable post-intervention when compared to the control group (5). It was further predicted that increases in liking and consumption of the target vegetable would be intermediate for children in the modelling and repeated exposure condition (2), and

the rewards and repeated exposure condition (3) and smallest in the repeated exposure condition (1) relative to the control group (5).

3.2 Method

3.2.1 Participants

One hundred and thirty six parent-child pairs were recruited to take part in this study. Children were aged from 25 to 55 months ($M = 38$ months; $SD = 7.75$ months). This age group was selected as fussy eating and neophobia (avoidance of new foods) are commonly seen around this age (Addessi et al., 2005) and during this preschool period, when children typically spend more time with their parents, it may be easier for parents to deliver a home-based intervention.

3.2.2 Procedure

Full ethical clearance for this study was obtained from Loughborough University's Institutional Review Board. Informed consent was obtained from all parents before the onset of the study, with parents fully advised of their right to withdraw themselves and their child at any point.

3.2.2.1 Recruitment

Parents were recruited via 20 parent and toddler groups and childcare centres in the East Midlands, UK. Following approval from the manager or group leader, mutually convenient times were agreed for testing to take place. Parents were approached by the researcher and invited to participate in a home-based study investigating methods which parents can use to help their children eat vegetables. Parents who expressed an interest in participating were then given an information sheet (Appendix P) detailing the study before providing consent for their own and their child's participation, with participation limited to one child per family. Parents were not compensated for their participation in this study.

3.2.2.2 Target vegetables

In line with previous research (e.g. Remington et al., 2012), each child was assigned a single target disliked vegetable. Assigning just one target vegetable also helped to keep the intervention simple and minimised the chances of the participants being overwhelmed or put-off by the intervention. Parents were asked to rank a list of six raw vegetables (baby corn, celery, red pepper, cherry tomato, cucumber, and sugar snap peas) in order of their own preference, with one being the one they liked best and six being the one they liked least. These six vegetables were chosen as the research team

deemed them to be commonly consumed by adults, readily available, being simple to prepare, and keeping in the fridge for a number of days without spoiling (thereby minimising waste). Parents were then asked to repeat this process according to their child's preferences. Parents were told that if they did not know whether their child liked the vegetable (as the vegetable was not familiar to the child) they should not rank the vegetable. This allowed disliked vegetables to be assigned rather than novel ones. The vegetable ranked fourth for the child was allocated as the target vegetable for the intervention, avoiding those ranked fifth or sixth to allow for both positive and negative shifts in liking (Cooke et al., 2011). Because some conditions required parents to model eating the vegetable, if the child's fourth ranked vegetable was ranked as fifth or sixth by parents, an alternative disliked vegetable was selected to limit any confounding effects of parental preferences. Children's dislike of the target vegetable was confirmed during a baseline session with the researcher (see *Baseline* section below).

All target vegetables were presented at baseline and post intervention in their raw form, washed, chopped into approximately 2.5g pieces (which were small enough to fit in the mouth) and served in 30g portions, weighed using Salter dietary electronic scales 1250. This weight was chosen as it represents more than an age-appropriate portion for children in this age group (NHS Choices, 2009; Infant and Toddler Forum, 2013), thereby reducing the possibility that any child would choose to eat the entire portion.

3.2.2.3 *Baseline*

During a baseline session, parent-child dyads were each tested separately from other dyads. Parents were asked to provide demographic information for themselves and their child including age, ethnicity, number of children and their highest level of education.

3.2.2.4 *Measures*

Children's liking of the target vegetable was measured using a three-point smiley faces scale (Birch, Zimmerman, & Hind, 1980; Appendix O) which comprises three stylised, gender neutral faces. One with a broad smile to represent 'yummy, I like it!', one neutral to represent 'ok' and one with a down-turned mouth to represent 'yucky, I don't like it!'. The smiley faces rating scale is seen as a more reliable measure of liking than pure verbalisations in children of this age (Blissett, Haycraft, & Farrow, 2010; Weisberg & Beck, 2010). Children were familiarised with this scale at a baseline session.

3.2.2.5 *Familiarisation*

Children were shown a brief child-friendly information sheet (Appendix D), which largely comprised pictures, to familiarise them with the protocol of the session and the researcher talked to them about what would be involved. Children were also familiarised with the three-point smiley faces scale. Each face was explained to them (with a description of how each of the faces would reflect how much they liked a food) and their ability to correctly identify the expression of each face was verified in a procedure similar to Weisberg and Beck (2010). Here, each child was asked to correctly identify which face represented “yucky”, “yummy” or “just ok”. Next, children were shown and asked to name the target vegetable which had been assigned to them, with it presented in its whole form. Children who could not name the vegetable were told its name and the vegetable was placed on the table in front of them.

3.2.2.6 *Testing baseline consumption and liking*

Children were then given a small plastic pot containing 30g of their target vegetable. The vegetable had been chopped into child-sized pieces (~2.5g). The children were asked to remove the lid of the pot and tell the researcher what was inside. Again, children who could not name the chopped vegetable were told its name. This process was chosen to ensure that the children linked the chopped vegetable to what it looks like in its whole form, aiming to minimise the effects of how the vegetable was later presented by parents. Children were then asked to try a piece of the target vegetable. If reluctant, children were gently encouraged by the researcher to first choose a piece to pick up with their fingers, then to lick the piece and, if possible, to progress to biting or eating the piece. Children were not encouraged to swallow the piece, so as to avoid causing stress to the children, and in an effort to increase their willingness to try the vegetable. Whether or not each child tasted the vegetable (defined as licking, sucking, biting or chewing) was then recorded by the researcher.

Once the children had tried the vegetable (or after they had refused to try it) they were asked “Do you like [name of vegetable]?”. They were then asked to rate their liking using the three-point smiley faces scale (‘yummy’, ‘ok’ or ‘yucky’). Children were then told that they could eat as much as they wanted of the vegetable in the pot, and a free eating session commenced. This session lasted a maximum of five minutes or was terminated when the children said that they did not want any more or when they left the test table. The test portion of the target vegetable was then removed and re-weighed (including pieces which were tasted but not consumed - i.e. licked or chewed but rejected) in order to measure consumption.

3.2.2.7 *Intervention groups and allocation*

Recruitment centre groups were systematically assigned by the primary investigator to one of four experimental conditions: 1. repeated exposure; 2. modelling and repeated exposure; 3. rewards and repeated exposure; or 4. modelling, rewards and repeated exposure. This method of allocation was chosen to prevent discussion of the study methods between parents in different intervention groups. Consecutive sampling was used so that a maximum number of dyads could be recruited from each centre. Centres were sequentially allocated to each condition, resulting in sequential cluster sampling. If there was not space in the next condition in the sequence, the centre was pragmatically assigned to an alternative condition, creating even sized conditions. Parents in all of these conditions were instructed to offer their child a small piece (~2.5g, which they were shown an example of during the baseline session) of the target vegetable (which was provided for parents by the research team) each day for 14 consecutive days, using the protocol for the intervention condition to which they were assigned. Parents were asked to conduct all offerings outside of a mealtime in line with previous research (Fildes et al., 2013), in order to avoid adding any potential stress associated with mealtimes. Parents in the repeated exposure condition (1) were instructed to simply offer their child a small piece of the target vegetable without eating it themselves. They were also asked to remain neutral in their responses to whether or not their child tasted the piece. Parents in the modelling and repeated exposure condition (2) were instructed to eat a small piece of the target vegetable in front of their child, expressing a positive response such as “oh this [name of vegetable] is really nice!”. These parents were instructed to offer their child a small piece of the vegetable immediately afterwards, but to remain neutral regardless of whether their child tried a piece of the vegetable. Parents in the rewards and repeated exposure condition (3) were asked to offer their child a small piece of the target vegetable, telling them that if they try a piece they can choose a sticker from a sheet provided for the study. Parents were further told that if their child did try a piece of the vegetable, they should not only give them the sticker they chose but also praise them with a phrase such as “well done, you tried your [name of vegetable]!” and to tell their child that they were receiving a sticker because they tried the vegetable. Finally, parents in the modelling, rewards and repeated exposure condition (4) were instructed to eat a piece of the target vegetable in front of their child, saying how nice it was, and then to offer their child a piece telling them they could choose a sticker if they tried it, and giving praise if the child did indeed try a piece. Parents in all conditions were instructed to adhere to their assigned method of offering for the entire 14 day period, and to record the success of the

protocol in a 'tasting diary' (Appendix I). This diary asked parents to record whether they completed each daily offering, and included a daily manipulation check (e.g., 'Did you stay neutral?' in the repeated exposure group) as well as a record of whether each offering resulted in a tasting (defined as contact with the child's mouth, including licking, sucking, biting and chewing, where swallowing was not necessary). During the baseline session, the researcher verbally explained to parents how to offer the vegetable and how to use the diary, and written instructions on how to complete the daily offerings were also provided (Appendix I). Parents were also given the opportunity to ask any questions about the protocol, and given the researcher's contact information should they have any further queries.

3.2.2.8 *Fourteen day follow-up consumption and liking*

After the 14 day intervention period, parent-child dyads attended a follow-up session at the toddler group they attended at baseline. This session was identical in format to the baseline session, in order to allow for comparison of liking and consumption of the target vegetable pre and post-intervention. Parent and child height (cm) and weight (kg; using Salter 9059 SS3R ultra-slim scales) were measured. Parents also returned their completed tasting diaries.

3.2.3 **Data analysis**

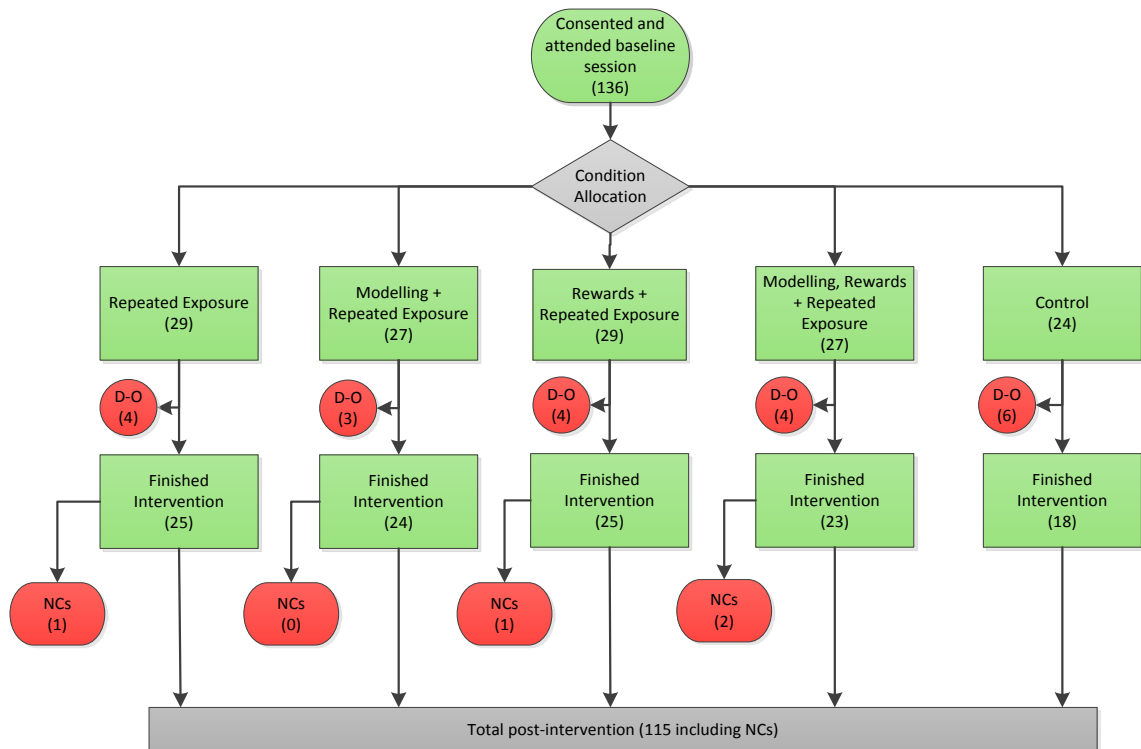
Sample size was calculated following Cohen's (1992) guidelines of adequate sample size for statistical power. Based on these guidelines, a minimum of 16 dyads in each condition was required in order to detect a large effect with power of 0.8 and $p < .05$. To account for attrition across the study, participants were over-recruited by 50%, meaning that a minimum of eight additional dyads were recruited to each condition. For detailed information about attrition per condition please see Figure 3.1. Child height and weight were converted into age and gender adjusted BMI z scores (Cole et al., 1995; Freeman et al., 1995). Exploratory analyses were conducted to check normality of the data. Parent BMI and child age and the total tastings achieved were non-normally distributed. Consumption data both pre and post were also non-normally distributed, with a floor effect of a large number of zero scores. For these reasons, data were analysed using non-parametric tests where possible and parametric tests (ANOVAs) were conducted where there was no suitable alternative. Repeated measures ANOVAs were used to assess whether there were significant differences in any changes in consumption between the groups across the intervention period. Kruskal-Wallis analyses were conducted to investigate any potential differences between group consumption pre-intervention, consumption post-intervention, and the total tastings

achieved. Mann-Whitney U analyses were then used to compare each experimental group's target vegetable consumption to that of the control group and the total tastings achieved between experimental groups. This allowed for assessment of whether, post-intervention, participants in each condition consumed significantly more in comparison to the control group. Finally, chi-square analyses were used to look for differences in liking of the target vegetable between groups, both pre and post-intervention.

3.3 Results

3.3.1 *Sample and attrition*

Of the 136 participants who completed the baseline session, 21 families (14.8%) were unavailable for the 14 day follow-up or withdrew from the study (due to illness, work commitments, or other personal reasons), leaving a sample of 115 parent-child dyads. Of these participants, 98 parents identified themselves as White/Caucasian, six identified as Black/Black British, two identified as Asian/Asian British and nine parents did not provide this information. The flow of participants through the study is shown in Figure 3.1. Based on previous research suggesting that 10 tastings of a disliked food are necessary for children to acquire liking (Sullivan & Birch, 1990), all analyses were repeated for a subset of the sample whose tasting diaries indicated that they had achieved 10 or more offerings (and removing those classed as 'non-completers' who achieved fewer than 10 offerings). However, as the findings of these analyses were unchanged from those using the full sample, full sample analyses are reported.



D-O: Dropout

NCs: Non-completers - i.e. those children who received fewer than 10 offerings of the target vegetable during the 14 day intervention period

Figure 3.1: Flow of parent-child dyads from baseline to post-intervention during a vegetable intervention for each of five experimental conditions

3.3.2 Descriptive statistics

All groups were compared for differences in child and parent characteristics, including age, gender, parental education, and BMI. There were no significant differences found for these characteristics between groups and this information is displayed in Table 3.1.

Table 3.1: Child and parent characteristics of the final sample by experimental group, and Chi-square/ANOVA tests of difference between conditions

	Repeated Exposure (1)	Modelling + Repeated Exposure (2)	Rewards + Repeated Exposure (3)	Modelling, Rewards + Repeated Exposure (4)	Control (5)	Group difference
Parent						
Parent Age [Years]	34.15 (4.74)	35.97 (5.11)	35.93 (5.71)	36.49 (3.64)	32.81 (4.03)	$F = 2.15$, n.s.
Parent BMI	25.5 (5.04)	26.03 (5.18)	25.43 (3.83)	25.59 (5.03)	22.72 (2.57)	$F = .58$ n.s.
Education Level [n (%)]						$\chi^2 = 2.88$ n.s.
Non-University graduate	14 (61)	12 (55)	10 (42)	9 (43)	9 (60)	
University level or higher	9 (39)	10 (45)	14 (58)	12 (57)	6 (40)	
Child						
Child Age [Months]	38.24 (8.82)	39.68 (9.01)	40.20 (6.58)	38.09 (8.16)	34.17 (6.17)	$F = .14$ n.s.
Child BMI Z score	0.29 (1.04)	0.27 (.77)	0.07 (.81)	0.19 (1.01)	0.50 (.58)	$F = .46$ n.s.
Child Gender [n (%)]						$\chi^2 = .99$ n.s.
Male	11 (46)	10 (42)	9 (38)	8 (38)	6 (33)	
Female	13 (54)	14 (58)	15 (63)	13 (62)	12 (67)	

Note: Mean (SD) displayed unless otherwise stated. Descriptive statistics are based on available data, with missing data in some categories.

3.3.3 Exploring differences among intervention and control conditions on children's consumption of a disliked vegetable

In order to examine group differences in consumption of the target vegetable across the study, repeated measures ANOVAs were conducted. Consumption of the target vegetable significantly increased over the intervention period in all groups, with a main effect of time ($F(1,110)=25.80$, $p<.001$). However, there was not a significant group by time interaction ($F(4, 110)=.89$, $p=.48$). Pre and post-intervention consumption data per experimental group can be seen in Table 3.2.

Table 3.2: Mean pre and post-intervention consumption of the target vegetable (in grams) per intervention condition, including minimum and maximum values, with significant group differences indicated.

Intervention condition		Pre Consumption		Post Consumption	
	N	Mean (g) (SD)	Min / Max	Mean (g) (SD)	Min / Max
Repeated Exposure (1)	25	0.28 (0.78)	0.00 / 3.60	2.90 (5.30)	0.00 / 19.35
Modelling + Repeated Exposure (2)	24	0.36 (0.60)	0.00 / 2.00	4.68 (8.37)	0.00 / 30.00
Rewards + Repeated Exposure (3)	25	0.48 (0.87)	0.00 / 2.50	3.65 ^a (6.83)	0.00 / 30.00
Modelling, Rewards + Repeated Exposure (4)	23	0.61 (1.06)	0.00 / 3.40	3.96 ^b (5.64)	0.00 / 22.15
Control (5)	18	0.25 (0.54)	0.00 / 2.15	1.14 ^{ab} (1.92)	0.00 / 5.85

^a Significant difference in post-intervention consumption between groups 3 and 5 ($p<.05$)

^b Significant difference in post-intervention consumption between groups 4 and 5 ($p<.05$)

Kruskal-Wallis analyses revealed that pre-intervention, there were no significant differences between the groups on children's consumption of the target vegetable ($H(4)=3.29$, $p=.51$). A series of Mann-Whitney U tests revealed that pre-intervention there were no significant differences in consumption of the target vegetable between any pairings of the five groups. There were also no significant differences between the groups on children's consumption of the target vegetable post-intervention ($H(4)=5.07$,

$p=.28$). However, Mann-Whitney U tests revealed that post-intervention, consumption was significantly higher for children in the modelling, rewards and repeated exposure group (4) (Mdn=1.65, $U=137.00$, $z=-1.98$, $p=.02$, $r=-.31$), and the rewards and repeated exposure group (3) (Mdn=50, $U=155.00$, $z=-1.82$, $p=.03$, $r=-.28$) compared to the control group (Mdn = .00). No significant differences were observed in post-intervention consumption amongst the modelling and repeated exposure (2) (Mdn=.00, $U=176.00$, $z=-1.14$, $p=.13$, $r=.18$) or the repeated exposure group (1) (Mdn=.00, $U=198.00$, $z=-.77$, $p=.23$, $r=.12$), when compared to the control group (Mdn=.00).

3.3.4 Exploring differences between the intervention conditions on the total number of tastings achieved

Previous research has shown that children need to try disliked foods a large number of times for them to become liked (e.g., Sullivan & Birch, 1994). With this in mind, analyses were used to explore whether there were significant differences in the number of tastings achieved between the intervention groups. Tasting data were the total number of reported tastings from the parent diaries. Kruskal-Wallis analysis revealed that there were significant group differences in the number of tastings achieved across the intervention period ($H(3)=15.53$, $p=.001$). A series of Mann-Whitney U tests revealed that the number of tastings achieved was significantly higher in the modelling, rewards and repeated exposure group (4) (Mdn=12.00, $U=116.50$, $z=-2.63$, $p=.004$, $r=-.06$) and rewards and repeated exposure group (3) (Mdn=11.00, $U=137.50$, $z=-2.61$, $p=.004$, $r=-.06$) compared to the repeated exposure group (1) (Mdn=6.00). The modelling, rewards and repeated exposure group (4) (Mdn=12.00, $U=105.50$, $z=-2.90$, $p=.002$, $r=-.07$) and rewards and repeated exposure group (3) (Mdn=11.00, $U=125.00$, $z=-2.90$, $p=.002$, $r=-.06$) also achieved significantly more tastings than the modelling group (2) (Mdn=5.00). There were no significant differences in the number of tastings achieved between the modelling, rewards, and repeated exposure group (4) (Mdn=12.00, $U=229.00$, $z=-.53$, $p=.30$, $r=-.01$) and the rewards group (3) (Mdn=11.00), or between the modelling and repeated exposure group (2) (Mdn=5.00, $U=220.50$, $z=.00$, $p=.50$, $r=.00$) and the repeated exposure group (1) (Mdn = 6.00).

3.3.5 Exploring differences among the intervention and control conditions on children's liking of a previously disliked vegetable

Of the 115 children who took part in the study, 39 did not appear to fully understand the smiley faces rating scale which was used to determine children's opinion of the target vegetable. These children could not correctly identify the "yummy" or "yucky" faces on request. Children who could not use the smiley faces rating scale were removed from

the liking analyses, although it is noted that this resulted in uneven group sizes. The number of children able to use the smiley faces rating scale can be seen in Table 3.3, alongside the percentages of children within each condition who rated the target vegetable as “yummy” both pre and post-intervention.

Table 3.3: Number of children rating the target vegetable as “yummy” on the smiley faces rating scale pre and post-intervention per condition

Experimental Group	N	Yummy Pre	Yummy Post
Repeated Exposure (1)	20	0	7
Modelling + Repeated Exposure (2)	15	0	4
Rewards + Repeated Exposure (3)	16	1 ^a	10
Modelling, Rewards + Repeated Exposure (4)	15	2 ^a	9
Control (5)	10	0	1

^a Children were only assigned this vegetable when they rated it as yummy but then only ate one small piece of it or less – i.e. where their response was considered incongruent with their true liking.

Chi-Square analyses revealed that pre-intervention, there was no significant difference in rated liking between the five groups ($\chi^2(8, N=76) = 1.52, p=.16, V=.28$). However, post-intervention there was a significant difference between the groups on children's rated liking of the target vegetable ($\chi^2(8, N=76)=15.48, p=.05, V=.32$). Here, the proportion of children who rated the target vegetable as “yummy” was highest in the modelling, rewards and repeated exposure (4) and rewards and repeated exposure (3) groups (over 60%), intermediate in the modelling and repeated exposure (2) and repeated exposure (1) groups (over 26%), and lowest in the control group (5) (10%). For exact numbers of children who rated the vegetable as “yummy” refer to Table 3.3.

3.4 Discussion

The aim of this study was to assess the effectiveness of a home-based rewards, modelling and repeated exposure intervention for increasing children's liking and acceptance of a disliked vegetable. It was predicted that children who participated in the all methods condition (4) would show significant post-intervention increases in both liking and consumption of a previously disliked target vegetable, compared to the control group (5). It was further predicted that there would be intermediate increases in liking and consumption of the target vegetable for children who were in the modelling and repeated exposure condition(2), or the rewards and repeated exposure condition

(3). Finally, it was predicted that children in the repeated exposure group (1) would have the smallest post-intervention increases in liking or consumption of the target vegetable, in comparison to the control group (5). These hypotheses were partially supported.

In the current study, post-intervention consumption and liking of the previously disliked vegetable was significantly greater amongst children who were in the all methods condition (4) than the control group (5), suggesting that a combination of parental modelling, rewards and repeated exposure is effective at increasing children's consumption and liking of a previously disliked vegetable. This is consistent with previous research using mixed methods interventions, such as the 'Food Dudes' (Horne et al., 2011; Lowe et al., 1998, 2004) and the 'Kids Choice' (Hendy et al., 2005) programmes. The current study adds to the results of these school-based interventions by suggesting that, alongside rewards, parental modelling could be an effective alternative to the peer modelling component of these interventions. It also suggests that the home environment can be a suitable setting for such interventions.

Greater consumption and liking of the disliked vegetable post-intervention was found amongst children who were in the rewards and repeated exposure condition (3), as well as the modelling, rewards and repeated exposure condition (4) when compared to those in the control group (5). Moreover, the number of tastings achieved by the intervention groups fitted the same pattern as was found for increases in liking and consumption. Specifically, the all methods group (4) and the rewards and repeated exposure group (3) achieved approximately twice as many tastes as children in the modelling and repeated exposure (2) or repeated exposure alone (1) groups. Taste exposures are likely to be necessary for a young child to accept and acquire a liking for novel or disliked foods (Birch et al., 1987), and the combination of rewards and repeated exposure appears to be most effective at increasing such tasting and subsequent consumption in this study. This finding is in line with previous research suggesting that small tangible rewards can be effective when combined with repeated exposure in both the school (Wardle et al., 2003) and home settings (Fildes et al., 2013; Remington et al., 2012). Although this appears to contradict the over-justification hypothesis of rewards (Deci et al., 1999), where giving rewards in exchange for consumption decreases liking for that food, it does support the current literature to date on rewarding tasting disliked compared to liked foods. As Cooke, Chambers, Añez, and Wardle (2011) discuss, rewarding children for consuming large amounts of already liked foods may actually lower the intrinsic value attributed to such foods. However, if

foods are not already liked, then pairing such foods with a reward can result in increased liking via a process of paired conditioning.

The current study found no significant differences in consumption or liking of the disliked vegetable post-intervention between children in the modelling and repeated exposure condition (2) when compared to those in the control group. This suggests that the combination of modelling and repeated exposure alone, without rewards, may not be effective at increasing liking or consumption of a previously disliked food. Although previous research suggests that enthusiastic parental modelling can be a useful tool for increasing vegetable consumption in children (e.g., Gregory et al., 2010; Harper & Sanders, 1975; Palfreyman et al., 2014; Pearson et al., 2009; Tibbs et al., 2001), to our knowledge there are currently no successful interventions which use parental modelling. It is possible that previous research showing modelling to be effective has had subtle elements of rewards within the design, such as praise for tasting. In an effort to unpack the effects of rewards and modelling, parents in the current study's modelling and repeated exposure condition (2) were asked to enthusiastically model tasting of the food but were explicitly asked to remain neutral regardless of whether their child tried the vegetable (i.e. not to praise their child). Whilst previous research suggests that modelling is a relatively commonly used practice (with approximately one third of parents in Musher-Eizenman and Holub's (2007) study reporting the use of modelling); this may have resulted in the parents' modelling being unnatural, where they were focused on remaining neutral or following the study instructions. It is also possible that children in this condition found it strange that they were not praised for trying a food their parent was enthusiastic about eating, as praise is thought to be a fairly common feeding practice (with 30% of parents in the Orrell-Valente et al. (2007) study using praise). This in turn may have reduced these children's enjoyment and subsequent liking of the vegetable. Moreover, although parents were given instructions on how to model appropriately, they may not have been sufficiently enthusiastic (see Hendy and Raudenbush, 2000) or their enthusiasm may not have lasted for the duration of the intervention, thereby potentially reducing the effectiveness of their efforts.

No significant differences in post-intervention liking or consumption of the target vegetable were found between the repeated exposure group (1) and the control group. It is likely that this is because children in the repeated exposure alone group did not achieve the 10 to 15 tastings necessary to increase liking and consumption of the target vegetable (Birch & Marlin, 1982; Sullivan & Birch, 1990). Although repeated

taste exposures are vital to encourage children to taste disliked foods, repeatedly offering in a neutral way did not appear to ensure tastings in this study. These findings suggest that additional methods are necessary to achieve the taste exposures needed to induce liking and acceptance of a disliked vegetable.

Overall, this study has made a valuable contribution to the knowledge base about successful methods which can be used to encourage children to eat, and like, more vegetables. By gathering data concerning tasting, liking and consumption and including a control group as well as a repeated exposure group, we are able to build on previous research (e.g., Lowe et al., 2004; Remington et al., 2012) to compare the effects of each component of the intervention. Nevertheless, the study does have limitations. Firstly, this study sample has limited ethnic diversity, which must be considered. Due to the parent led nature of the study we were unable to fully control parents' reactions when offering the vegetable or their response to children tasting. While this means that fidelity to the intervention cannot be guaranteed for all participants, this is a wholly necessary part of developing a home-based intervention which results in high ecological validity. We also do not know whether parents offered the target vegetable at other times during the intervention, and future studies should aim to control for this. It is also important to acknowledge that some children ate the disliked food at baseline, however these children were only assigned the vegetable as their target vegetable if they ate a very small quantity, such as only the first piece they were asked to try. It is also possible that some of the target vegetables which were assigned were not strictly disliked, and may have in fact been novel, although this was controlled for wherever possible with information from parents. Furthermore, participants were allocated to the various conditions through a process of sequential cluster sampling. Whilst this allowed maximal recruitment from each centre, this may have resulted in some differences between the experimental groups. This was controlled for as much as possible by the inclusion of participants from multiple recruitment centres in each condition, but there may still have been reduced variance within each condition. Finally, it should be noted that sample size was calculated on the basis of detecting large effects, whilst the effects found in this study were in fact small. Whilst small effects are likely to still result in meaningful changes in children's consumption of vegetables in the longer term, it is possible that with a larger sample, more significant findings may be detected.

These findings indicate that parent led home-based interventions comprised of repeated exposure and rewards, with or without the addition of parental modelling, are successful at increasing children's consumption and liking of a previously disliked

vegetable. These results also suggest that in home-based interventions, neither parental modelling nor repeated exposure are sufficient for increasing children's liking and consumption of a disliked vegetable without the use of rewards. Although this finding is contrary to what was initially expected, it could be promising that parental modelling is not vital to increase liking and consumption, especially for parents who do not eat vegetables themselves or do not often eat meals with their child. Such interventions have minimal economic burden and may prove to be a viable alternative to school programmes which tend to be costly and exclusive. Further research is required to identify whether increases in liking and consumption of a previously disliked vegetable are maintained over time.

Chapter 4

The previous chapter developed and investigated the efficacy of a parent led home-based repeated exposure intervention which aimed to increase children's liking and consumption of a disliked vegetable. Four versions of the intervention were compared: repeated exposure; modelling and repeated exposure; rewards and repeated exposure; and modelling, rewards and repeated exposure. Some success at increasing both liking and consumption was seen, particularly in the modelling, rewards and repeated exposure as well as the rewards and repeated exposure groups. Together, these findings suggested that parent led, home-based repeated exposure interventions using rewards to incentivise tasting, with or without the inclusion of parental modelling may well be successful for increasing children's consumption of disliked vegetables. However, there was a large degree of variability in post-intervention consumption within each group, with significant increases in consumption in all groups. This suggests that individual differences in parent and child factors may influence the outcome of interventions. With this in mind Chapter 4 aimed to examine whether certain parent and child factors, specifically parental feeding practices, child temperament and child eating behaviours, are associated with the effectiveness of home-based, parent led, repeated exposure interventions aimed at increasing children's intake of a disliked vegetable. Chapter 4 further aimed to examine whether parent and child factors can predict the success of such interventions.

Chapter 4: Investigating the role of parent and child characteristics in intervention outcomes

Some of the results which are presented in this chapter were delivered as oral presentations at two international conferences:

1. Holley, C.E., Farrow, C., & Haycraft, E. (2014). Exploring parent and child factors in the efficacy of interventions aimed at increasing children's acceptance and liking of a disliked vegetable. Oral presentation delivered at the International Feeding Disorders Conference, UCL Institute of Child Health, London, UK, 4-5 November 2014.
2. Holley, C.E., Haycraft, E. & Farrow, C. (2015). The role of individual characteristics in the efficacy of interventions for increasing children's acceptance of a disliked vegetable. Oral presentation delivered at the British Feeding and Drinking Group Annual Meeting, Wageningen, Holland, 3-4 April 2015.

Investigating the role of parent and child characteristics in intervention outcomes

4.1 Introduction

It is well known that vegetables are commonly disliked by children (e.g., Cooke & Wardle, 2005; Skinner, Carruth, Bounds, & Ziegler, 2002). With food habits established in childhood known to track through to adulthood (e.g., Lytle, Seifert, Greenstein, & McGovern, 2000; Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2007), interventions aimed at increasing vegetable consumption in early childhood seem vital. Both parent and child factors have been linked to children's intake of fruit and vegetables (e.g., Cooke et al., 2004; Galloway, Fiorito, Lee, & Birch, 2005; Galloway, Lee, & Birch, 2003; Palfreyman, Haycraft, & Meyer, 2014). However, it is not known whether individual differences in the ways that caregivers parent, or in children's characteristics, influence the outcome of interventions aimed at increasing children's acceptance of previously disliked vegetables. Indeed, Mitchell, Farrow, Haycraft, and Meyer (2012) suggest that although interventions aimed at increasing vegetable consumption have shown promising results, their outcomes may well be influenced by the ability of the parent and/or child to engage with the intervention.

The previous chapter described the development of a home-based intervention comprised of a programme of 14 daily offerings by parents of a vegetable which their child disliked. It focused on comparing different elements of an intervention to explore which behaviours are necessary alongside repeated exposure to increase children's liking and consumption of a disliked vegetable. Four different variants of this programme were developed: one where parents simply offered the vegetable daily (condition 1 - repeated exposure); one where parents modelled eating the target vegetable and then offered it to their child (condition 2 - modelling and repeated exposure); one where parents gave small incentives and praise in exchange for trying the vegetable (condition 3 - rewards and repeated exposure); and one combining modelling, rewards and daily offering (condition 4). It was found that post-intervention consumption of the target vegetable was significantly higher in the rewards and repeated exposure (condition 3) and the combined modelling, rewards and repeated exposure (condition 4) groups when compared to a no-offerings control group. Nevertheless, significant increases in consumption across the intervention period were seen in all groups, with strong variability within each group. This suggests that rather than one type of intervention being the most successful, individual differences in both parent and child factors likely influence the success of such interventions. With this is

mind, there is value in exploring how other family characteristics might be related to the success or failure of these interventions collectively. Research is needed to better understand the individual family based characteristics that make interventions most successful for families, in order to help modify and tailor the development of future interventions in this area.

One characteristic that might alter the success of such interventions is the feeding practices that parents typically use with their children (see section 1.3.2). Feeding practices are specific strategies which parents use in an attempt to alter or maintain their child's eating behaviour (Ventura & Birch, 2008). Feeding practices have previously been shown to influence children's eating behaviours in both positive (such as promoting healthy food choice and consumption) and negative (such as increasing unhealthy food choice and food avoidance) ways (e.g., Blissett, Haycraft, & Farrow, 2010; Fisher, Mitchell, Smiciklas-Wright, & Birch, 2002; Palfreyman et al., 2012; Pearson, Biddle, & Gorely, 2009). One commonly researched feeding practice is pressure to eat. Parents have reported using this practice to encourage greater consumption of healthier foods, such as fruit and vegetables, in their children (Fisher et al., 2002; Galloway et al., 2005; Wardle, Carnell, & Cooke, 2005). However, research suggests that this feeding practice is often ineffective as it tends to predict lower consumption of pressured foods (Galloway et al., 2005).

There are several other feeding practices which parents may use in an effort to promote 'healthier' eating in their children. Parental modelling of fruit and vegetable intake is a potentially successful method for increasing child intake (e.g., Cullen, 2001; Gregory et al., 2011; Palfreyman et al., 2014; Pearson et al., 2009; Tibbs et al., 2001), and parental modelling has also been related to lower levels of food fussiness and higher interest in food among pre-schoolers (Gregory et al., 2010). Moreover, providing a healthy home environment and encouraging balance and variety may help to promote healthy eating (Birch & Marlin, 1982), increase vegetable consumption (Melbye et al., 2013), and reduce food avoidant eating behaviours, such as food fussiness (Powell et al., 2011), in children. Involving children in meal planning and teaching them about nutrition are also adaptive feeding practices that parents report using (Musher-Eizenman & Holub, 2007), and primary school-based nutrition education programmes have been shown to increase children's consumption of fruits and vegetables (Auld, Romaniello, Heimendinger, Hambidge & Hambidge, 1999). With this in mind, it is possible that parental teaching about nutrition and involvement may serve to promote healthy eating in children. Moreover, children of parents who provide a

healthy home environment and teach their children about nutrition but do not pressure their children to eat may respond better to interventions which promote greater acceptance of a food.

Parenting does not occur as a one-way process and internal characteristics of children, such as their temperament, influence parenting (e.g., Stright, Gallagher, & Kelley, 2008; Vereecken, Legiest, De Bourdeaudhuij, & Maes, 2009; see also section 1.3.5) and quite probably the likely success of any parenting based interventions. Social Learning Theory states that learning is a cognitive process which takes place within a social context (Bandura, 1977). As such, it is likely that a child's sociability would influence this process; with low sociability potentially inhibiting a child's potential to learn eating behaviours through others, particularly through methods such as modelling. Indeed, a higher prevalence of feeding difficulties has been found in unsociable children (e.g., Hagekull, Bohlin, & Rydell, 1997; Pliner & Loewen, 1997), and children with inhibited approach (shyness/low sociability) have shown lower initial acceptance of novel foods (Moding et al., 2014). Another aspect of child temperament is emotionality. Children who display higher levels of emotionality have been reported by parents to be more food avoidant (Haycraft et al., 2011; Powell et al., 2011) and parental reports of their child being emotional or shy (less sociable) have been related to children's unwillingness to try new foods (Pliner & Loewen, 1997). This research indicates that some aspects of child temperament may be linked to more difficult eating behaviours in children, and the success of vegetable interventions.

Children's general eating behaviours are also likely to be important in determining their intake of healthy foods (see section 1.3.4). Enjoyment of food has been positively related to fruit and vegetable consumption in pre-schoolers (Cooke et al., 2004) and it has also been found to be a predictor of consumption change across previous vegetable interventions, with those with higher enjoyment of food achieving greater increases in consumption across the study (Caton et al., 2014). Food responsiveness is another eating behaviour and indicator of external eating, where highly food responsive children are likely to eat a highly palatable food regardless of their state of hunger (Wardle, Guthrie, Sanderson, & Rapoport, 2001). Conversely, satiety responsiveness is representative of making decisions about eating a food based on internal satiety cues (Wardle et al., 2001). Children who are high in satiety responsiveness will eat less if they have recently consumed a snack (Wardle et al., 2001). Finally, food fussiness is also likely to influence children's eating behaviours. Children who are picky or fussy eaters often consume fewer fruits and vegetables than

other children (e.g., Galloway et al., 2005), and food fussiness has been reported to correlate negatively with enjoyment of food and food responsiveness and positively with satiety responsiveness (Svensson et al., 2011; Wardle et al., 2001). These eating behaviours may influence the choices children make about what and when they eat, including vegetables.

In summary, it is known that children do not eat enough fruits and vegetables (Lennox et al., 2011). Furthermore, it is likely that parent factors (such as feeding practices) and child factors (such as temperament and eating behaviour) contribute to children's low consumption of vegetables. The aim of this study was to examine whether parental feeding practices, child temperament, and child eating behaviours were associated with children's acceptance of a disliked vegetable after a home-based, parent led, repeated exposure intervention. Factors that were significantly associated were then examined for their ability to predict the success or failure of the repeated exposure interventions. It was hypothesised that a repeated exposure based intervention would result in greater consumption of a disliked vegetable for children whose parents use health-promoting feeding practices, including encourage balance and variety, involve their child in meal planning and preparation, model healthy eating, teach about nutrition, keep a healthy home food environment, and for children who display higher levels of food approach behaviours (i.e. enjoyment of food and food responsiveness). It was further hypothesised that a repeated exposure based intervention would result in lower consumption of a disliked vegetable for children who are high in emotionality, low in sociability, display higher levels of food avoidant behaviours (i.e. food fussiness and satiety responsiveness), and whose parents use greater pressure to eat.

4.2 Method

4.2.1 Participants

Ninety parent-child pairs took part in this study. These dyads participated in one of the four intervention conditions outlined in Chapter 3 (families in the control condition described in Chapter 3 were excluded from the current study). Children were aged from 27 to 55 months ($M = 39$ months; $SD = 7.77$ months). Parents' age ranged from 22 to 46 years ($M = 35.85$ years, $SD = 4.82$ years). Child height and weight were measured by the researcher and converted into age and gender adjusted BMI z-scores (Child Growth Foundation, 1996; Cole, Freeman, & Preece, 1995; Freeman et al., 1995). Children's BMI z-scores ranged from -3.07 to 1.73 ($M = 0.21$, $SD = 0.90$). Parents' BMI

(kg / m²) ranged from 25.60 to 38.44 ($M = 25.60$, $SD = 4.66$), and 42% of the children who took part were male ($n = 38$).

4.2.2 Procedure

Full ethical clearance for this study was obtained from Loughborough University's Institutional Review Board. Following recruitment (see section 3.2.2.1), all parents provided informed consent and were fully advised of their right to withdraw themselves or their child at any point. Children also assented to take part in the study.

4.2.2.1 Baseline

During a baseline session, parents were asked to complete a series of validated questionnaire measures, described below, as well as to provide demographic information for themselves and their child, including age, gender, ethnicity, and level of education. Children were also assigned a target vegetable which parents rated as being disliked by their child. This dislike was confirmed by the child during a taste test and five minute free-eating session. A full description of the experimental methodology can be found in Chapter 3 (see section 3.2.2.6).

4.2.3 Measures

4.2.3.1 Comprehensive Feeding Practices Questionnaire (CFPQ; Musher-Eizenman & Holub, 2007; Appendix E)

Feeding practices were measured using the CFPQ, a questionnaire measuring 12 different feeding practices. Six of these subscales were included in this study: Pressure to eat (e.g. *'If my child says, "I'm not hungry," I try to get him/her to eat anyway'*); Modelling (e.g. *I show my child how much I enjoy eating healthy foods*); Environment (e.g. *Most of the food I keep in the house is healthy*); Encourage balance and variety (e.g. *I encourage my child to eat a variety of foods*); Involvement (e.g. *I involve my child in planning family meals*); and Teaching about nutrition (e.g. *I discuss with my child the nutritional value of foods*). Items are responded to on a five-point likert scale. Mean scores are generated for each subscale, with possible scores between one and five. Higher scores indicate greater use of the feeding practice. This measure has been validated and shown to have good test-retest reliability (Musher-Eizenman & Holub, 2007). Most subscales showed adequate internal validity in the current sample, with Cronbach's alpha values ranging from .60 to .81. The only subscale which showed somewhat inadequate internal validity in the current sample was the Involvement subscale, which had a Cronbach's alpha value of .50. With this in mind, findings for the involvement subscale should be treated with caution.

4.2.3.2 *EAS Temperament survey for children (EAS; Buss & Plomin, 1984; Appendix F)*

Child temperament was assessed using the EAS. The EAS measures four dimensions of child temperament, two of which were assessed in this study: Sociability (e.g. Child likes to be with people); and Emotionality (e.g. Child cries easily). Parents are asked to state how characteristic of their child each statement is on a five-point likert scale. Mean scores are then calculated for each subscale, with possible scores ranging from one to five. Higher scores on each subscale represent higher levels of that trait (i.e. higher emotionality or sociability). The EAS is a valid measure of young children's temperament as reported by parents (Mathiesen & Tambs, 1999). Cronbach's alphas in the current sample were .65 for the Sociability subscale and .90 the Emotionality subscale.

4.2.3.3 *Children's Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson & Rapoport, 2001; Appendix G)*

The CEBQ was used to assess child eating behaviours. The CEBQ measures eight different dimensions of children's eating behaviour. Four of the subscales were used for the purposes of this study; two measuring food approach eating behaviours (food responsiveness and enjoyment of food), and two measuring food avoidance (satiety responsiveness and food fussiness). Parents are asked to respond to each statement using a five-point likert scale ranging from never to always, and mean scores for each subscale are calculated. Scores range from one to five, with higher scores indicating higher frequency of that behaviour. The CEBQ has been demonstrated as having good internal validity and test-retest reliability (Wardle et al., 2001). For the current sample, Cronbach's alphas were good, ranging from .76 to .89.

4.2.4 Intervention

Parent-child dyads all took part in a parent led, home-based 14 day intervention designed to increase children's consumption of a disliked vegetable. Each dyad was assigned to one of four experimental groups: Repeated exposure (condition 1); Modelling and Repeated exposure (condition 2); Rewards and Repeated exposure (condition 3); or Modelling, rewards and repeated exposure (condition 4). For a full description of the intervention protocol, refer to Chapter 3 (see section 3.2.2.7). Parents were also asked to complete a daily tasting diary, recording whether offerings were performed in line with the instructions and whether these offerings resulted in tastings.

4.2.5 Post-intervention

After the 14 day intervention period, parent-child dyads attended a follow-up session. This session was identical in format to the baseline session, in order to allow comparison of liking and consumption of the targeted vegetables pre and post-intervention. Parent and child height and weight were also measured (using Salter 9059 SS3R ultra-slim scales/Stanley tylon pocket tape measure), and parents returned their completed tasting diaries.

4.2.6 Measuring consumption of the disliked vegetable

Both pre (baseline) and post intervention, each child was provided with a weighed and chopped 30g portion of their disliked target vegetable. Each child was asked to try a piece of the vegetable, and told they could eat as much as they liked during a five minute free eating session. The portion was removed and re-weighed to measure consumption once five minutes had passed or the child had terminated the session.

4.2.7 Outcome variables

The main outcome measures for the study were post-intervention consumption of the disliked vegetable (measured after the 14-day intervention period) and consumption change across the study. Consumption change was calculated by subtracting pre-intervention consumption from post-intervention consumption, allowing for comparison regardless of baseline consumption. Positive change scores represented an increase in consumption across the study, while negative scores indicated a decrease in consumption. Finally, the total number of tastings of the disliked vegetable which each child made across the intervention was also calculated.

4.2.8 Data analysis

A series of Kolmogorov-Smirnov tests indicated that the majority of the study's variables were not normally distributed therefore non-parametric tests were used, where possible, to test the study's hypotheses. Preliminary one-tailed Spearman's correlations were run between parent and child age and BMI/BMIz with the study variables. Child age was significantly correlated with teaching about nutrition ($r=.27$, $p=.003$) and child BMI z was significantly related to child enjoyment of food ($r=.32$, $p=.002$). Analyses involving the teaching about nutrition and enjoyment of food subscales controlled for child age and BMIz, respectively. Parent age and BMI were not significantly related to any of the feeding practices.

One-tailed Spearman's correlations (or partial correlations, where appropriate) were used to investigate associations between child temperament, eating behaviours and parental feeding practices with pre-intervention consumption, post-intervention consumption, consumption change, and the total number of tastings children achieved across the intervention period. Significant correlates of each of these outcome measures were then combined and entered into a forced entry, one-tailed logistic regression model to assess which factors could best predict success of the interventions.

Due to the large number of correlations conducted and the associated risk of type 1 errors, a more stringent significance level of $p < .01$ was used for the correlations. Significance was set at $p < .05$ for the regression analyses.

4.3 Results

4.3.1 Descriptive statistics

Descriptive statistics for all measures are displayed in Table 4.1. The study sample's mean scores for the CEBQ, CFPQ and EAS subscales are similar to other means from similar samples (e.g., Ashcroft et al., 2008; Haycraft et al., 2011; Musher-Eizenman & Holub, 2007; Pliner & Loewen, 1997; Powell et al., 2011). On average, consumption of the disliked vegetable increased markedly across the intervention period, with post-intervention consumption more than eight times greater than pre-intervention consumption.

Table 4.1: Mean and standard deviation (SD) scores for parent feeding practices, child temperament, child eating behaviours and measures of vegetable consumption

Measure	Mean (SD)
Parental feeding practices	
Pressure to eat	3.32 (0.82)
Modelling	4.11 (0.75)
Environment	3.67 (0.68)
Encourage balance and variety	4.33 (0.49)
Involvement	3.43 (0.87)
Teaching about nutrition	3.63 (0.83)
Child temperament	
Sociability	3.55 (0.67)
Emotionality	2.76 (1.03)
Child eating behaviours	
Food responsiveness	2.53 (0.73)
Enjoyment of food	3.64 (0.72)
Satiety responsiveness	3.05 (0.60)
Food fussiness	3.00 (0.75)
Pre-intervention consumption^a	0.43 (0.84)
Post-intervention consumption^a	3.78 (6.57)
Consumption change^a	3.36 (6.43)
Total tastings	8.24 (4.97)

^a Grams of vegetable eaten

4.3.2 Relationships between parents' feeding practices, child temperament and eating behaviours with measures of consumption

One-tailed correlations were run to assess whether there were any significant associations between parents' feeding practices, child temperament or eating behaviours with pre-intervention consumption of a disliked vegetable, post-intervention consumption of a disliked vegetable, consumption change and the total number of tastings achieved. Child food fussiness was significantly correlated with lower pre and post-intervention consumption of a disliked vegetable. Greater child sociability was significantly correlated with greater post-intervention consumption of a disliked vegetable and greater consumption change scores. There were no other significant relationships (see Table 4.2).

Table 4.2: One-tailed Spearman's correlations between parent and child factors with consumption scores and total tastings (N=90).

	Pre-consumption		Post-consumption		Consumption change		Total tastings†	
	R _s	p	R _s	p	R _s	p	R _s	p
Measure								
Parental feeding practices								
Encourage balance and variety	.16	.07	.12	.12	.10	.17	.14	.10
Environment	.02	.42	.20	.03	.17	.06	-.00	.50
Modelling	.05	.34	.15	.08	.11	.16	.19	.05
Pressure to eat	-.01	.47	-.04	.35	-.02	.44	-.09	.21
Teaching about nutrition ^a	-.06	.30	-.10	.18	-.10	.19	-.15	.08
Involvement	.06	.29	.02	.45	.01	.47	.08	.23
Child temperament								
Emotionality	-.05	.34	-.04	.36	-.08	.46	-.03	.39
Sociability	.01	.45	.23	.01	.28	.01	.13	.11
Child eating behaviours								
Food responsiveness	.03	.39	.05	.32	.02	.44	-.07	.27
Enjoyment of food ^b	-.07	.29	-.07	.27	-.07	.29	-.12	.16
Satiety responsiveness	-.05	.31	-.13	.12	-.07	.26	-.08	.23
Food fussiness	-.25	.01	-.31	.00	-.20	.03	-.17	.06
Child age (months)	.05	.31	-.07	.26	-.12	.13	.11	.16
Child BMIz⁺	.12	.14	.12	.15	.12	.15	-.17	.07

^apartial correlation controlling for child age^bpartial correlation controlling for child BMI z-score

Significant correlations are presented in bold

4.3.3 Predictors of the success of the interventions

In order to identify intervention 'success', the consumption change data were split to form two groups: those for whom the interventions were successful (as categorised by showing any increase in grams of vegetable consumed between pre and post-intervention), and those for whom the interventions were not successful (categorised by no change or a decrease in consumption). Descriptive statistics for these two groups are displayed in Table 4.3. Mann-Whitney U analysis revealed that consumption change was significantly different between these two groups ($U=0.00$, $z=-8.42$, $p<.001$).

Table 4.3: Descriptive statistics for change in vegetable consumption for children for whom the interventions were successful or not

	N	Median (g)	Mean (g)	SE mean	Range
Successful	44	4.60	7.00	1.31	0.10 to 29.80
Not successful	46	0.00	-0.30	0.11	-3.60 to 00.00

g = grams

These two new groups were then used to explore whether intervention success can be predicted by food fussiness and sociability (the only two significant correlates). A one-tailed logistic regression was performed, using the enter method. The model was a significant fit for the data ($\chi^2(2)=6.56$, $p=.02$) and was able to correctly predict success of the intervention in 61% of cases. Sociability, but not food fussiness, was a significant individual predictor of success (Table 4.4).

Table 4.4: Coefficients for the logistic regression model predicting success of the interventions from children's sociability and food fussiness (N=90)

	<i>b</i>	SE B	<i>p</i>	95% CI for Odds Ratio		
				Lower	Odds	Upper
Sociability	0.71	0.36	.03	1.00	2.03	4.11
Food fussiness	-0.35	0.30	.12	0.39	0.70	1.27

4.4 Discussion

This study set out to examine whether individual differences in caregivers' feeding practices or children's characteristics are associated with the children's acceptance of a disliked vegetable after a home-based, parent led, repeated exposure intervention. The ability of these variables to predict the success of this intervention was then tested. It was hypothesised that this repeated exposure based intervention would result in greatest acceptance for children who display higher levels of food approach behaviours and for children whose parents use more health-promoting feeding practices. It was further hypothesised that this repeated exposure based intervention would result in least acceptance among children who are more food avoidant, are higher in emotionality, lower in sociability, and whose parents use more pressure to eat. These hypotheses were only partially supported. While there were no significant correlations between feeding practices and the outcome of the repeated exposure intervention, children's sociability and food fussiness were significantly correlated with the outcomes of this intervention, and in combination were able to predict their success.

Contrary to the hypotheses, no significant correlations were found between food approach behaviours or feeding practices and children's consumption of the target vegetable in the interventions. This was an exploratory study, as there is currently very

limited research investigating the impact of these factors on intervention outcomes. One previous study has found that children's enjoyment of food can predict consumption change across an intervention (Caton et al., 2014). However, it should be noted that Caton et al.'s study was with a large sample of children ($N = 332$), who were younger ($M = 18.9$ months) than those in this study, and that the intervention groups involved repeated exposure with either flavour-flavour or flavour-nutrient learning, rather than modelling and rewards. There are several possible explanations for the low number of significant correlations in the current study. First, it is possible that child eating behaviours and maternal feeding practices were not relevant within the context of this study. For example, in the case of food (and indeed satiety) responsiveness, parents were asked to offer their child the target vegetable at their usual snack time, or before a meal. This should have ensured that children in the study were hungry when offerings occurred, minimising the effect of individual differences in food/satiety responsiveness. Second, the variance within the data set was relatively low, with standard deviations of means ranging from 0.49 to 0.83. Without adequate variance within scores, correlations are less likely to emerge. This low variance could have been created by a number of causes. It could be that as the data on these factors were self-reported, parents were influenced in their responses by social desirability. It is also possible that the parents who volunteered to take part in this study were particularly motivated to participate in this intervention. This may have meant that they altered their usual feeding practices to fit with the study protocol, or that parents who already used particular feeding practices were more likely to take part in the study. It may have been possible to detect more relationships between feeding practices, eating behaviours, and study consumption and success if the different intervention groups' data had been analysed separately. These intervention groups had different methods of offering and encouraging tasting (i.e. modelling and rewards), and these may have interacted differently with particular parent or child characteristics. However, given the sample size for this study, this was not possible.

Partial support for the study's hypotheses was found as sociability was significantly associated with post intervention vegetable consumption as well as with increased intake across the interventions. Sociability was also able to predict the success of the interventions. As predicted, this parent led repeated exposure intervention appear to be more successful for children who are more sociable. This is in line with Social Learning Theory (Bandura, 1977), where it is stated that learning takes place within a social context. The capacity of children who are low in sociability to learn through others may be diminished, while children who are more sociable may be more open to the

influence of factors such as parental modelling, or rewards (particularly praise). Previous research supports this notion, where children who are shy or less sociable have shown lower initial acceptance of novel foods (Moding et al., 2014), and a higher prevalence of feeding difficulties has been found in unsociable children (e.g., Hagekull, Bohlin, & Rydell, 1997; Pliner & Loewen, 1997). Moreover, although sociability was not significantly correlated with the number of tastings children made across the intervention, it may be that the nature of the tastings was different for children who were more sociable. Parents were told that a range of behaviours from licking and sucking to biting or eating qualified as tasting the vegetable. Therefore, it is possible that more sociable children were more motivated to suck or eat the piece of vegetable so as to please their parent, and that these types of tastings may be better for increasing acceptance of the target vegetable than a brief lick or bite of the piece.

Food fussiness was found to be significantly negatively correlated with consumption of the disliked vegetable, both pre and post intervention, which supported predictions. These findings help to validate this subscale as a measure of food fussiness, which represents how selective children are about the range of foods they eat (Wardle et al., 2001). This is in line with previous research which found a negative association between food fussiness and child weight (Viana et al., 2008; Webber et al., 2009), as well as research suggesting that picky/fussy eaters consume fewer vegetables (Galloway et al., 2005). Moreover, research by Caton et al. (2014) has suggested that children who are fussier are more likely to consume a very small amount or none of a target vegetable during interventions. In the current study, food fussiness was correlated with pre intervention consumption as well as post intervention consumption, but was not correlated with consumption change. This suggests that rather than food fussiness having a particular influence on the outcome of repeated exposure interventions, food fussiness may have a pervasive effect on consumption of vegetables in general. This notion is further corroborated by the regression analyses, where although food fussiness and sociability formed a model which could significantly predict success of the intervention, only sociability was a significant predictor of success when used alone. It is also possible that children's sociability and how fussy they are with food have interactive effects on intervention success. For example, it is possible that whilst food fussiness has an effect on children's consumption of vegetables, the potential effect that fussiness could have on intervention outcomes is attenuated by their level of sociability. Here, it may be that fussy children who are highly sociable overcome their fussiness in order to gain the social interaction involved in tastings in the reward and modelling aspects of these interventions.

Contrary to the hypotheses, children's emotionality and parental use of pressure to eat were not significantly correlated with post intervention consumption of the disliked vegetable or consumption change across the intervention period. Although previous research suggests that use of pressure to eat results in lower consumption of the pressured foods (Galloway et al., 2005), it is not clear whether parents who would ordinarily use pressure to eat did so during the course of the intervention. It is possible that parents in fact adhered to the study protocol, and as such would not have used controlling feeding practices to encourage consumption during the study.

It is noteworthy that the number of tastings children made across the intervention period was not significantly correlated with feeding practices, eating behaviours or child temperament. Tasting information was reported by parents and so it is possible that they did not always report their child's tastings accurately and might have reported more tastings than actually occurred due to demand characteristics. It is also possible that parent and child individual characteristics are related to the *quality* rather than the *number* of tastings children make. Information was not gathered about the nature of tastings, just whether or not the vegetable came into contact with the child's mouth. It is plausible that tastings which involve longer contact with the taste buds may have more of an impact on child's post-intervention consumption, and this is something which future research may benefit from considering in more detail.

This study has a number of strengths and limitations. First, as there are very few previous studies into the effect of individual differences on intervention outcomes, the current study is novel and adds to previous literature by helping to guide potential tailoring of future interventions. However, the fact that the intervention groups were combined for the analyses might have made it difficult to detect correlations between individual differences and intervention outcomes, where these varied between the intervention groups. To better assess this, future research with similar interventions should employ larger samples, to allow for the impact of parent and child differences to be assessed separately for each intervention condition. The current study found no relationships between parent or child factors and the number of tastings children made during the intervention. Future research could gather data on the quality of tastings during these interventions which would allow assessment of whether parent and child factors alter the quality of tastings, rather than the number of tastings. The measures of child eating behaviours, parent feeding practices and temperament were all self-report measures. As such, there may have been a degree of inaccuracy in parents' reports,

which may also explain the lack of significant findings in this study. The sample employed was also not particularly diverse; despite attempts to recruit a less homogenous sample (by recruiting from Sure Start toddler groups as well as community groups), the majority of this sample were white and middle class. The applicability of these findings to other samples must therefore be considered.

The study's findings indicate that this parent led, home-based, repeated exposure intervention is more successful with sociable children, and that other types of interventions might need to be tailored to children with different temperamental predispositions. Furthermore, these results suggest that food fussiness may have a prevailing effect on eating behaviour and vegetable consumption, rather than specifically altering the outcome of interventions such as these. This suggests that in order for vegetable consumption to be increased in individuals with food fussiness, interventions may be better targeted at reducing food fussiness than specifically increasing consumption of vegetables.

Chapter 5

Chapter 3 investigated the efficacy of parent led home-based interventions aimed at increasing children's acceptance of a disliked vegetable. It was found that a fourteen-day intervention comprised of daily offerings of a target vegetable using rewards to incentivise tasting paired with repeated exposure (with or without the inclusion of parental modelling) can successfully increase children's liking and acceptance of a previously disliked vegetable. Chapter 5 sought to extend these findings by investigating the longitudinal efficacy of home-based parent led interventions for achieving sustained increases in liking and consumption of a previously disliked target vegetable. Children's liking and consumption of the target vegetable was reassessed at two, six and 12 months post intervention.

Chapter 5: Exploring the longitudinal efficacy of home-based parent led interventions aimed at increasing children's liking and consumption of a disliked vegetable

Exploring the longitudinal efficacy of home-based parent led interventions aimed at increasing children's liking and consumption of a disliked vegetable

5.1 Introduction

With it known that a diet high in vegetables can prevent many non-communicable diseases (Heidemann et al., 2008; Maynard et al., 2003; Vioque et al., 2008), interventions which aim to increase vegetable consumption are high on the public health agenda. To be of maximum benefit across the lifespan of individuals, interventions should target young children and consequent increases in consumption of vegetables need to be sustained across time. Therefore, the longitudinal efficacy of interventions is of the utmost importance.

A number of successful school-based interventions have been designed to increase children's consumption of vegetables (e.g., Cooke et al., 2011; Hendy, Williams, & Camise, 2005; Reynolds et al., 2000). The 'Food Dudes' is a well-known school-based intervention using repeated exposure with peer role models and rewards to encourage tasting and consumption of vegetables. Although the 'Food Dudes' has been hailed for increasing children's consumption in the short-term, it has not been as effective in the long-term. Upton, Upton, and Taylor (2013) measured parental provision and children's consumption of fruits and vegetables at lunchtime in six primary schools who had participated in the 'Food Dudes' programme at three and 12 months post-intervention. Although children's consumption of fruits and vegetables was significantly higher than that of the control group at three months post-intervention, this was only amongst those children who ate lunches provided by schools. At 12 months post-intervention, lunchtime consumption was no higher amongst the intervention group than the control group.

The long-term efficacy of other school-based interventions involving repeated exposure and rewards has also been explored. Hendy et al.'s (2005) 'Kids Choice' programme used a token rewards system, food choice, and peer participation to encourage children to consume vegetables. Children's consumption of vegetables significantly increased across the intervention period, with children's preferences for vegetables significantly higher two weeks' post-intervention than at baseline. However, when reassessed seven months post-intervention, preferences for vegetables had returned to baseline levels. Cooke et al. (2011) also found support for the inclusion of rewards in interventions for increasing children's consumption of vegetables. In this study, 4 to 6 year-old school children were assigned to 12 daily taste exposures to a disliked

vegetable. The vegetable was offered alone or paired with social or tangible rewards and a control group was also recruited. Children in both reward groups showed significant increases in consumption of the disliked vegetable when compared to the control group, both post-intervention and at three month follow-up. Although the repeated exposure group's consumption significantly increased over the intervention period, this finding was no longer significant three months post-intervention. All three experimental groups showed sustained increases in liking of the target vegetable across the intervention and at the three month follow-up. This suggests that while tangible and social rewards might be useful for increasing children's liking and consumption of a disliked vegetable for a period of three months or more, increases in consumption resulting just from repeated exposure do not persist.

An alternative to school-based interventions aimed at increasing children's consumption of vegetables are home-based parent led interventions. These can include similar components to their school-based counterparts (e.g. modelling and rewards) but may be more economical to develop and implement. One such intervention was tested by Wardle et al. (2003) who compared the ability of daily taste exposures versus provision of nutritional information for increasing children's liking and consumption of a vegetable. Greater increases in both liking and consumption were seen in the repeated exposure group than either the information group or a control group, suggesting that parent administered taste exposures may be effective for increasing children's acceptance of vegetables. Another promising parent led intervention was developed by Remington, Añez, Croker, Wardle, and Cooke (2012). They found that 12 daily taste exposures administered by parents alongside tangible rewards (a sticker) significantly increased children's liking and consumption of a disliked vegetable. However, daily offerings paired with social rewards (praise) did not increase children's liking and consumption significantly more than a control group post-intervention. These findings suggest that tangible rewards may be more effective for increasing children's liking and consumption of a disliked vegetable than social rewards. Fildes, van Jaarsveld, Wardle, and Cooke (2013) investigated whether these significant increases could also be achieved if instructions for an intervention (comprising daily offering paired with tangible rewards) were mailed to parents, removing the need for direct contact with a researcher. They found that liking and intake of the target vegetable increased significantly more for children whose parents received the mailed intervention than for those in the control group, although it must be considered that liking and intake were reported by parents.

It is possible that interventions including a modelling element as well as rewards may be more effective at increasing children's liking and consumption of a disliked vegetable. A recent study compared the efficacy of home-based parent led exposure interventions which included elements of rewards, modelling or both alongside daily offerings (Holley, Haycraft, & Farrow, 2014; see Chapter 3). It was found that children who were exposed to 14 daily offerings of a disliked vegetable with rewards (stickers) for tasting, with or without parental modelling of tasting, showed significantly larger increases in liking and consumption than a control group. Together, this body of research (Fildes et al., 2013; Holley et al., 2014, Chapter 3; Remington et al., 2012; Wardle, Cooke, et al., 2003) suggests that home-based parent led interventions may be a viable cost-effective alternative to rather more expensive school-based alternatives.

Although the findings of studies investigating home-based parent led interventions seem promising, there is a lack of evidence on the longitudinal efficacy of these interventions. Whilst Remington et al. (2012) reported that significant increases in children's liking and consumption resulting from daily offerings paired with tangible rewards were maintained at three months post-intervention, other studies have failed to report longitudinal efficacy (e.g., Fildes et al., 2013; Wardle et al., 2003) and no home-based studies to date have reported on 12 month effects. With this in mind, the current study aimed to evaluate the success of a home-based parent led intervention comprised of repeated exposure, rewards and parental modelling. The ability of four conditions of this intervention to increase children's liking and consumption of a disliked vegetable was investigated at two, six and 12 months post-intervention. The four intervention conditions all involved repeated exposure, with one testing the effect of mere exposure (condition 1), one testing parental modelling paired with repeated exposure (condition 2), one testing rewards paired with repeated exposure (condition 3), and one combining all of these methods (modelling, rewards and repeated exposure; condition 4). A control condition (condition 5) was also implemented.

Taking the short-term findings of the intervention into consideration (Chapter 3), it was predicted that children who participated in the all methods condition (condition 4) and the rewards condition (condition 3) would show significantly larger increases in liking and consumption of the target vegetable than the control group (condition 5) at two, six and 12 months post-intervention. It was also predicted that there would be no significant differences in consumption between the modelling group (condition 2), the repeated exposure group (condition 1), and the control group (condition 5) at two, six or

12 months post-intervention. However, it was predicted that liking of the target vegetable would be intermediate in the modelling group (condition 2) and the repeated exposure group (condition 1) when compared to the control group (condition 5).

5.2 Method

5.2.1 Participants

One hundred and fifteen parent-child dyads who had previously taken part in a 14-day intervention study (see Chapter 3) were contacted for longitudinal follow-up sessions at two, six and 12 months post-intervention. Children were aged from 25 to 55 months ($M = 38$ months; $SD = 7.75$ months) at the baseline phase of the intervention. Further details about the participants are presented in Chapter 3 (section 3.2.1, Table 3.1 and Table 5.1).

5.2.2 Procedure

Loughborough University's Institutional Review Board gave full ethical clearance before commencement of the study. Parents gave informed consent to be contacted for longitudinal follow-ups when they were recruited to the intervention and were informed of their right to withdraw themselves and their child from the study at any time.

5.2.3 Recruitment

As outlined in Chapter 3, parents and their child were recruited from 20 toddler groups and childcare centres across the East Midlands of the UK following permission from centre managers and group leaders. Parents were approached and asked if they would like to take part in a home-based study which would investigate possible methods parents can use to encourage their child to eat vegetables.

5.2.4 Intervention groups and allocation

Parent-child dyads were systematically assigned to one of four conditions of a 14-day parent led home-based intervention aimed at increasing their child's consumption of a disliked vegetable or to a no-treatment control group. A systematic procedure was followed to identify a disliked vegetable for each child (for details about target vegetable assignment please see section 3.2.2.2). The four experimental conditions were: repeated exposure (1); modelling and repeated exposure (2); rewards and repeated exposure (3); or modelling, rewards and repeated exposure (4) and the fifth group was a control group (5). Parents in each of the four treatment groups were asked to offer their child a small, child-sized piece (~2.5g) of a target vegetable (which had been confirmed as disliked by their child) daily for 14 consecutive days, using the

particular methods of offering assigned to them (just offering, enthusiastically trying it in front of their child, offering a sticker for consumption, or a combination of these options). A 14 day period was chosen for the intervention to allow parents to complete 10 to 15 offerings, which, if they resulted in tastings, should be sufficient to transform children's acceptance of the disliked vegetable (Birch & Marlin, 1982; Sullivan & Birch, 1990). For full details of the four intervention groups and instructions given to parents see section 3.2.2.7.

5.2.5 Testing children's consumption and liking

Children's consumption and liking of the target vegetable was assessed pre and post-intervention (see Chapter 3), and at two, six and 12 months post-intervention during individual follow-up sessions at the toddler groups from which children were recruited or in participants' homes. These sessions were identical in format. This allowed direct comparison of consumption and liking of the target vegetable at each time point. All dyads were invited to take part in each session, regardless of whether or not they had missed a previous follow-up session. During each session, children were given a small pot containing a washed and chopped 30g portion of the target vegetable. Children were asked to remove the lid and try one small piece of the vegetable. Any children who were reluctant were coaxed by the researcher to first pick up a piece of the vegetable and, if possible, proceed to licking and tasting the piece. Whether each child tasted the vegetable (classified as any contact with the mouth) was recorded by the researcher.

After tasting or refusing the vegetable, each child was asked "Do you like [name of vegetable]?" and asked to rate how much they liked it using the three-point smiley faces rating scale (their comprehension of which had been confirmed). The smiley faces rating scale (Birch, 1980; Appendix O) is comprised of three stylised gender-neutral faces. One of these faces displays a broad smile to represent 'yummy, I like it!', one has a neutral expression to depict 'ok', and one with a downturned mouth to represent 'yucky, I don't like it!'. Once their liking had been assessed, each child was told they could eat as much of the 30g washed and chopped portion of the vegetable as they liked and they were left to eat as much as they liked unprompted. This free-eating session was stopped when the child left the table, stated that they didn't want any more, or when five minutes had passed. The remainder of the test portion was then weighed to measure how much of the vegetable had been consumed.

5.2.6 Parent and child height and weight

Parent and child height (cm) and weight (kg) were measured by the researcher at the post-intervention session (i.e. immediately after the intervention ended). From these data, parent BMI and child age and gender adjusted child BMI z scores (Cole et al., 1995; Freeman et al., 1995) were calculated.

5.2.7 Data analysis

Normality of the data was assessed using Kolmogorov-Smirnov tests alongside analysis of histograms, skewness and kurtosis. Consumption data at all three follow-up time points showed a strong floor effect, with a large number of participants consuming none of the target vegetable. Owing to this, non-parametric analyses were performed unless there was not a suitable non-parametric equivalent method (e.g. in the case of ANOVA). Repeated measures ANOVAs were conducted to assess whether there was a significant difference between groups on changes in consumption from pre-intervention to each follow-up point (two, six and 12 months post-intervention). Kruskal-Wallis analyses were used to assess whether there were differences between all groups' consumption at two, six and 12 months post-intervention. Mann-Whitney U tests were performed to compare each intervention group's consumption of the target vegetable to that of the control group at two, six and 12 months post-intervention, allowing assessment of each intervention condition in comparison to the control group. Lastly, between group differences in children's liking of the target vegetable were investigated using chi square analyses at each time point. To assess whether there was sufficient statistical power to detect the expected small effects found across the original intervention period (see Chapter 3), power analyses were conducted for each statistical test using GPower (version 3.1).

5.3 Results

5.3.1 Descriptives

At baseline, all groups were compared for differences in parent and child age and BMI, to rule out the contribution of any of these factors in any observed effects, or to allow them to be controlled for where necessary. There were no significant differences between groups on any of these factors and this information is displayed in Table 5.1.

Table 5.1: Mean (Standard Deviation) parent and child age and BMI at baseline, categorised by experimental group, and ANOVA tests of difference between conditions.

		Repeated Exposure (1)	Modelling Repeated Exposure (2)	+ Rewards + Repeated Exposure (3)	Modelling, Rewards + Repeated Exposure (4)	Control (5)	Group difference
Parent							
Parent	Age [Years]	34.15 (4.74)	35.97 (5.11)	35.93 (5.71)	36.49 (3.64)	32.81 (4.03)	$F = 2.15$, n.s.
Parent	BMI	25.5 (5.04)	26.03 (5.18)	25.43 (3.83)	25.59 (5.03)	22.72 (2.57)	$F = .58$, n.s.
Child							
Child	Age [Months]	38.24 (8.82)	39.68 (9.01)	40.20 (6.58)	38.09 (8.16)	34.17 (6.17)	$F = .14$, n.s.
Child	BMI Z score	0.29 (1.04)	0.27 (.77)	0.07 (.81)	0.19 (1.01)	0.50 (.58)	$F = .46$, n.s.

Note: Descriptive statistics are based on available data, with missing data in some cases.

5.3.2 Sample and attrition

A large proportion of the 115 parent-child dyads who took part in the intervention did not participate in the two, six and 12 month follow-ups. This resulted in a sample of 57, 47 and 41 dyads at each respective time point. The flow of participants through the study can be seen in Figure 5.1 and reasons for attrition are mentioned in the discussion.

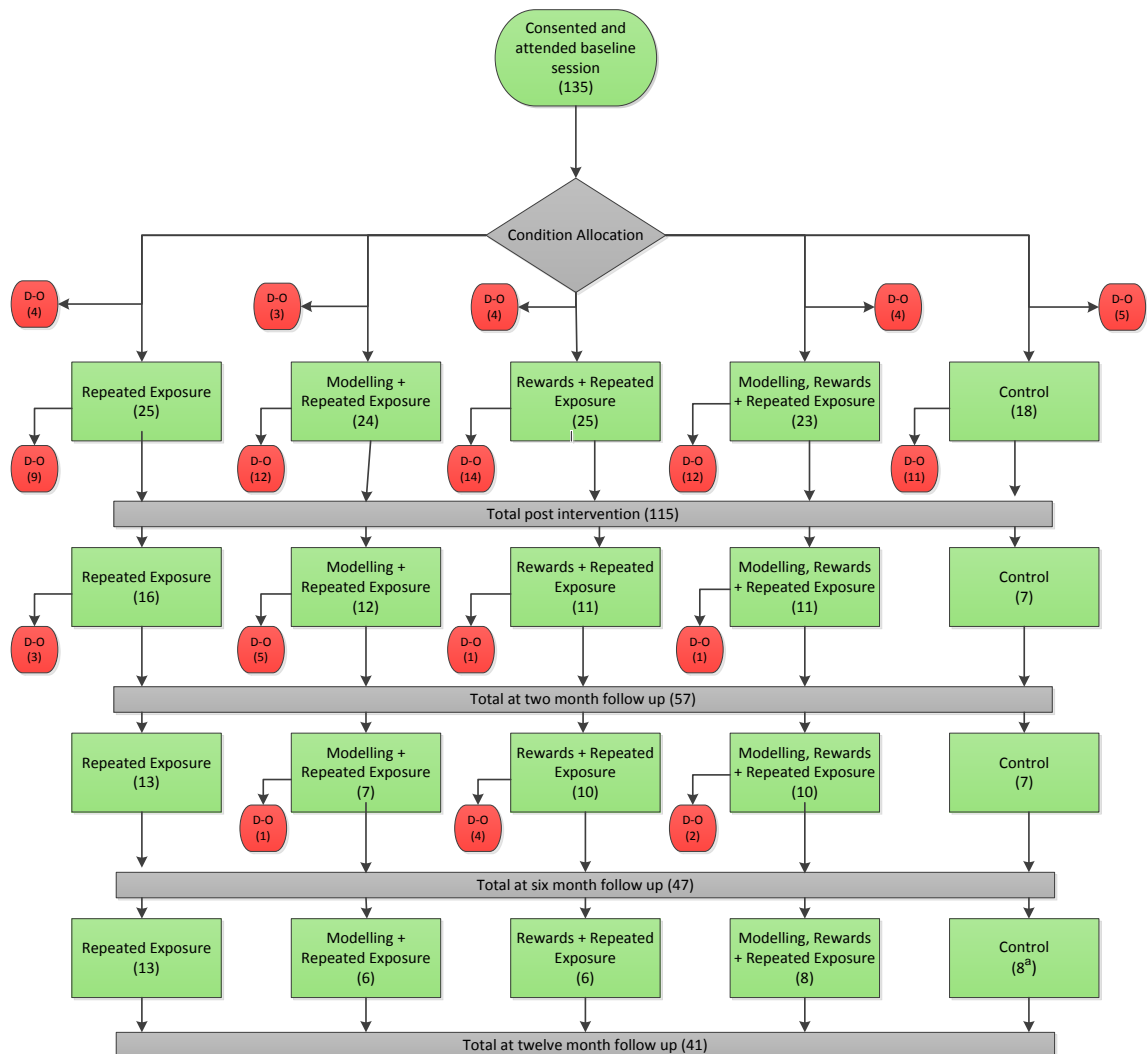


Figure 5.1: Flow of parent-child dyads for each of five experimental conditions across a 12 month follow-up after a vegetable intervention

5.3.3 Exploring longitudinal differences in children's consumption of a disliked vegetable between intervention and control groups

To explore the longitudinal effects of the intervention conditions on consumption, repeated measures ANOVAs were conducted. Follow-up consumption data per experimental group can be seen in Table 5.2. Repeated measures ANOVAs explored between group differences in consumption at two, six and 12 months post-intervention. Consumption of the target vegetable significantly increased from pre-intervention to two months post-intervention, as demonstrated by a main effect of time ($F(1,52)=22.95$, $p<.001$). However, there was not a significant group by time interaction ($F(4,52)=.78$, $p=.54$). Consumption of the disliked vegetable also significantly increased from baseline to six ($F(1,42)=28.63$, $p<.001$) and baseline to 12 months post-intervention ($F(1,36)=25.95$, $p<.001$), but again there was not a significant group by time interaction at either the six month ($F(4,42)=1.11$, $p=.36$) or 12 month ($F(4,36)=.60$, $p=.66$) time points.

Kruskal-Wallis analyses revealed that at two ($H(4)=2.23$, $p=.69$), six ($H(4)=4.31$, $p=.37$), and 12 months post-intervention ($H(4)=2.30$, $p=.68$) there were no significant differences in children's consumption of the vegetable between the groups. Mann-Whitney U tests revealed that no group's consumption was significantly different to that of the control group. However, at six months post-intervention, there was a trend ($p<.10$) suggesting that consumption for those in the modelling, rewards and repeated exposure group (Median=7.23, $U=21.00$, $z=-1.38$, $p=.09$, power=.02) and for those in the rewards group (Median=12.25, $U=19.00$, $z=-1.58$, $p=.06$, power=.02) was approaching being significantly higher than that of the control group (Median=2.25).

Table 5.2: Mean consumption of the disliked target vegetable (in grams; g) per condition at two, six and 12 months post-intervention, including minimum and maximum values

		Intervention Condition				
		Repeated Exposure	Modelling + Repeated Exposure	Rewards + Repeated Exposure	Modelling, Rewards + Repeated Exposure	Control
		(1)	(2)	(3)	(4)	(5)
2 Month	N	16	12	11	11	7
	Mean (g)	8.58	4.44	10.24	8	3.51
	(SD)	(11.65)	(8.54)	(12.48)	(8.93)	(4.06)
	Min/Max	0.00/30.00	0.00/30.00	0.00/30.00	0.00/28.00	0.00/10.5
6 Month	N	13	7	10	10	7
	Mean (g)	9.85	6.76	15.02	11.64	4.46
	(SD)	(12.69)	(11.22)	(2.8)	(11.53)	(6.28)
	Min/Max	0.00/30.00	0.00/30.00	0.00/30.00	0.00/30.00	0.00/17.55
12 Month	N	13	6	6	8	8
	Mean (g)	8.03	9.39	5.82	14.39	8.86
	(SD)	(9.87)	(11.83)	(6.48)	(13.33)	(11.65)
	Min/Max	0.00/30.00	0.00/30.00	0.00/14.50	0.00/30.00	0.00/30.00

5.3.4 Exploring longitudinal differences in children's liking of a previously disliked vegetable amongst the intervention and control conditions

A small number of children were unable to use the smiley faces rating scale during follow-up taste tests. These children were unable to correctly identify the “yummy” or “yucky” faces when requested and so were removed from the liking analyses. The number of children who could successfully use the smiley faces rating scale can be seen in Table 5.3, as well as the number of children who rated the target vegetable as “yucky”, “just ok” or “yummy” within each group at each follow-up point.

Chi-square analyses revealed that there were no significant differences in rated liking of the target vegetable between any of the groups at two ($\chi^2(8, N=48)=4.38, p=.85, \text{power}=.03$), six ($\chi^2(8, N=46)=8.06, p=.45, \text{power}=.03$), or 12 months ($\chi^2(8, N=40)=9.06, p=.33, \text{power}=.02$) post-intervention.

Table 5.3: The number of children rating the target vegetable as ‘yucky’, ‘just ok’ or ‘yummy’ per experimental condition at two, six and 12 months post-intervention.

		Intervention condition					Control
		Repeated Exposure	Modelling + Repeated Exposure	Rewards + Repeated Exposure	Modelling, Rewards + Repeated Exposure		
2 Month	N	15	9	9	9		6
	Yucky	8	4	2	2		2
	Yummy	1	1	1	2		1
	Just ok	6	4	6	5		3
6 Month	N	13	7	9	10		7
	Yucky	4	3	0	2		3
	Yummy	1	2	2	1		1
	Just ok	8	2	7	7		3
12 Month	N	13	6	6	8		7
	Yucky	3	3	3	0		4
	Yummy	1	0	0	1		0
	Just ok	9	3	3	7		3

5.4 Discussion

The aim of this study was to investigate the long-term efficacy of a home-based parent led repeated exposure, rewards and modelling intervention aimed at increasing children's liking and consumption of a disliked vegetable. It was hypothesised that in line with the short-term findings of these interventions reported in Chapter 3, children in the all methods group (4) and the rewards and repeated exposure group (3) would show significantly larger increases in liking and consumption of the target vegetable at two, six and 12 months post-intervention than the control group (5). It was also predicted that there would be no significant difference in consumption of the disliked vegetable between the modelling (2) and repeated exposure groups (1) and the control group (5) at any time point. Finally, it was hypothesised that the modelling (2) and repeated exposure (1) group's liking of the target vegetable would be intermediate to that of the other experimental groups and the control groups (5) at each time point. These hypotheses were largely unsupported.

In the current study, there were no significant differences in consumption of the target vegetable between children who had participated in any of the four conditions of the repeated exposure intervention and the control group at two, six or 12 months post-intervention. This is contrary to the findings of the original intervention study (Holley et al., 2014, see Chapter 3), where children in the modelling, rewards and repeated exposure group (4) and the rewards and repeated exposure condition (3) had significantly higher consumption of the target vegetable than the control group (5) immediately post-intervention. However, it should be noted that although there were no significant differences between groups' consumption, there was a trend towards higher consumption in the modelling, rewards and repeated exposure (4) and rewards and repeated exposure groups (3) when compared to the control group (5) at six months post-intervention, with group differences approaching significance. Power calculations determined that there was a lack of statistical power for these analyses due to participant attrition.

The current study also found no significant effect of repeated exposure based interventions on children's longitudinal liking of a previously disliked vegetable. Again, this is contrary to the effectiveness that was evident immediately post-intervention (Holley et al., 2014, see Chapter 3). Over 60% of children who participated in the modelling, rewards and repeated exposure group (4) and the rewards group (3) liked the target vegetable immediately post-intervention, while over 26% of children who participated in the modelling group (2) or a repeated exposure alone group (1), and

only 10% of children in the control group (5), liked the vegetable post-intervention. As with the consumption analyses, these tests lacked statistical power to detect the expected small effects which were detected immediately post-intervention.

The lack of statistical power found in this study was due to two main factors. Firstly, although the number of participants initially recruited into the study had allowed for 50% attrition, withdrawal across the study period was higher than anticipated. Several reasons for dyad attrition were identified, including parents not being contactable, illness, dyads moving out of the area, parents returning to work, children starting school, and parents feeling that they could not accommodate the follow-up session into their routine. It should be noted that these reasons were predominantly attributable to external pressures, rather than any burden of the study itself. Secondly, sample sizes for the original study were calculated on the basis of detecting a large effect, but the significant short-term effects of these interventions only represented small effects on children's liking and consumption of the target vegetables. It is possible that with a larger sample size or with lower participant attrition during follow-up test sessions, the significant group differences in consumption of the target vegetable found immediately after the 14 day intervention would have been maintained at six, or even 12 months post-intervention.

As well as issues with statistical power, a limitation of this study is that by the 12 month follow-up even children in the control condition (5) had received up to five exposures to the target vegetable. As such, by the end of the study the control children had also received a repeated exposure intervention, albeit one which was implemented by the experimenter rather than parent led in the home environment. This may explain why group differences in consumption and liking were not found, as many children in the control group (5) increased their liking and consumption by the 12 month follow-up. In this way, rather than non-significant findings between groups suggesting that there was no effect of the intervention on children's liking and consumption, these results are possibly more indicative of the efficacy of repeated exposure, which even the control group were subjected to, with over 87% of children in the control group trying the vegetable at 12 month follow-up. This is in line with a body of previous literature, asserting that repeated exposure is successful for transforming children's liking and consumption of a disliked vegetable (see Cooke, 2007, for a review). Furthermore, this possibly suggests that the previous threshold of 10 to 15 exposures being necessary for preschool children to acquire acceptance of a food (Birch & Marlin, 1982; Sullivan & Birch, 1990) may be a conservative estimate, where in fact a lower number of taste

exposures may be sufficient to increase liking and consumption in some children. It is also possible that children's higher age by the one year follow-up period aided their acceptance of the target vegetable, as it is known that neophobia peaks around two years of age and gradually decreases thereafter (Addessi, Galloway, Visalberghi, & Birch, 2005b).

Although this study has its limitations, it makes a valuable contribution to the field. While the sample of participants was greatly diminished over the longitudinal follow-ups, a large well powered sample of parent-child dyads was recruited and participated in the interventions. Furthermore, 36% of the original sample was retained until 12 months post-intervention, which required a large investment of time from the sole researcher. As previously mentioned, there is a lack of longitudinal data on the efficacy of interventions to increase children's acceptance of vegetables, particularly those implemented by parents. The only published data on the longitudinal efficacy of home-based interventions report data from just one time point three months post intervention, whereas this study reports longitudinal data from three time points post-intervention, giving a clear picture of any possible changes in effects over time. Another strength of this study is that it exclusively used objective measures from baseline to 12 month follow-up, whilst other studies have employed subjective measures of consumption and BMI (e.g. Fildes et al., 2013).

While the findings of this study are non-significant, they suggest that with a larger sample and a control group who are only exposed to the vegetable at 12 month follow-up, that the longitudinal effects of this interventions may be successful. In order to further explore this, larger scale studies should be conducted where the impact of high attrition rates can be minimised by recruiting enough participants to detect small effects on children's liking and consumption of target vegetables. Although not statistically significant, these findings could be clinically meaningful given the trends observed in the data and the fact that food preferences track throughout life (Mikkilä et al., 2007). While there is no existing research on the health implications of small increases in vegetable consumption, research from adult studies suggests that an increase of just half a portion of fruits and vegetables a day could reduce an individual's risk of ischaemic heart disease by 2% (Crowe & Roddam, 2011), stroke by 2.5% (Dauchet, Amouyel, & Dallongeville, 2005) and even increase life expectancy (Shaw, Horrace, & Vogel, 2005). Together, this research supports the notion that even small changes in consumption could have big health implications across the population, highlighting the necessity for further large scale studies in this area.

Part II: Investigating caregiver offering of vegetables

Chapter 6

Chapters 3, 4 and 5 investigated the efficacy of parent led home-based interventions for increasing children's acceptance of disliked vegetables. These chapters focused on the use of three parent behaviours for encouraging children's consumption of vegetables; modelling, non-food rewards, and repeated exposure. However, research suggests that caregivers also use other methods to encourage their children to eat vegetables. Furthermore, it is known that there are a number of influences on whether or not caregivers offer their children vegetables. Chapter 6 aimed to build on current research by investigating which methods caregivers use to offer vegetables to their children. It adopted a qualitative approach as previous research has been restricted by the use of questionnaire measures developed without the input of caregivers. The chapter also aimed to investigate caregivers' perceived influences on whether and how they offer their children vegetables.

Chapter 6: Investigating offering of vegetables by caregivers of preschool age children: A qualitative study

This chapter has been submitted for publication in *Child: Care, Health & Development* as:

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Although the content of Chapter 6 is largely the same as the version that is under review, the formatting and presentation have been altered to be consistent with the rest of this thesis.

Investigating offering of vegetables by caregivers of preschool age children: A qualitative study

6.1 Introduction

Vegetables are important for health (e.g., Maynard, Gunnell, Emmett, Frankel, & Davey Smith, 2003) but are under eaten by children (Lennox et al., 2011). Preschool children are particularly poor consumers of vegetables, with research suggesting 1.5 to 3 year-olds in the UK consume an average of 72g of vegetables a day (Lennox et al., 2011). The Children's Food Trust (2015) recommends that primary school children consume 200g of fruit and vegetables a day. Although there are no fixed guidelines on appropriate consumption for preschool children, current consumption figures are certainly not approaching healthy recommendations. Furthermore, it is known that simply providing foods for children does not guarantee that they will be eaten. As such, investigating the methods caregivers use to offer vegetables to their children and the factors that can influence the success of caregiver offering is imperative in order to tailor advice on achieving healthful diets in young children.

Previous quantitative research (e.g., Musher-Eizenman & Holub, 2007) has revealed that caregivers use a range of methods to encourage children's food consumption. Some feeding practices such as modelling and rewards have been shown to be successful for increasing children's consumption of vegetables (e.g., Holley, Haycraft, & Farrow, 2014, Chapter 3; Remington, Añez, Croker, Wardle, & Cooke, 2012; Wardle et al., 2003), while other feeding practices that are more controlling seem to be counterproductive. For example, parental use of pressure to eat has been shown to reduce children's intake of pressured foods (e.g., Galloway, Fiorito, Lee, & Birch, 2005; Galloway, Fiorito, Francis, & Birch, 2006) and is associated with greater food fussiness (Farrow, Galloway, & Fraser, 2009), while restriction of foods often results in children subsequently consuming more of the restricted foods (e.g., Birch & Fisher, 1998), particularly under conditions of emotional stress (Farrow, Haycraft, & Blissett, 2015). Research using measures such as the Comprehensive Feeding Practices Questionnaire (CFPQ; Musher-Eizenman & Holub, 2007) provides invaluable information on the range of feeding practices used by caregivers. However, such measures have generally been developed by researchers and clinicians, with little or no input from caregivers. Furthermore, the nature of such questionnaire research prevents the identification of other practices, that aren't assessed in these measures but that are potentially used by caregivers. For these reasons, qualitative research

involving caregivers to explore the practices which they use to feed children is of interest.

Researchers have begun to use qualitative methods to examine a wider variety of the methods caregivers use to get their children to eat. This has included exploring the use of parental mealtime practices to encourage children's eating (Koivisto & Sjöden, 1996), parental strategies for managing their children's intake of snack foods (Corsini, Wilson, Kettler, & Danthiir, 2010) and feeding practices used to influence children's food likes and dislikes (Casey & Rozin, 1989; Russell, Worsley, & Campbell, 2015). Moore, Tapper and Murphy (2007) used semi-structured interviews to assess the strategies that mothers of 3 to 5 year-old children use in order to encourage their children when they were reluctant to eat familiar foods, as well as when they were presented with novel foods. Mothers reported using modelling to encourage consumption of familiar foods and introduce novel foods. Mothers also reported using pressure in the form of assertiveness and contingent rewards (such as dessert or television watching) to encourage consumption, but not to introduce novel foods. Russell et al. (2015) conducted a similar study, this time investigating the strategies parents of 2 to 5 year-old children use to alter their children's food preferences. They found that parents reported using a diverse range of behaviours, which differed in their effectiveness, such as coercion which was generally thought of as unsuccessful. Although potentially applicable to vegetable consumption, parents were not specifically interviewed on the strategies they employ in relation to encouraging consumption of vegetables. Given that a diet rich in vegetables has significant health benefits (e.g., Freedman, Dietz, Srinivasan, & Berenson, 1999; Vecchia, Decarli, & Pagano, 1998) and that eating habits established early in childhood track through childhood and into adulthood (e.g., Farrow & Blissett, 2012; Mikkilä, Räsänen, Raitakari, Pietinen, & Viikari, 2007), increasing our understanding of how to best promote offerings of vegetables early in childhood is a logical step to improve future health. By increasing consumption of vegetables amongst this age group, life-long benefits of a healthful diet including vegetables can be maximised.

Previous research in this field has been conducted with older children by Kirby, Baranowski, Reynolds, Taylor, and Binkley (1995). This focus group study investigated environmental and behavioural characteristics which influence the fruit and vegetable consumption of 9-11 year-old children, their parents and teachers, and how these factors change according to socio-economic status (SES). In contrast to higher SES families, families in the lower SES groups had very few fresh fruits and vegetables

available in the home, with these parents rarely providing their children with fruits and vegetables in their pre-cut form. Children across all SES groups reported thinking of vegetables as “grown-up” foods, which taste “nasty”. Although of interest, the findings of this research are not necessarily transferable to caregivers of younger children, who are likely to be less autonomous and whose caregivers have a much greater impact on their eating behaviour at this age (Birch, Savage, & Ventura, 2007). Furthermore, this research does not delineate between fruits and vegetables, for which there may be distinct influences on consumption, where fruits are often sweeter and more palatable to children than vegetables. Here, detailed further examination of the methods caregivers of preschool age children use specifically in relation to their child's vegetable consumption is warranted.

To be useful, advice given to caregivers on increasing vegetable consumption must reflect the current feeding practices that are used by the general population, or address recommendations that are not widely used currently. With this in mind, the current study aims were to build on previous research by using a qualitative approach to investigate the particular methods caregivers use to present their preschool children with vegetables, as well as the perceived effectiveness of these methods. The study also aimed to explore caregivers' perceived barriers to offering their child vegetables.

6.2 Method

6.2.1 Participants

Seventeen primary caregivers with a preschool age child participated in the study, none of whom had children which had been hospitalised for feeding problems, of which two were fathers, 14 were mothers and one was a grandmother. Mean child age was 34.9 months (SD 12.23, range 21 to 59) and mean caregiver age was 37.5 years (SD 5.81, range 24 to 51). Caregivers were predominantly of White/Caucasian ethnicity (n=14), with two caregivers identifying as mixed race and one as of Chinese ethnicity. Half of the caregivers in this study were educated to university level or higher (n=9) while the other half were non-university graduates (n=8).

6.2.2 Procedure

Full ethical clearance for this study was obtained from Loughborough University's Institutional Review Board.

6.2.3 Recruitment

Participants were recruited using posters which were placed at toddler groups in Leicestershire as well as on online University noticeboards and in University staff common areas (Appendix B). The study was also advertised in two local Leicestershire newspapers; the Leicester Mercury and Loughborough Echo.

6.2.4 Focus groups

Written informed consent was obtained from all participants before the onset of the study, with participants fully advised of their right to withdraw at any point. Families were recruited from the East Midlands area of the UK and the focus groups were conducted at Loughborough University. Focus groups were run until data saturation was reached (i.e. until no new material was being generated). Five focus groups were conducted. Although these groups comprised a small number of caregivers, all group members were active participants and discussion flowed freely throughout each of the sessions. Three of the groups comprised caregivers recruited using a poster with the tagline 'Do you have a child aged 2-4?' with the description 'we'd love to hear about your experiences of getting your child to eat fruits and vegetables, both good and bad', while two further groups comprised caregivers recruited via a poster with the tag line 'Do you have a 2-4 year-old who doesn't like vegetables?' and the description 'We'd love to hear about your experiences of trying to get your child to eat vegetables'. This second set of focus groups was run to ensure that the methods of offering vegetables used by caregivers of a child who refuses/avoids eating vegetables were adequately covered as recent government statistics suggests that children's consumption of vegetables is half that of fruit (Public Health England & Food Standards Agency, 2014).

All focus groups were facilitated by one moderator (CH) and the sessions were digitally recorded. The moderator used a set of open ended and closed questions written by the research team, which were derived from a thorough review of the relevant literature. These questions aimed to address two main research questions: (1) What methods do caregivers use to encourage their children to eat vegetables?; (2) What factors influence how and whether caregivers present vegetables to their child? Each of these research questions was addressed with a number of questions within the focus groups (see Table 6.1). After the full set of questions had been covered, caregivers were asked to complete a short demographic questionnaire, including questions about parent and child age, ethnicity, and whether the child had been hospitalised for feeding problems.

Table 6. 1: List of main questions (and research questions) answered within the focus groups

<i>What methods do caregivers use to encourage their children to eat vegetables?</i>
Do you give your child vegetables – either within meals or as a snack?
How do you go about this?
Do you offer the same vegetable another time/again if it is rejected?
If your child rejects a vegetable, what do you do next time?
If you are offering a vegetable again, after it has been rejected, does the way you offer the vegetable change or stay the same?
Do you offer your child vegetables that you don't like yourself?
Do you think these methods that you use to encourage vegetable consumption work?
Which methods don't work?
<i>What factors influence how and whether caregivers offer vegetables?</i>
Are the methods you use to encourage your child to eat vegetables methods which you have planned to use?
Have the methods you use changed since you first became a parent?
(If yes) Why did the methods you use change?
What makes you choose a method?
What would stop you from (re)offering a vegetable?
When do you stop offering a vegetable?
Why do you stop offering a vegetable?
How long or how many times do you keep offering a rejected vegetable for?
If you have more than one child, do you use the same methods of offering with all of your children?
(if not) Why not?
Does/has the way your child reacts shape(d) the methods you use?

6.2.5 Analysis

All focus group recordings were transcribed verbatim by the researcher (CH). Although data collected covered fruit and vegetables, only responses relating to vegetable

consumption are analysed and reported on here, in line with the study aims. Transcribed data were initially analysed as two separate groups; group one comprised those caregivers recruited purely on the premise of talking about their experiences with their child and vegetables, and group two comprised the focus groups involving caregivers who were recruited on the basis of having a child who didn't like vegetables. Data were analysed using thematic analysis and following the steps outlined by Braun and Clarke (2006). Initially, after checking the transcripts against the original recordings, all transcripts were read and re-read to fully immerse the researcher (CH) in the data. During this phase, primary thoughts and concepts for later coding were noted. Once the researcher was fully familiar with the data, the process of coding themes and subthemes was undertaken. Initially, interesting features within the data were assigned codes which meaningfully described something of the subject. Next, the full list of codes for the transcripts was collated and sorted into groups representing potential themes. These groups of codes were then collated, through a recursive process of combining and separating groups. This resulted in an organised set of themes all of which were distinct from each other whilst sitting together in a meaningful way. Both inductive and deductive methods were adopted, allowing themes to be applied from the questions asked as well as new themes to be identified within the transcripts. Themes were assessed using a semantic approach, where themes are identified within the explicit meaning of the data, and not examining the latent underlying features of these themes, resulting in a rich description of the data set (Braun & Clarke, 2006). To facilitate reflection and reconciliation of the themes identified, discussion of the coded items was held within the research team. The other members of this team had not been involved in the focus groups, nor had they read the full transcripts of the groups. These discussions were used to qualify the trustworthiness of the analysis, in combination with a second researcher (CF) performing an analysis on 20% of the transcripts. This method of assessing trustworthiness of the analysis has been widely used and is acknowledged as appropriate for such a thematic analysis (Yardley, 2008).

6.3 Results

6.3.1 Descriptive statistics

A total of five focus groups were conducted, with a mean duration of 38:42 (minutes:seconds) (SD 13:09, range 20:10 to 53:18).

6.3.2 Thematic analysis

It was expected that the two different recruitment posters would result in recruiting two distinct groups of caregivers, for which two separate thematic analyses would be conducted allowing for examination of convergence and divergence. However, after analyses indicated a lack of divergence between the two groups of transcribed data and consulting with an experienced qualitative researcher, the two groups were collapsed and analyses are reported as one group. Thematic analysis revealed three main themes surrounding methods of offering vegetables to children, and four main themes around the influences on caregiver offering of vegetables. These are presented in Figure 6.1.

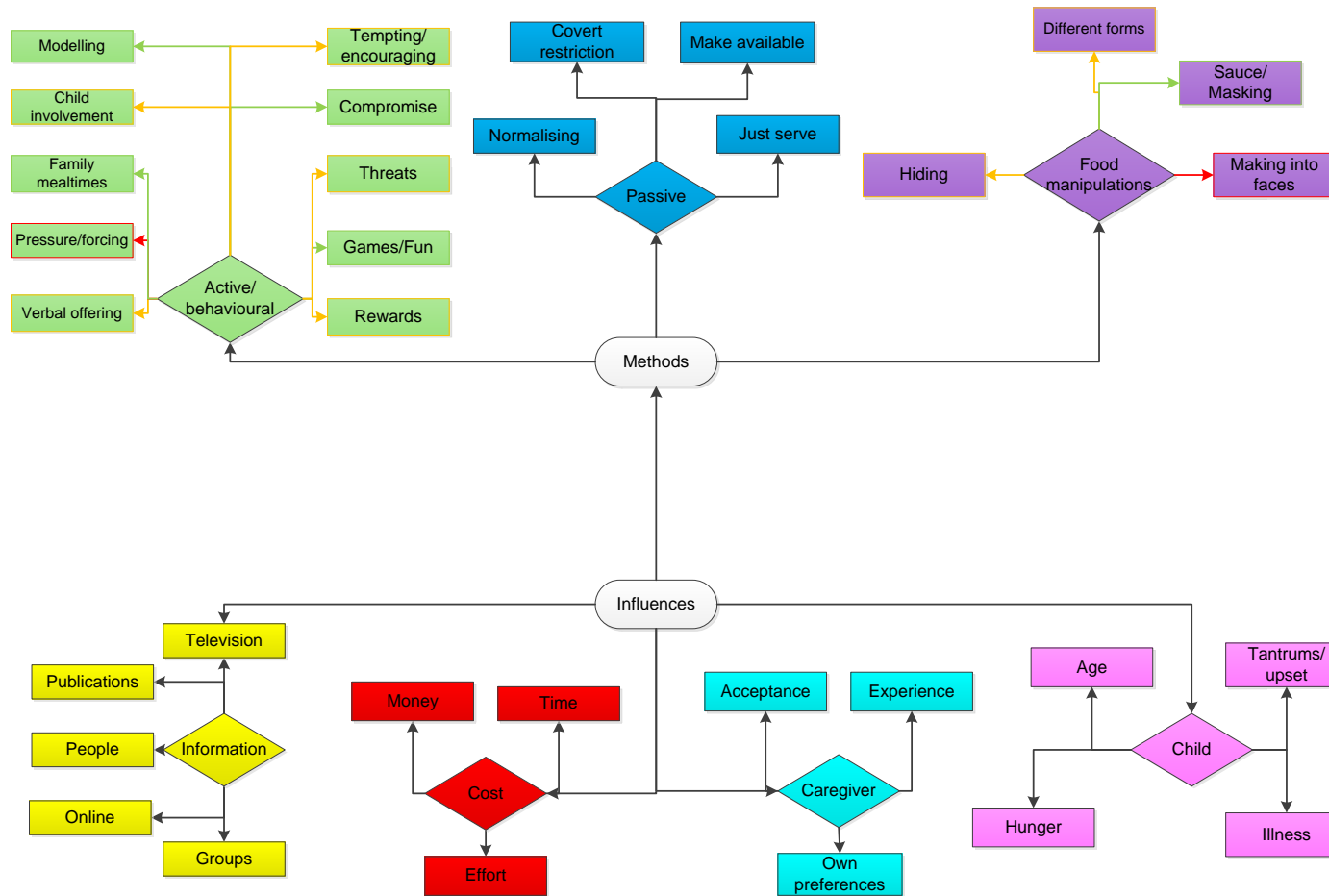


Figure 6.1: Map of themes surrounding parental methods of exposing their child to vegetables as well as the influences on exposure.

successful → sometimes successful → unsuccessful →

6.3.2.1 *Methods of presenting vegetables*

Three major themes reflecting ways of offering emerged from the focus groups, indicating that caregivers use three primary types of methods when presenting vegetables to their children; behavioural/active methods, passive methods, and food manipulations.

6.3.2.1.1 *Behavioural/active methods*

These were methods which relied on specific caregiver-child interactions or behaviours in relation to the caregivers' presentation of vegetables (see Figure 6.1). Caregivers reported several behavioural/active methods as being successful for getting their child to eat vegetables; the first of these was modelling. Examples of modelling ranged from caregivers eating in front of their children and putting vegetables on their own plates, to caregivers stating how yummy foods were while they ate, encouraging partners to eat vegetables in front of the child, as well as using the child's siblings as role models. The second successful behavioural or active method was using games or fun to encourage children to eat vegetables. For example *"at tea time he's just got into, probably in the last 2 months is having a race with his Daddy, or all three of us."* Caregivers also reported successfully using family mealtimes to encourage their child to eat vegetables, which likely represents another method of modelling. For example, *"I find if we eat as a family it is better, because if I'm doing something and give [child] something to eat she sort of, you know, wonders what I'm doing or will mess about"*. Finally, caregivers reported that using compromise within the meal setting was successful for getting their child to eat vegetables. Typically this was including additional requested items or compromising on the order in which courses of a meal were eaten.

A number of behavioural/active methods were reported by some caregivers as being successful and by others as not, or as working on some occasions but not others. One of these methods was verbal offering of vegetables to their child *"do you want to try one of these peas?"*. Some caregivers also acknowledged trying to tempt or encourage their child to try and eat vegetables. Caregivers identified sometimes taking this one step further, by offering their child rewards for eating vegetables, for example *"you can have some pudding if you finish off your X, Y or Z"*. Rewards took several forms, such as play time, sticker charts or dessert. Child involvement was used by some caregivers, for example *"We've been growing our own vegetables as well which has helped. Sort of help pick the veg and then help prepare it"*. Caregivers reported involving their children in several ways including children choosing vegetables in the supermarket or

choosing what is served at mealtimes, to growing them at home, as well as helping to prepare and cook them. Some caregivers reported using pressure or coercion in an attempt to get their child to eat vegetables, but all of these parents agreed that this method does not work. For example, *“I’ve tried ‘sit there ‘til you’ve finished’ and he can sit there for 3 hours and not eat it, so I don’t do that”*. Finally, some caregivers reported using threats such as not being able to have dessert or having to go to bed if their child didn’t eat their vegetables.

6.3.2.1.2 *Passive methods*

Caregivers identified a number of passive methods of presenting their children with vegetables (see Figure 6.1). These included just serving vegetables so that they were put on the child’s plate without discussion, and normalising offering through this continued presentation: *“But I always make a point of putting it there, because I want it to...it’s got to be normal hasn’t it?”*. Caregivers also made vegetables available for their child to snack on, whilst removing alternative, more favoured food from the environment in order to encourage the child to eat vegetables as part of their meals: *“there’s times when he’s had some of these-is it Goodies? Those maize-type crispy things, and there’s not really anything to them. But if he has those, I’ve only ever let him have a couple like about a third or a half of a pack in a little bowl, but that will affect how much he eats and how fussy he is later on in the day”*.

6.3.2.1.3 *Food manipulations*

Caregivers reported manipulating vegetables in a variety of ways in order to get their child to eat them (see Figure 6.1). Several caregivers reported using sauces as well as masking vegetables with flavours to get their child to eat them and most caregivers agreed that this was a successful method. Caregivers also reported hiding vegetables within other foods: *“I put carrot in mashed potato and mash it up so it’s like mashed potato, and swede so that it’s the same consistency as potato”*, although they were less certain of whether this was a successful method. Caregivers also identified presenting the same vegetable in different forms over a period of time, but were also uncertain as to whether this was a consistently successful method, with some caregivers commenting that they will *“do it a different way if not roast it, or I’ll mash it or put it in a cottage pie topping or something. That always goes down well!”*. Finally, caregivers acknowledged making vegetables into faces, but all caregivers who reported trying this method agreed that it did not work to get their child to eat vegetables: *“faces don’t work,*

really. Like you say I do it for my entertainment I think 'ooh that'd make a brilliant eye!' (all laugh) I could lay it like this on the plate that looks amazing and it's like...no".

6.3.2.2 *Influences on how/when parents present vegetables*

Multiple influences on how and when caregivers present their children with vegetables emerged from the focus groups. These were broadly clustered around four main themes: information, cost, parent factors, and child factors.

6.3.2.2.1 *Information*

Caregivers talked about obtaining information on how to get their children to eat vegetables from a number of sources (see Figure 6.1). These sources included: books, television and online, support groups, people and social support (e.g., from family members or other parents). Caregivers also commented that the general provision of information for caregivers is poor and can be conflicting, for example *"I was at a bit of a loss because you don't get much advice from anywhere, I felt, from where I live".*

6.3.2.2.2 *Cost*

Cost was a recurring theme in the influences on caregiver offering of vegetables to their children (see Figure 6.1). This theme can be broken down into three types of cost, the first of which is financial (including food waste). Caregivers also talked about the time taken to prepare and cook vegetables for their children, as well as the effort involved in cooking and coming up with inventive ways of offering vegetables. Although acknowledged by several caregivers as a barrier to repeated presentation, costs did not always lessen or stop caregivers from presenting their children with vegetables which they may not eat: *"[child] gets carrots and green beans and broccoli on his plate two or three times a week, and they get thrown in the bin. But they're always on his plate".*

6.3.2.2.3 *Caregiver factors in presenting vegetables*

A few caregiver factors which influence whether caregivers present their children with vegetables emerged from the focus groups (see Figure 6.1). One of these was caregivers' own preferences for vegetables. Here, it varied between caregivers as to whether they would offer their children vegetables which they do not eat themselves. Caregivers' experiences of feeding vegetables to other children also influenced how and whether they presented their 2 to 4 year-old with vegetables, for example one

caregiver commented: *“it changes I think from one child to the next because you learn from your first and then try and do it different with the next”*. This experience altered the methods which caregivers used, as well as caregivers’ attitudes towards offering. For example, caregivers with older children reported feeling more relaxed about getting their younger child to eat vegetables. Finally, some caregivers reported developing acceptance to the vegetables their child would and wouldn’t eat, or their child’s general dislike of these foods. One caregiver explained: *“I’m not sure if we’d persevered with it, it would’ve had the desired result because I think that ultimately the child’s resistance is greater than any amount of coercion of your part”*. Mindsets such as this one prevented caregivers from offering their child (other) vegetables, or lessened their attempts at offering.

6.3.2.2.4 *Child factors in presenting vegetables*

There were several child factors identified in the focus groups which influenced caregivers’ presentation of vegetables (see Figure 6.1). One of these was the age of the child, which impacted on the methods which caregivers said they adopted, such as whether they used rewards or disguised vegetables. Another child factor was how hungry their child was. Several caregivers explained that they tried to ensure their child was hungry before offering vegetables in an attempt to increase acceptance of them: *“I do find that if it’s something that they don’t particularly want, they can then refuse it if they’re not really that hungry...if he’s hungry he’ll eat the lot, and there’s no messing around and it’s gone”*. Caregivers also identified that child tantrums and upset can influence how/when they present vegetables. This seemed to influence caregivers in one of two ways: 1) that if their child became upset that they would stop the episode of presenting a vegetable; or 2) that they would not present vegetables if they thought it may upset their child, as they were concerned about creating greater feeding difficulties for their child. Finally, some caregivers reported that they would not reoffer a vegetable if it had made their child unwell, or if their child was already unwell.

6.4 Discussion

The aim of this study was to investigate caregivers’ methods of presenting vegetables to their children, the perceived success of these methods and the perceived barriers to offering their child vegetables. It was found that caregivers adopt a number of methods when offering their children vegetables and that these methods can be broadly categorised into active/behavioural methods, passive methods, and methods which are based on manipulating the foods being offered. A number of influences on caregiver

offering also emerged from the focus groups. These fell into one of four categories: information, cost, caregiver factors and child factors.

Caregivers in this study suggested various behavioural/active methods of offering vegetables, two of which (rewards and modelling) have been the crux of successful parent led interventions aimed at increasing children's acceptance of a disliked vegetables (e.g., Holley et al., 2014 (Chapter 3); Remington et al., 2012; Wardle et al., 2003). This is a promising finding, suggesting that such interventions may have good feasibility for caregivers, where the required behavioural methods are in line with current practices used by caregivers. In line with previous literature on parental feeding practices, caregivers suggested using compromise during mealtimes, a demonstration of flexible, authoritative feeding practices (Baumrind, 1968), and unanimously agreed that using more rigid and authoritarian feeding practices, such as pressure, were counterproductive. Indeed, previous literature has found that authoritative feeding practices are associated with higher intake of vegetables (Patrick, Nicklas, Hughes, & Morales, 2005), so the current findings suggest that caregivers in these focus groups have a good gauge of which feeding practices to implement and which to try and avoid. Getting children involved in growing, choosing and preparing vegetables was also rated as a successful behavioural/active method by some caregivers in the current study, or as successful on some occasions, aligning with research demonstrating that involvement via a school gardening programme can increase children's willingness to try vegetables (Morris, Neustadter, & Zidenberg-Cherr, 2001). However, involving children in these practices may prove difficult for caregivers who find time constraints to be a barrier to offering their children fruits and vegetables, a point which will be further discussed below.

Passive methods suggested by caregivers in this study are synergistic with the evolutionary perspective on children's food rejection. This perspective suggests that newly ambulatory children enter a phase called 'neophobia', whereby new and unknown foods are refused, particularly vegetables (Cooke, Wardle, & Gibson, 2003). Just serving these foods and normalising the inclusion of vegetables at mealtimes as well as making them available within the home increases children's familiarity with these foods, where it is known that familiarity is significantly associated with children's liking of a food (Cooke & Wardle, 2005). This in turn should reduce children's neophobia, which is likely to increase acceptance of these vegetables over time. Some caregivers in the current study also covertly restricted other less healthy and more highly favoured alternative foods as a way to encourage children to eat meals which

include vegetables. This is a practice which has been shown to promote children's fruit and vegetable consumption (Brown, Ogden, Gibson, & Vogelee, 2008).

In line with previous research, caregivers suggested manipulating food in a variety of ways as being potentially successful for increasing children's consumption of vegetables (Poelman & Delahunty, 2011; Reimer et al., 2004; Savage, Peterson, Marini, Bordi, & Birch, 2013). These manipulations included hiding vegetables to increase their child's consumption (such as mashing other vegetables in with potatoes), using sauces, and presenting vegetables in different forms. Although there is some research evidence that hiding vegetables within foods can increase children's consumption of the hidden vegetable (e.g., Spill, Birch, Roe, & Rolls, 2011) the use of this practice likely misses valuable opportunities for children to develop a liking or willingness to consume vegetables when they are "seen". Because children are unaware of the presence of the vegetables (Pescud & Pettigrew, 2014), it is unclear what impact hiding vegetables has on increasing consumption of vegetables when they can be seen. Previous research has suggested that preparation methods can influence acceptance of vegetables, particularly in children who like fewer vegetables, given that taste and texture can vary significantly as vegetables are cooked (Poelman & Delahunty, 2011). With this in mind, exploring different methods of preparation and presenting vegetables in a variety of forms seems logical for increasing children's consumption. As a combination of methods, hiding vegetables may be useful for increasing children's consumption in the short-term, whilst manipulations such as offering vegetables in a variety of preparations may promote children's tasting of these foods, in turn potentially resulting in long-term increases in consumption. It would be of interest to explore caregivers' perceptions of these methods for achieving different outcomes.

A number of influences to offering of vegetables were highlighted by caregivers in this study. One of these was information about offering vegetables to children. Although caregivers reported obtaining information from a number of sources, caregivers highlighted that information was not only limited but also conflicting, which aligns with previous research (e.g., Mitchell, Haycraft, & Farrow, 2013). Furthermore, heavily supported research findings for the effective use of methods such as repeated exposure (e.g., Cooke, 2007) have not been included in UK child feeding guidelines (Mitchell et al., 2013). Together, this suggests that the provision of information to caregivers on the importance of offering and reoffering vegetables must be improved.

Another barrier to offering was the cost of offering vegetables, whether financial, time, or effort; although some caregivers stated that this would not stop them from reoffering these foods to their children. Research suggests that a diet higher in fruits and vegetables does cost more financially than a diet higher in fats and sweets (Drewnowski, Darmon, & Briend, 2004), but the affordability of this expenditure is dependent on parental income. It is likely that financial barriers are not as prominent for the relatively middle class sample in this study as for some other caregivers. However, for caregivers who have a smaller budget for feeding their children, the repeated food waste resulting from rejection of vegetables would present a bigger barrier to future offering. Providing information to parents on the success of repeated offering of foods and reassuring them that waste need not be long-term may encourage parents to reoffer vegetables in the short-term until their child accepts these foods. Previous studies have revealed time to be a barrier to parents' preparation of meals (Fulkerson et al., 2011), as well as to increasing individuals' own fruit and vegetable consumption (e.g., Anderson & Cox, 2000; Heimendinger & Duyn, 1995; Kearney & McElhone, 1999; Kilcast, Cathro, & Morris, 1996). Furthermore, shopping for fresh fruit and vegetables requires more regular trips to food shops (Anderson & Cox, 2000), which are particularly hard to accommodate into irregular work hours and busy lifestyles (Kearney & McElhone, 1999). While this previous research was conducted to investigate adults' consumption, it seems likely that these same barriers would be applicable to caregivers of young children, although caregivers' vested interest in achieving a healthful diet for their children may be helpful in overcoming these barriers. Caregivers could be educated on practical solutions which could reduce the cost of offering vegetables as well as the associated time burden. An example of this would be preparing in bulk and in advance of mealtimes, which are methods previously demonstrated by high vegetable consumers (Kilcast et al., 1996).

The current study suggests that individual differences such as caregivers' preferences and attitudes towards their children's consumption are a central influence on offering of vegetables to children. Caregivers' reports that they would only give their child vegetables in line with their own preferences may well limit children's intake, as previous literature suggests children's vegetable intake may be positively related to parental intake (e.g., Cooke et al., 2004; Palfreyman et al., 2014). Caregivers' attitude towards their child's vegetable consumption also appears to influence offering of vegetables. Some caregivers in this study stated that they had developed a level of acceptance towards their child's refusal of many vegetables and had resolved themselves to the selection of foods their child would eat. This attitude creates a barrier

to increasing children's consumption of vegetables as it can result in caregivers no longer offering refused vegetables to their child. With this in mind, it may be worthwhile to develop more family based vegetable interventions, which seek to increase caregivers' acceptance as well as children's. Furthermore, caregivers who have come to accept their children's food refusal may benefit from better provision of information on the value of persistent offering of disliked foods to children (Cooke, 2007), and also of eating more vegetables in sight of their children (modelling; Palfreyman, Haycraft, & Meyer, 2014).

A number of child factors which influence how and when caregivers offer their child vegetables were also discussed, such as child age, hunger and children getting upset. Child upset seemed to be a concern to caregivers due to their fear of creating greater feeding difficulties. To minimise this fear, advice to caregivers should be tailored to reassure them about the appropriate level of persistence to use when feeding a child, with it known that repeated exposures to disliked foods are necessary for children to accept them (Cooke, 2007) and that pressure to eat can result in lowered preference for pressured foods (e.g., Galloway et al., 2005; Galloway et al., 2006). In line with current UK recommendations (e.g. NHS Choices, 2013), caregivers also reported ensuring that their child was hungry before offering them vegetables. Encouragingly, caregivers reported that this was successful for achieving consumption, suggesting that this current guideline should be maintained for future caregivers. Child age influenced the behavioural method of offering which caregivers' employed; suggesting that advice given to caregivers about possible methods to encourage consumption of vegetables should include information about which particular methods are the most appropriate for children of different ages. More research in this area seems appropriate in order to develop specific advice tailored to child age.

There are multiple strengths to the current study. First, it provides up to date information about the methods caregivers in the UK use to offer vegetables to young children, where there is limited previous research not only with this age group but also for specific offering of vegetables. With it known that children's consumption of vegetables is particularly low, this area is a public health priority. Furthermore, these data are enriched by providing information on the perceived barriers to caregivers offering of vegetables, which could be translated into information for caregivers on how to overcome these barriers. Having said this, this study does have its limitations. First, the caregivers in this study participated voluntarily by responding to a poster advert for the study. As such, these individuals who are motivated to take part in research may be

particularly interested in their child's eating behaviour and their methods of offering and perceived barriers to offering may differ from other less motivated caregivers, or to caregivers for whom vegetable consumption is of less interest. Furthermore, the employment levels of the participants in this study suggest that this sample are of relatively high SES and, as caregiver methods and particularly barriers to offering may well be different amongst lower SES groups, future research should aim to recruit a more socio-economically diverse sample of caregivers. Finally, the reflexivity of the caregiver-child interactions at feeding time is impossible to disentangle, and therefore discussion of caregiver and child influences on consumption of vegetables must bear this in mind. Future research could explore possible differences in methods used to achieve short-term wins versus methods used to achieve long-term changes in children's consumption of vegetables. Here, it is likely that methods which caregivers employ to increase consumption on individual occasions are different to the methods which caregivers believe are suitable for achieving a longer-term healthful diet. Research should also be conducted which can further explore how both caregiver and child characteristics such as SES, BMI and food fussiness can impact on caregivers methods of offering and the barriers to offering of vegetables.

The findings of this study indicate that caregivers use three main types of methods of offering: active/behavioural, food manipulation and passive methods. The results also suggest there are four main areas that act as barriers to offering of vegetables: information, cost, caregiver factors and child factors. This study makes a valuable contribution to research into increasing children's vegetable consumption by providing novel information about the methods used by caregivers, the barriers to offering vegetables and the strategies that caregivers believe are effective. Future research should seek to expand on this, by producing large scale quantitative data on which of the comprehensive array of methods that emerged from this study are reported as successful by parents. Together, this information can be used to tailor future advice for caregivers who want to achieve a more healthful diet for their child, by taking into consideration the barriers which caregivers experience to help ascertain the most appropriate methods of offering vegetables for them.

Chapter 7

Chapter 6 used a qualitative approach to generate a comprehensive list of the methods caregivers use to encourage their children to eat vegetables as well as the perceived influences on whether they offer their child vegetables. Caregivers adopted a number of methods to offer their children vegetables which could be split into three categories. These categories of methods were active/behavioural methods, passive methods, and methods which are based on manipulating the foods being offered. Chapter 6 also revealed that caregivers perceive a number of influences on whether they offer their child vegetables. These influences were information, cost, parent factors and child factors. Chapter 7 sets out to build on this research by gathering large scale data on the methods caregivers use to offer their children vegetables. This study had four main aims. First, it aimed to assess which methods of offering vegetables caregivers perceive to be successful at encouraging vegetable intake. The second aim was to explore whether frequency of reoffering vegetables was associated with methods used to offer vegetables, caregiver vegetable intake, feeding practices and perceived influences to offering or consumption (including child eating behaviours). The third aim was to examine whether children's consumption of vegetables was associated with methods used to offer vegetables, caregiver vegetable intake, feeding practices and perceived influences to offering or consumption (including child eating behaviours). Lastly, it aimed to assess which factors could best predict frequency of reoffering of vegetables and children's consumption of vegetables.

Chapter 7: If at first you don't succeed: Methods used by caregivers to reoffer vegetables to preschool age children

If at first you don't succeed: Methods used by caregivers to reoffer vegetables to preschool age children

7.1 Introduction

As outlined earlier in this thesis (see section 1.2.2), it is known that vegetable consumption in children is low, and that vegetables are commonly rejected by children. Previous research suggests that in order for children to like and accept a rejected food they may need to try it as many as 10 to 15 times (e.g., Birch & Marlin, 1982; Birch, Gunder, Grimm-Thomas, & Laing, 1998; Sullivan & Birch, 1990), but that less than 9% of caregivers reoffer new foods as many as 10 times (Carruth, Ziegler, Gordon, & Barr, 2004). With this in mind, it is necessary to consider the influences on caregiver offering of vegetables, as well as the methods which caregivers use to offer vegetables, in order to increase successful offerings and concurrent consumption of vegetables amongst children.

A body of research indicates that while some particular methods used to increase children's consumption of vegetables have demonstrated success, others seem less promising. Experimental research suggests that teacher modelling may increase children's willingness to try vegetables (Hendy & Raudenbush, 2000) as might offering non-food rewards, such as stickers, which have been shown to be successful for achieving tastings of disliked vegetables during interventions as well as increasing children's vegetable consumption post-intervention (Añez, Remington, Wardle, & Cooke, 2013; Holley, Haycraft, & Farrow, 2014 (Chapter 3); Wardle, Herrera, Cooke, & Gibson, 2003). Cross-sectional research has also investigated associations between methods of offering used by caregivers and children's consumption of vegetables. Caregivers' use of negotiation as a way to get children to eat has been associated with a higher likelihood of daily vegetable consumption among 11 year-olds (Vereecken et al., 2009), as has parental encouragement of balance and variety and caregivers maintaining a healthy home environment (Melbye et al., 2013). Conversely, greater caregiver control over their children's eating, and restricting their child's food intake for health reasons, have both been associated with lower vegetable consumption amongst 11 year-old children (Melbye et al., 2013), as have parental permissiveness and catering for children's demands (both during meal planning and after food refusal) (Vereecken et al., 2009). Indeed, research by Vereecken, Rovner, and Maes (2010) reasserts that adaptive, less controlling feeding practices are associated with greater consumption of vegetables while more controlling, maladaptive feeding practices are associated with lower consumption of vegetables in children.

As well as considering methods used by caregivers to offer vegetables, it is important to consider influences on whether caregivers offer and re-offer vegetables. Vegetables need to be available in order for them to be consumed, with research suggesting that the availability of vegetables is an important predictor of children's intake (for a review see Jago, Baranowski, & Baranowski, 2007). However, there are many possible influences on the provision of vegetables which caregivers may experience. One of these influences is time, where adults have reported that they do not have the time available to shop for fresh fruits and vegetables on a regular basis (Anderson & Cox, 2000), and that preparing vegetables is time consuming (Kilcast, Cathro, & Morris, 1996; see also Chapter 6). The financial cost of vegetables can also be important, with evidence that a diet rich in fruits and vegetables can cost more than a diet higher in sugar and fats (Drewnowski et al., 2004). These influences were raised by caregivers in Chapter 6, but caregivers were not all in agreement that cost influenced their decision to offer vegetables to their children. A number of caregivers reported that they were frustrated about the waste created when food was rejected and that this also acted as a barrier to reoffering. A further possible influence on offering of vegetables is caregivers' own preferences for vegetables, which may also influence children's consumption of vegetables (see Chapter 6). Indeed, literature suggests that children's and adolescents' vegetable intake may be positively related to parental intake (Cooke et al., 2004; Hanson et al., 2005; Palfreyman et al., 2014).

A previous exploratory qualitative study (Chapter 6) identified that caregivers' methods of offering vegetables to their preschool-age children fell into three broad categories: active/behavioural methods, passive methods, and food manipulations. Influences on caregivers' offering of vegetables fell into one of four categories: information, cost, parent factors, and child factors (Chapter 6). In order to apply this research more widely, it is necessary to conduct further, large scale research which determines caregivers' perceptions of which of these methods work, which methods are related to greater vegetable consumption in children, and which factors influence their offering of vegetables to young children. This information could then be used to inform future education for parents and interventions aimed at increasing children's vegetable consumption.

The current study therefore had four aims. The first aim was to assess which methods of offering caregivers perceive to be successful at promoting vegetable intake. The second aim was to investigate whether the frequency of reoffering of vegetables is

associated with the methods used to offer vegetables, caregiver vegetable intake, feeding practices and perceived influences to offering or consumption (including child eating behaviours). It was hypothesised that caregivers would reoffer rejected vegetables fewer times if they ate fewer vegetables themselves, they used more controlling feeding practices, and also if they described their children as fussier eaters. It was further predicted that lower caregiver reoffering of vegetables to their children would be associated with concerns about financial costs as well as time and waste.

The third aim of the study was to examine whether children's consumption of vegetables is associated with methods used to offer vegetables, caregiver vegetable intake, feeding practices and perceived influences to offering or consumption (including child eating behaviours). It was hypothesised that children who ate fewer vegetables would be fussier with food in general and enjoy food less. Moreover, caregivers of children who ate fewer vegetables would eat fewer vegetables themselves, use more controlling methods of offering (such as pressure to eat, hiding vegetables within foods, and use of threats) and less adaptive methods (such as modelling healthy eating, creating a healthy home environment, encouraging balance and variety, and involving children in meal choice and preparation). A final aim of the study was to assess which factors could best predict (a) caregivers' frequency of reoffering of previously rejected vegetables and (b) children's consumption of vegetables.

7.2 Methods

7.2.1 Participants

Caregivers of 2 to 4 year-old children were invited to take part in the study. To be included, caregivers were required to play a central role in feeding their child. With this in mind, caregivers who expressed an interest in participating but who had low involvement in feeding were excluded from the study. A total of 297 caregivers took part.

7.2.2 Procedure

Full ethical clearance for this study was granted by Loughborough University's Institutional Review Board. All caregivers were advised of their right to withdraw from the study at any time. Caregivers were further informed that all responses were treated with confidentiality as well as being used and stored anonymously.

7.2.3 Recruitment

Approximately half of the caregivers (n=150) were recruited from 17 toddler groups across Leicestershire, UK. Permission was sought from group leaders for the researcher to attend sessions in order to recruit willing caregivers. Caregivers were approached by the researcher and asked if they would like to participate in a study investigating how caregivers offer vegetables to their young children. They were informed that the study involved completion of a one-off questionnaire which would take 10 to 15 minutes. Caregivers who agreed to participate were then issued with an information sheet giving full details of the study (Appendix P), as well as a consent form to be signed if they wished to take part, and a paper copy of the study questionnaire pack.

Caregivers (n=147) were also recruited via posters displayed on University noticeboards, online via social media and an online university noticeboard, as well as through articles in the Leicester Mercury, Loughborough Echo, and through a radio interview on BBC radio Leicester. Caregivers recruited via these advertisements were directed to an online version of the questionnaire generated using Bristol Online Surveys (<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>). The content of the online and paper surveys was identical.

7.2.4 Measures

This study measured a number of constructs surrounding caregiver offering of vegetables which were derived from a previous qualitative study (see Chapter 6). These constructs fell into one of two categories: (1) methods of offering vegetables; or, (2) influences on offering vegetables. A number of validated questionnaires were also utilised to measure these constructs. A summary of the constructs measured is presented in Table 7.1.

Table 7.1: Summary of methods of offering and possible influences on offering and consumption to be measured. Footnotes denote the measure used for each construct.

Methods	Influences
Normalising presence of vegetables ^b	Child mood ^b
Covert restriction ^b	Child tantrums ^b
Modelling ^{a b}	Child hunger ^b
Food rewards ^b	Caregiver avoiding frustration ^b
Other rewards ^b	Caregiver tastes ^b
Threats ^b	Caregiver acceptance ^b
Encouragement/pressure ^{a b}	Time ^b
Games ^b	Waste ^b
Involvement ^{a b}	Money ^b
Hiding ^b	Children's general food fussiness ^c
Compromise ^b	Children's general food responsiveness ^c
Presenting in different forms ^b	Children's slowness in eating ^c
Healthy home environment ^a	Children's enjoyment of food ^c
Encourage balance and variety ^a	Caregivers' vegetable consumption ^d

^a Comprehensive Feeding Practices Questionnaire^b newly developed item(s)^c Children's Eating Behaviour Questionnaire^d Adapted Food Frequency Questionnaire

7.2.4.1 Comprehensive Feeding Practices Questionnaire (CFPQ; Musher-Eizenman & Holub, 2007; Appendix E)

The CFPQ is a 49 item questionnaire which measures a broad range of general feeding practices used by caregivers. A number of these which were expected to be related to children's consumption of vegetables were measured in this study, including: caregivers' use of Pressure (four items, e.g. *"If my child says, 'I'm not hungry,' I try to get him/her to eat anyway"*); Modelling (four items, e.g. *"I show my child how much I enjoy eating healthy foods"*); Healthy home environment (four items, e.g. *"Most of the food I keep in the house is healthy"*); Encourage balance and variety (four items, e.g. *"I encourage my child to eat a variety of foods"*); and, Involvement (three items, e.g. *"I involve my child in planning family meals"*). The CFPQ has been validated (Musher-Eizenman & Holub, 2007) and used successfully with other UK caregivers with young children (e.g., Powell et al., 2011). While reliability for the modelling and pressure subscales was good in the current sample (with Cronbach's alphas of .82 and .75, respectively), the involvement, encouraging balance and variety, and healthy home environment subscales demonstrated slightly lower reliability, with Cronbach's alphas ranging from .53 to .55.

7.2.4.2 *Children's Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson, & Rapoport, 2001; Appendix G)*

The CEBQ is a 35 item questionnaire measuring a variety of children's eating behaviours. Four of its subscales which were expected to be related to caregivers' reoffering and children's consumption were administered to measure children's: food fussiness (six items, e.g. *"My child enjoys tasting new foods"*); food responsiveness (five items, e.g. *"My child enjoys eating"*); slowness in eating (four items, e.g. *"My child eats slowly"*); and, enjoyment of food (four items, e.g. *"My child enjoys eating"*). This measure has been shown to be reliable in other samples of UK caregivers of children of a similar age (e.g., Cooke et al., 2004). All four subscales demonstrated good reliability with this sample, with Cronbach's alphas ranging from .78 to .89.

7.2.4.3 *Measuring caregiver and child vegetable consumption: Brief Food Frequency Questionnaire (FFQ; Cooke et al., 2003; Appendix J)*

An adapted version of Cooke et al.'s FFQ was used to measure children's vegetable consumption. The original version of the FFQ asks caregivers how often their child consumes fruit (fresh or tinned), vegetables (including salad but not potatoes), meat or fish (any kind), cakes, biscuits, sweets or chocolate, rice, potatoes or pasta, and eggs. In the adapted version, caregivers were asked to indicate how often their child ate: (1) raw vegetables (e.g. carrot sticks, celery); (2) cooked vegetables (including sweet potato but not potato); and (3) salad (e.g. tomatoes, lettuce). These three categories ensured that vegetables consumed in any form were included in caregiver estimates of children's consumption. For reference, caregivers were also issued with a guide to age-appropriate portions of vegetables (Infant and Toddler Forum, 2013; see Appendix R). The original FFQ asks caregivers to report their child's consumption on a scale ranging from 'never/rarely' to 'four or more times a day'. These categories were altered for this study to allow assessment of intake in portions. Instead, caregivers reported their child's consumption of each of these three categories on an eight point scale, ranging from 'never/rarely' to 'four or more portions a day'. In order to calculate children's total vegetable consumption from these three categories, caregivers' responses were converted into equivalent portions per week. Responses of 'never/rarely' were assigned a score of 0, responses of 'one or two portions a week' were assigned a score of 1.5 and so on up to 'four or more portions a day' being scored 28 (see scoring details in Appendix J). Children's total weekly vegetable consumption was then calculated by summing caregivers' responses for all categories.

7.2.4.4 *Newly developed caregiver-report items*

Where suitable validated alternatives could not be found, questionnaire items were created for the purposes of this study (see Appendices K-N). These were individual items designed to tap simple constructs born out of a previous focus group study (see Chapter 6), and were verified as suitable using a small pilot study.

7.2.4.4.1 *Caregivers' use of methods of offering vegetables (Appendix K)*

Questions assessed caregivers' use of a number of methods of offering, with responses scored on one of two five-point likert scales. Responses for use of covert restriction, compromise/flexibility and non-food rewards ranged from 'never' to 'always'. Responses for caregivers' use of normalising offering, presenting vegetables in different forms, and threats ranged from 'disagree' to 'agree'. These methods were assessed using single items with the exception of threats, which was assessed with two items to ensure different types of threats were reported. Single items were analysed using their raw scores whilst a mean score was calculated from the two items measuring use of threats.

7.2.4.4.2 *Caregivers' frequency of use, and perception of success, of methods of offering vegetables (Appendix L)*

Caregivers were also asked to report how often they used a number of methods to encourage their child to eat vegetables (with responses ranging from 'never' to 'always') as well as whether they perceived these practices to work (i.e. resulted in their child consuming a vegetable, responded to as 'yes' or 'no'). These methods were modelling eating vegetables, using food rewards, using non-food rewards, issuing threats, using encouragement or pressure, playing games with/relating to food, involving their child in vegetable/meal choice/preparation, hiding vegetables in with other foods, using compromise, and reoffering vegetables in different forms. Raw scores for these questions were used in analyses.

7.2.4.4.3 *Influences on offering of vegetables (Appendix M)*

Items were developed to evaluate the impact of previously identified potential influences on caregiver offering of vegetables. These possible influences were: cost, waste, time, child mood, tantrums, child hunger, avoiding frustration, caregivers' acceptance of their child's eating of vegetables (e.g., being satisfied with the selection they consume or resigned to reoffering being unsuccessful), and caregivers' own tastes.

These questions were scored on a five-point likert scale with responses ranging from 'disagree' to 'agree', apart from one question regarding the influence of parents' own tastes, which was scored from 'never' to 'always'. These influences were assessed using single items with the exception of acceptance over children's eating of vegetables, which was assessed with two items to ensure different facets of acceptance were reported. Single items were analysed using their raw scores whilst a mean score was calculated from the two items measuring acceptance.

7.2.4.4.4 Assessing caregiver feeding of vegetables: frequency of reoffering and difficulty experienced (Appendix N)

Two general questions were generated to assess caregivers' experiences of feeding vegetables to children. First, caregivers were asked the frequency with which they have difficulty getting their child to eat vegetables (measured on a four-point likert scale ranging from 'never' to 'always'). Second, they were asked how many times on average they would re-offer their child a vegetable which their child had rejected on a previous occasion, with response options on a scale from zero to 10+ times. Raw scores on these questions were used in analyses.

7.2.5 Demographic measures

Caregivers were asked to provide their child's and their own gender and date of birth. Caregivers were also asked to state their relationship to the child, as well as their ethnicity and level of education.

7.2.6 Data analysis

A series of Kolmogorov-Smirnov tests indicated that the majority of the study's variables were not normally distributed, therefore non-parametric tests were used, where possible, to test the study's hypotheses. Initial Mann Whitney U analysis confirmed there were no significant differences between participants who completed the questionnaire online versus on paper on the study's outcome variables (data not shown). Preliminary one-tailed Spearman's correlations were run between caregiver and child age with each of the study variables. Child age was significantly correlated with caregivers' use of covert restriction ($r = -.16$, $p < .001$), threats ($r = .21$, $p < .001$), encouragement/pressure ($r = .27$, $p < .001$), tantrums ($r = .16$, $p < .001$); children's food fussiness ($r = .18$, $p < .001$); caregivers' acceptance of their child's eating ($r = .15$, $p < .01$); and the influence of food waste ($r = .18$, $p < .001$). Caregiver age was only significantly correlated with the presentation of vegetables in different forms ($r = .21$, $p < .001$). Due to

these associations, partial correlations (which controlled for parent and/or child age) were run between each of these associated factors and the outcome variables of reoffering of vegetables and children's vegetable consumption.

One-tailed Spearman's correlations were used to investigate associations between caregiver reoffering of rejected vegetables and caregiver factors, as well as influences on offering or consumption. One-tailed Spearman's correlations were also used to investigate associations between children's vegetable consumption with caregiver factors and influences on offering or consumption. Significant correlates of each of these outcome measures (reoffering of vegetables and children's consumption of vegetables) were subsequently entered into two separate stepwise entry regression models to assess which factors could best predict (a) frequency of reoffering of vegetables and (b) children's consumption of vegetables. As child age was significantly related to some of the factors which were entered into these regression models, child age was entered into the first block, using the forced method, to ensure any indirect effects of child age in the model were controlled for.

Due to the large number of correlations conducted and the associated risk of type 1 errors, a more stringent significance level of $p < .01$ was used for all correlations. Significance was set at $p < .05$ for the two regression analyses.

7.3 Results

7.3.1 Sample

Caregivers were predominantly mothers ($n=269$), with 12 fathers, five grandparents and seven child-minders or nannies also recruited. Caregivers' age ranged from 21.0 to 63.2 years ($M=36.0$; $SD=6.14$) and child age ranged from 19.0 to 62.0 months ($M=38.3$; $SD=10.73$). Caregivers were predominantly of White ethnicity ($n=267$) with eight caregivers identifying as Asian/Asian British, two as Black/Black British, four as Chinese, five as mixed ethnicity, and four reporting as 'other'. Two-thirds of the caregivers in this study were educated to university level or higher ($n=196$) with the remaining third educated below University level ($n=97$).

7.3.2 Descriptive statistics

Descriptive statistics for the validated subscale measures are displayed in Table 7.2. The study sample's mean scores for the CFPQ and CEBQ subscales are comparable to means from similar samples (e.g., Ashcroft, Semmler, Carnell, van Jaarsveld, & Wardle, 2008; Haycraft et al., 2011; Musher-Eizenman & Holub, 2007; Pliner & Loewen, 1997; Powell et al., 2011).

Table 7.2: Mean and standard deviation (SD) scores for validated measures of caregiver feeding practices and children's eating behaviours

Measure	Mean (SD)
Feeding practices	
Modelling	4.42 (0.68)
Encourage balance and variety	4.42 (0.51)
Environment	3.89 (0.70)
Pressure to eat	3.09 (0.92)
Involvement	3.41 (0.92)
Children's eating behaviours	
Enjoyment of food	3.91 (0.77)
Slowness in eating	2.77 (0.76)
Food fussiness	2.74 (0.77)
Food responsiveness	2.60 (0.82)

Descriptive statistics for the newly developed items are presented in Table 7.3. Mean scores suggest that normalising the presence of vegetables was the most commonly used method for encouraging children to consume vegetables, whilst compromising (e.g. on the order of foods eaten) was least commonly used. Caregivers' acceptance over children's consumption of vegetables was the most commonly reported influence to offering and consumption of vegetables with tantrums being least commonly reported. Together, the mean scores for these newly developed items indicate that most caregivers use these methods some of the time and are subject to some degree of these influences. Caregivers consumed an average of 22.66 portions of vegetables per week, (3.24 portions of vegetables per day), whilst children consumed an average of 17.91 portions per week (2.56 portions per day), though it should be noted that there was a large degree of variance in consumption. Lastly, caregivers reported reoffering disliked vegetables an average of 7.61 times.

Table 7.3: Mean and standard deviation (SD) scores for newly developed measures of methods of reoffering vegetables and influences on reoffering.

Newly developed Items	Mean (SD)
Methods	
Normalising presence of vegetables	4.96 (0.21)
Modelling eating vegetables	4.25 (0.92)
Encouragement/ pressure	3.35 (1.01)
Involvement in choice/preparation of vegetables	3.18 (0.82)
Hiding vegetables in other food	2.79 (1.16)
Presenting vegetables in different forms	2.76 (0.96)
Playing games with vegetables	2.45 (1.16)
Food rewards	2.32 (1.16)
Covert restriction	2.15 (1.07)
Other rewards	2.01 (1.07)
Threats	1.56 (0.91)
Compromise	1.27 (0.70)
Influences	
Caregiver weekly vegetable consumption	22.66 (14.27)
Acceptance	2.44 (1.23)
Child mood	2.38 (1.40)
Caregivers own tastes	2.35 (1.28)
Waste	2.15 (1.34)
Child hunger	1.93 (1.22)
Avoiding frustration	1.84 (1.19)
Time	1.78 (1.11)
Money	1.70 (1.08)
Tantrums	1.69 (1.10)
Outcome variables	
Child weekly vegetable consumption	17.91 (11.41)
Frequency of reoffering of vegetables	7.61 (3.82)

7.3.3 Which methods of offering vegetables do caregivers perceive as successful at promoting consumption in their child?

To address the first aim of the study, percentages of caregivers from the sample who believe each method of offering was successful at promoting vegetable consumption in their child were calculated and are reported in Table 7.4. Caregivers generally agreed that modelling eating vegetables, use of encouragement/pressure, involving children in vegetable choice/preparation, hiding vegetables in other foods, and presenting vegetables in different forms were successful methods of offering vegetables to young children. Caregivers also tended to agree that threats and compromise were unsuccessful methods to encourage children to eat vegetables. However, caregivers were less sure as to whether playing games with vegetables worked and were divided as to whether food rewards and other rewards were successful methods to use to encourage children's vegetable consumption.

Table 7.4: Percentage of caregivers who perceive each method of offering vegetables to their child is successful for promoting consumption (yes) or not successful (no)

Method	N	Yes (%)	No (%)
Modelling eating vegetables	287	94.10	5.90
Involvement	281	90.30	9.70
Encouragement/ pressure	286	84.90	15.10
Presenting vegetables in different forms	287	79.10	20.90
Hiding vegetables in other food	291	69.90	30.10
Playing games with vegetables	287	61.30	38.70
Food rewards	284	50.00	50.00
Other rewards	284	49.10	50.90
Threats	287	22.20	77.80
Compromise	288	10.50	89.50

7.3.4 Relationships between caregiver factors and both frequency of reoffering and children's consumption of vegetables.

One-tailed correlations were run to investigate associations between methods of offering and general feeding practices with both frequency of caregiver offering of vegetables as well as children's consumption of vegetables (Table 7.5). Three methods were significantly associated with re-offering of rejected vegetables. Caregivers normalising the presence of vegetables, modelling consumption of vegetables, and modelling of healthy eating in general were all associated with parents re-offering rejected vegetables to their child more frequently. Caregivers' use of food rewards was the only method of offering which was negatively associated with caregivers re-offering rejected vegetables.

Several methods of offering were associated with children's consumption of vegetables as reported by caregivers. Caregivers normalising the presence of vegetables, involving children in vegetable choice/preparation, generally involving children in meal choice/preparation and modelling healthy eating, making healthy foods available within the home (as measured using the CFPQ Environment subscale), and encouraging balance and variety in children's diets were all significantly associated with children eating more vegetables. Caregivers using food and non-food rewards more frequently, hiding vegetables more frequently, and generally using pressure to eat were all significantly associated with lower consumption of vegetables amongst children.

Table 7.5: One-tailed Spearman's (unless otherwise stated) correlations between vegetable-specific methods of offering and global feeding practices with frequency of reoffering and consumption of vegetables.

Method	Caregivers' frequency of re-offering		Children's total vegetable consumption	
	R	P	R	p
Passive				
Covert restriction ^a	-.04	.25	-.10	.06
CFPQ Environment	.12	.02	.21	.00
Normalising presence of vegetables	.15	.01	.19	.00
Active/Behavioural				
Modelling frequency	.23	.00	.09	.06
Food reward frequency	-.17	.00	-.14	.01
Other reward frequency	-.08	.10	-.18	.00
Threats frequency ^a	-.08	.13	-.04	.27
Encouragement/pressure frequency ^a	-.10	.07	-.07	.14
Games frequency	-.08	.09	-.01	.44
Involvement frequency	.11	.04	.19	.00
Compromise frequency	-.01	.41	-.07	.14
CFPQ Involvement	.11	.03	.19	.00
CFPQ Encouraging balance and variety	.11	.03	.17	.00
CFPQ Modelling	.20	.00	.15	.01
CFPQ Pressure	-.11	.04	-.14	.01
Food manipulation				
Presenting in different forms frequency ^b	.10	.07	.09	.09
Hiding vegetables in other food frequency	.02	.39	-.17	.00

CFPQ: Comprehensive Feeding Practices Questionnaire

^a partial correlation controlling for child age^b partial correlation controlling for parent age

Significant correlations are presented in bold

7.3.5 Relationships between perceived influences on offering of vegetables and both frequency of caregiver reoffering and children's consumption of vegetables

One-tailed correlations were run to investigate associations between various influences on caregiver offering of vegetables and both frequency of caregivers' reoffering of rejected vegetables and children's total vegetable consumption, as reported by caregivers (Table 7.6). Caregivers reoffered rejected vegetables significantly fewer times when they accepted their child's consumption of vegetables, ate fewer vegetables themselves, were influenced by children's mood and tantrums, wanted to avoid frustration, and when time, waste and money were influences on offering. Furthermore, children whose caregivers ate fewer vegetables, whose mood was said to influence offering, who were described as more food fussy and enjoyed food less ate significantly fewer vegetables.

Table 7.6: One-tailed Spearman's correlations (unless otherwise stated) between influences on offering vegetables and frequency of caregiver reoffering and children's consumption of vegetables.

Influence	Caregivers' frequency of re-offering		Children's total vegetable consumption	
	R	P	R	p
Child				
Child mood	-.14	.01	-.14	.01
Tantrums ^a	-.23	.00	-.08	.11
Child hunger	-.11	.03	-.06	.15
CEBQ Food fussiness ^a	-.06	.18	-.32	.00
CEBQ Food responsiveness	.01	.46	-.02	.40
CEBQ Slowness in eating	-.04	.24	-.10	.05
CEBQ Enjoyment of food	.06	.14	.15	.01
Caregiver				
Avoiding frustration	-.30	.00	-.12	.02
Caregivers' tastes	.12	.02	.01	.42
Acceptance of child's vegetable consumption ^a	-.37	.00	-0.10	.05
Caregivers' vegetable consumption	.14	.01	.61	.00
Cost				
Time	-.25	.00	-.08	.09
Waste ^a	-.28	.00	-.06	.17
Money	-.16	.00	.00	.49

CEBQ: Children's Eating Behaviour Questionnaire

^a partial correlation controlling for child age

Significant correlations are presented in bold

7.3.6 Predicting frequency of caregiver reoffering of vegetables which have been previously rejected by children.

To address the fourth aim of the study, a stepwise multiple regression was performed to identify a model which could significantly explain variance in caregivers' reoffering of rejected vegetables to their child, as well as identify the strongest statistical predictors of reoffering (Table 7.7). Child age was entered in the first step of the regression. All significant correlates of caregiver re-offering of vegetables (Tables 7.5 and 7.6) were entered into the second step of the stepwise regression, namely: caregivers' consumption of vegetables, acceptance over their child's consumption of vegetables, normalising the presence of vegetables, modelling eating vegetables and modelling healthy eating in general, using food rewards, children's mood, children's tantrums, caregivers' avoiding frustration, time, waste and cost. A final model was identified, where child age, modelling of vegetable consumption, caregivers avoiding frustration, as well as general modelling of healthy eating created a model which explained 18% of the variance in caregivers' reoffering of vegetables ($F(4, 231)=12.39, p<.001$). However, it should be noted that child age was not a significant individual predictor in this final model. Table 7.7 shows the contribution of all predictors in the final model.

Table 7.7: Stepwise regression model of predictors of frequency of reoffering of vegetables by caregivers with confidence intervals in parentheses.

	<i>b</i>	<i>SE B</i>	β	<i>P</i>
Step 4				
Child age	-0.02 (-0.06, 0.02)	0.02	-0.06	0.35
Modelling of vegetable consumption	0.94 (0.44, 1.45)	0.26	0.23	0.00
Avoiding frustration	-0.78 (-1.16, -0.40)	0.19	-0.25	0.00
CFPQ Modelling	0.73 (0.06, 1.40)	0.34	0.14	0.03

CFPQ: Comprehensive Feeding Practices Questionnaire

7.3.7 Predicting children's consumption of vegetables

To address the fourth aim of the study stepwise regression was performed to identify a model which could explain a significant proportion of the variance seen in children's reported consumption of vegetables, as well as identifying the strongest predictors of consumption (Table 7.8). Child age was entered in the first step of the regression. All significant correlates of children's consumption of vegetables (Tables 7.5 and 7.6) were entered into the second step of the stepwise regression, namely: caregivers' consumption of vegetables, caregivers normalising the presence of vegetables, hiding

vegetables in other foods, making healthy foods available within the home (as measured using the CFPQ Environment subscale), involving children in food choice and preparation, using food and other rewards to encourage consumption of vegetables, encouraging balance and variety in their child's diet, modelling healthy eating, using pressure, as well as children's food fussiness, enjoyment of food, and mood. A final model was identified where children's age, their caregivers' vegetable consumption, children's food fussiness, caregivers' general efforts to involve their child in meal choice and preparation, and use of non-food rewards explained 49% of the variance in children's consumption of vegetables ($F(4,216)= 8.94$, $p<.001$). Again, child age was not a significant predictor in this model. The contribution of the predictors in the final stage of the regression model can be seen in Table 7.8.

Table 7.8: Stepwise regression model of predictors of children's vegetable consumption, as reported by caregivers, with confidence intervals in parentheses

	<i>B</i>	<i>SE B</i>	β	<i>p</i>
Step 5				
Child age	0.06 (-0.47, 0.16)	0.54	0.54	0.28
Caregivers' vegetable consumption	0.51 (0.43, 0.59)	0.04	0.60	0.00
CEBQ food fussiness	-3.99 (-5.55, -2.43)	0.79	-0.26	0.00
CFPQ Involvement	1.54 (0.27, 2.80)	0.64	0.12	0.02
Other rewards frequency	-1.16 (-2.26, -0.06)	0.56	-0.10	0.04

CEBQ: Children's Eating Behaviour Questionnaire

CFPQ: Comprehensive Feeding Practices Questionnaire

7.4 Discussion

The first aim of the current study was to investigate which methods of offering vegetables caregivers perceive as successful at promoting vegetable intake. Second, it aimed to explore whether frequency of reoffering of vegetables is associated with the methods used to offer vegetables, caregiver vegetable intake, feeding practices and perceived influences on offering or consumption (including child eating behaviours). The third aim was to investigate whether children's consumption of vegetables is associated with methods of offering vegetables, caregiver intake of vegetables, feeding practices and perceived influences on offering or consumption (including child eating behaviours). The final aim of the study was to assess which factors could best predict (a) caregivers frequency of reoffering of previously rejected vegetables and (b) children's consumption of vegetables.

Caregivers in this study perceived a number of methods of offering vegetables as successful for increasing their child's vegetable consumption. These methods were modelling eating vegetables, using encouragement or pressure, involving their child in vegetable choice and preparation, hiding vegetables within other foods, and presenting vegetables in different forms. Previous research supports the use of modelling to increase consumption of new foods (e.g., Hendy & Raudenbush, 2000), with caregivers frequent use of modelling an encouraging sign of caregivers using adaptive methods to encourage consumption. Presenting foods in different forms or using different preparation methods to encourage acceptance has also been supported by previous research (Poelman & Delahunty, 2011). Although hiding vegetables within foods can increase their consumption (e.g., Spill, Birch, Roe, & Rolls, 2011), this may only relate to consumption of the hidden vegetables, rather than consumption in general (Pescud & Pettigrew, 2014). Although caregivers in this study reported use of encouragement or pressure as successful for getting their child to eat vegetables, use of pressure to eat has been linked to lower consumption of the pressured food (Galloway, Fiorito, Francis, & Birch, 2006). Here, it is likely that use of pressure may demonstrate short-term success for the caregivers (i.e. child tried a mouthful) but may not be fostering children's long-term liking for that food.

Caregivers tended to agree that threats were not successful for encouraging children's consumption of vegetables and this was one of the least commonly reported methods of encouraging consumption. This supports previous research where a more controlling or authoritarian feeding style has been associated with lower vegetable consumption (Patrick et al., 2005). Caregivers also agreed that compromise was not successful for

encouraging children to eat vegetables, and this was the least commonly used method. However, it is possible that although garnered from a previous study (Chapter 6), the example given for compromise (*'e.g. letting your child eat their dessert first'*) was not representative of commonly used compromising in relation to vegetable consumption. The use of rewards to encourage consumption is a practice parents frequently report using (e.g. Birch & Fisher, 1998; Moore, Tapper, & Murphy, 2007), but was one of the less commonly used methods among caregivers in the current study. Moreover, caregivers were divided as to whether food rewards and non-food rewards were successful methods of encouraging consumption, which aligns with existing research findings. Use of food rewards can result in an increased liking for the reward food and decreased liking of the target food (see Cooke, Chambers, Añez, & Wardle, 2011, for a review). On the other hand, non-food rewards have shown success for increasing both liking and consumption of foods (e.g. Añez et al., 2013; Holley et al., 2014: Chapter 3). Caregivers' mixed opinions on the efficacy of rewards may be due to knowledge of some of these findings, or due to fears over rewards backfiring, where using rewards to encourage a child to eat foods could result in lower consumption or children demanding rewards in order to consume foods.

Examination of the influences which are related to caregiver reoffering found that time, waste and cost were all significantly associated with lower caregiver reoffering of rejected vegetables. This is in line with both previous research and the study hypothesis. Research by Drewnowski et al. (2004) asserts that a diet high in fruits and vegetables does indeed cost more than a diet higher in sugars, and it appears that this increased cost can present a barrier to offering among UK populations. Previous research also states that time can be a barrier to increasing vegetable consumption (Kearney & McElhone, 1999; Kilcast et al., 1996, see chapter 5 for further discussion of this). This suggests that providing caregivers with time and money saving tips for vegetable preparation may be a viable method for increasing reoffering of vegetables.

Caregiver factors were also associated with caregivers reoffering previously rejected vegetables. Caregivers' acceptance of their child's consumption of vegetables and frustration over possible rejection were associated with lower reoffering of disliked vegetables. Here, it is possible that educating caregivers on the efficacy of repeated exposure could help to alleviate their frustration, increasing reofferings.

Findings from this study also suggest that child factors can play a role in the number of times caregivers reoffer rejected vegetables to their child, where caregivers who were

influenced by their child's mood and tantrums reoffered vegetables fewer times. Contrary to predictions and previous research (e.g. Tan & Holub, 2012), children's food fussiness did not significantly correlate with the number of times caregivers reoffered disliked vegetables to their child. Although previous research has found an association between higher food fussiness and parents providing a less healthy home environment (Tan & Holub, 2012), it is possible that other factors, such as caregivers' acceptance over their child's vegetable consumption, are more important factors in caregivers' reoffering of disliked vegetables.

As there were a number of factors that were significantly related to caregivers' reoffering of previously rejected vegetables, this study explored the strongest statistical predictors of reoffering. Modelling of vegetable consumption and healthy eating in general, as well as caregivers' acceptance of their child's consumption of vegetables, were the best statistical predictors. This highlights the central role of caregivers modelling eating behaviours and opinions of their child's eating behaviours in caregivers' feeding decisions. In turn, this emphasises the need for further caregiver education on the success of repeated exposure for increasing children's consumption of vegetables, which could remove caregivers' resignation to their child's current consumption.

As well as investigating influences on caregivers' reoffering of rejected vegetables, this study sought to explore factors associated with children's consumption of vegetables. As hypothesised, children who had greater enjoyment of food and were less fussy with food in general consumed more vegetables. This replicates findings from studies with older children (Cooke et al., 2004; Galloway et al., 2005) and highlights that even young children's general eating behaviours are related to their consumption of vegetables. Furthermore, caregivers' consumption of vegetables was strongly associated with children's consumption, which is in line with both the hypotheses and previous research (Fisher et al., 2002; Palfreyman et al., 2014).

In addition to exploring which methods caregivers perceive as successful, it is important to investigate which methods are associated with children's consumption of vegetables. Numerous adaptive caregiver feeding practices were associated with children consuming more vegetables including modelling of healthy eating and involving children in meal choice and preparation. This supports and extends previous research which suggests that adaptive feeding practices in general are associated with

healthier diets in children (Vereecken et al., 2010), including studies conducted in other cultures (e.g., Melbye et al., 2013).

In line with previous research on controlling feeding practices and the study's hypotheses, pressure to eat was associated with lower consumption of vegetables in children (e.g. Galloway, Fiorito, Francis, & Birch, 2006), though it is important to consider that use of pressure may be a response to low consumption of vegetables, as well as a possible cause or influence on low consumption (see section 1.3.2 for further discussion of this). Other feeding practices were also associated with lower consumption of vegetables, including use of food and other (non-food) rewards. However, previous research on non-food rewards seem generally positive (e.g. Añez et al., 2013; Cooke et al., 2011; Holley et al., 2014: Chapter 3). It is possible that these conflicting findings arise from the way in which caregivers use non-food rewards, with the low reported frequency of use of rewards suggesting that caregivers do not have faith in the ability of rewards to encourage consumption of vegetables. Here, further information for caregivers about how and when non-food rewards are best used may be a useful addition to literature and support resources for achieving greater vegetable consumption in young children.

As there were a number of factors that were significantly related to children's consumption of vegetables, this study explored the strongest predictors of children's consumption. The strongest statistical predictors of children's consumption of vegetables were caregivers consuming more vegetables, children being less fussy with food in general, caregivers involving children in food choice and preparation, and caregivers using fewer non-food rewards to encourage consumption. This denotes that not only is caregiver consumption related to child consumption of vegetables (as suggested in previous research), but that this association is particularly important. This suggests that whole family interventions which aim to increase caregiver intake of vegetables are most likely to be successful. This also highlights the importance of child factors such as food fussiness in determining their eating behaviour, which may well influence the methods which caregivers use to offer their child vegetables.

Looking at the analyses together, it is possible to see discrepancies between the methods which caregivers perceive as successful for encouraging consumption of vegetables and those which are associated with children's reported vegetable consumption. Firstly, caregivers were unsure as to whether food and non-food rewards were successful for increasing consumption but use of these methods was associated

with lower consumption of vegetables. Caregivers also believed that hiding was a successful method to achieve consumption but hiding vegetables was again associated with lower consumption. Lastly, caregivers reported that pressure/encouragement (e.g. “one more bite”) was successful for achieving consumption whilst general use of pressure to eat was associated with lower consumption. These discrepancies may suggest that for some children these methods are more effective than for others, or the fact that certain methods are effective at increasing consumption in the short-term, but not sustained liking and consumption of vegetables in the longer-term.

This is the first known study to investigate a variety of methods of offering, influences on offering and children’s consumption of vegetables. Furthermore, this study compares caregivers’ perceptions of which methods work with associations between these methods and reported consumption. This has allowed for the identification of discrepancies between these two measures of ‘success’, which has not been achieved in previous literature. Taken together, the findings of this study suggest that the provision of information for caregivers wanting to achieve a diet with adequate vegetables for their child should cover a number of facets. First, it should provide tips on how to prepare vegetables in a variety of quick and easy ways. Second, it should inform caregivers of the most successful ways to use non-food rewards in order to increase consumption of vegetables in children. Third, it should provide information about the necessity of perseverance with reoffering in order to achieve acceptance of vegetables, so as to prevent caregivers becoming resigned to their child’s limited consumption. Finally, it should include information on avoiding using controlling methods of feeding children vegetables, which may be successful for achieving short-term gains but not establishing long-term healthy habits. Instead, caregivers should be educated on the relative long-term benefits of using more adaptive feeding methods.

This study has a number of strengths and limitations. This is a novel study which draws together a body of previous research and allows comparison between caregivers’ opinions and cross-sectional investigation of which methods of offering work. This study also has a large sample, allowing investigation of the large number of methods and influences which previous studies have identified (e.g. Chapter 6). However, due to its cross-sectional nature, causality cannot be determined and this study relied on self-report measures of caregiver and child vegetable consumption, which may not be wholly accurate. This study also recruited a relatively homogenous sample, and further research should seek to extend these findings with families from other cultures and socio-economic groups.

This study revealed that child factors, such as their level of food fussiness, can be related to their consumption of vegetables. Although there was no direct association between food fussiness and caregivers' reoffering of vegetables, it is likely that child factors influence the methods which caregivers employ to feed their child. Future research should seek to further explore the influence of child factors such as temperament on caregivers' feeding of vegetables.

In conclusion, this study outlines the importance of caregiver and child factors in both caregivers' reoffering, and children's consumption, of vegetables. Future interventions to increase vegetable intake in children might benefit from providing specific information to caregivers about the practices and behaviours which may be most likely to promote success and improve children's vegetable consumption.

Chapter 8

Chapter 7 aimed to assess which methods of offering vegetables caregivers perceive to be successful at encouraging vegetable intake in their children. It also aimed to investigate whether caregivers' reoffering of vegetables was related to child, caregiver, or external factors. Finally, it investigated the relationships between children's consumption of vegetables and child, caregiver, and external factors. Modelling of vegetable consumption and healthy eating in general, as well as caregivers' acceptance of their child's consumption of vegetables, were strong predictors of caregivers reoffering vegetables. Conversely, caregivers consuming more vegetables, children being less fussy with food in general, caregivers involving children in food choice and preparation, and caregivers using fewer non-food rewards to encourage consumption were all significant predictors of children's consumption of vegetables. With children's level of food fussiness being highly associated with children's vegetable consumption, Chapter 8 aimed to investigate whether children who are defined as fussy or not fussy with vegetables differ on a number of factors. These factors were (1) caregivers' frequency of reoffering previously rejected vegetables; (2) the methods caregivers use to offer vegetables; (3) the general feeding practices caregivers use; (4) children's consumption of vegetables; and (5) these children's general eating behaviours.

Chapter 8: Investigating differences between children who are fussy or not fussy with vegetables: feeding practices, eating behaviours and methods of offering vegetables

Investigating differences between children who are fussy or not fussy with vegetables: feeding practices, eating behaviours and methods of offering vegetables.

8.1 Introduction

A number of previous studies have investigated the general feeding practices which caregivers employ with their children (e.g., Blissett & Farrow, 2007; Gregory, Paxton, & Brozovic, 2010; Haycraft & Blissett, 2008; Musher-Eizenman & Holub, 2007). This research suggests that while some feeding practices (such as modelling and involving children in food choice and preparation) are successful for achieving healthy eating behaviour and food choice in children, others appear to be more detrimental (e.g., pressure to eat and restriction; Vereecken, Rovner, & Maes, 2010). Previous research also suggests that child factors may play a role in their eating habits (e.g., Wardle, Guthrie, Sanderson, & Rapoport, 2001; Webber, Hill, Saxton, Van Jaarsveld, & Wardle, 2009). With this in mind, it is of interest to explore the potential impact which children's eating behaviours might have on the practices which caregivers employ with their children; not only for feeding in general, but with specific reference to when feeding children vegetables. Vegetable consumption is low in children (Lennox et al., 2011) and so it is possible that caregivers will use different feeding strategies with children who will readily eat vegetables than with those who won't.

One child factor which is sometimes related to children's vegetable intake is neophobia. Neophobia is an evolutionary trait which results in children rejecting or refusing foods, particularly those which are new or less familiar (Birch & Fisher, 1998). It commonly expresses itself when children are around two years of age, as they become more mobile, and gradually declines through childhood (Addessi et al., 2005). Research suggests that children's food fussiness and neophobia are related to not only the methods which caregivers use to feed their children, but also children's consumption of vegetables. Mothers of fussy children have reported that they are less likely to make healthy food readily available for their children (Tan & Holub, 2012). Furthermore, parents have been shown to use more ineffective feeding behaviours, such as restriction and force feeding, when their children have high levels of neophobia or unhealthy food preferences (Russell et al., 2015). Conversely, parents of children with healthy diets have been found to use more encouragement and involvement around

healthy eating, and are less indulgent about providing alternative foods (Russell et al., 2015). Research also indicates that fussy children consume fewer vegetables than not fussy children (Galloway, Fiorito, Lee, & Birch, 2005), while children who enjoy food more tend to consume more vegetables (e.g., Cooke et al., 2004). Thus it appears that child factors can be an important determinant of children's vegetable consumption and may also impact upon parents' offering of vegetables.

This study aimed to investigate whether there are differences between children defined as fussy or not fussy by their caregivers in terms of: (1) caregivers' frequency of reoffering previously rejected vegetables; (2) the methods caregivers use to offer vegetables; (3) the general feeding practices caregivers use; (4) children's consumption of vegetables; and (5) these children's general eating behaviours. It was hypothesised that children who are perceived to be fussy would be reoffered rejected vegetables fewer times and consume fewer vegetables than children who are not fussy. It was also hypothesised that caregivers of fussy children would consume fewer vegetables, use more pressure and controlling feeding practices, and that enjoyment of food would be lower in children reported to be fussy.

8.2 Methods

8.2.1 Participants

Caregivers who played a central role in feeding their 2 to 4 year-old child were invited to take part in questionnaire study (Chapter 7). In total, 297 caregivers took part.

8.2.2 Procedure

Ethical clearance was obtained for this study from the Loughborough University Institutional Review Board. Caregivers were recruited from 17 toddler groups across Leicestershire as well as via University noticeboards and social and local media. Full details of the recruitment procedure are provided in Section 7.2.3. Caregivers gave full informed consent before completing the study pack and were informed of their right to withdraw at any time.

8.2.3 Measures

A number of constructs surrounding caregiver offering of vegetables were measured in this study. These were derived from a previous qualitative study (see Chapter 6), and assessed using a combination of developed measures and questions written

specifically for the purposes of a previous questionnaire study (see Chapter 7 for details).

8.2.3.1 Comprehensive Feeding Practices Questionnaire (CFPQ; Musher-Eizenman & Holub, 2007; Appendix E)

Caregivers' feeding practices were assessed using the CFPQ. Five subscales from this questionnaire were used in this study: caregivers' use of pressure, Modelling, Healthy home environment, Encourage balance and variety and Involvement. Responses are rated on a five-point scale and higher mean scores on the subscales indicate greater use of that feeding practice. For a full description of these subscales and their reliability see section 7.2.4.1.

8.2.3.2 Children's Eating Behaviour Questionnaire (CEBQ; Wardle, Guthrie, Sanderson, & Rapoport, 2001; Appendix G)

Children's eating behaviours were measured using the CEBQ. Four of its subscales were administered to measure children's: food fussiness; food responsiveness; slowness in eating; and, enjoyment of food. Responses are provided using a five-point scale with higher mean scores indicating a higher level of that eating behaviour. Further description of these subscales and their reliability can be found in section 7.2.4.2.

8.2.3.3 Measuring caregiver and child vegetable consumption: Brief Food Frequency Questionnaire (FFQ; Cooke et al., 2003; Appendix J)

An adapted version of Cooke et al.'s FFQ was used to measure caregivers' and children's vegetable consumption. Caregiver and child intake of three food categories were assessed: raw vegetables; cooked vegetables; and salad. Responses report how many portions of each category are consumed per week, where summing of these three responses allows assessment of total vegetable consumption per week. For a full description of this adapted version of the FFQ see section 7.2.4.3.

8.2.3.4 Caregivers' frequency of use of methods of offering vegetables (Appendix L)

A number of questions were written for the study to ascertain how often caregivers used a number of methods to encourage their child to eat vegetables (see section 7.2.4.4.2). Caregivers were asked to report how often they used each method, with responses ranging from 'never' to 'always'. These methods were modelling of eating vegetables, using food rewards, using non-food rewards, issuing threats, using

encouragement or pressure, playing games with/relating to food, involving their child in vegetable/meal choice/preparation, hiding vegetables in with other foods, using compromise, and reoffering vegetables in different forms. Raw scores for these questions were used in analyses.

8.2.3.5 *Identifying children as fussy/not fussy with vegetables* (Appendix N)

In order to enable comparison of 'fussy' versus 'not fussy' children, two groups were created using responses to a single item asking "*Do you have difficulty getting your child to eat vegetables?*" with responses given on a four point scale (never, occasionally, often, always).

8.2.4 **Data analysis**

A series of Kolmogorov-Smirnov tests showed that all of the study's variables were not normally distributed, therefore non-parametric tests were employed to test the study's hypotheses. Responses to the question "*Do you have difficulty getting your child to eat vegetables?*" were used to identify caregivers who: (1) reported having no difficulty getting their child to eat vegetables (children who were not fussy, $n=56$) and (2) those who reported often or always having difficulty (fussy children, $n=78$). In the interest of drawing two distinct groups of dyads, caregivers who reported occasionally having difficulty getting their child to eat vegetables were not included in the analyses reported on for this study. Mann-Whitney U tests were then used to investigate differences between these groups in the number of reofferings of rejected vegetables caregivers make, the amount of vegetables these children consume, the methods of offering vegetables that caregivers use, the general feeding practices caregivers use, and children's general eating behaviours. Due to the large number of analyses being conducted, a more stringent alpha of $p<.01$ was utilised.

8.3 **Results**

8.3.1 **Sample**

Caregivers were predominantly mothers ($n=125$), with one adoptive mother, two fathers, five child-minders or nannies, and one grandparent also recruited. Caregivers' age ranged from 22.7 to 57.3 years ($M=35.4$; $SD=5.69$) with child age ranging from 20.0 to 62.0 months ($M=37.0$; $SD=9.94$). Caregivers were predominantly of White ethnicity ($n=121$), with five caregivers reporting as Asian/Asian British, one as Black/Black British, three as Chinese, one as mixed ethnicity, one identifying as 'other' and two caregivers not reporting their ethnicity. Sixty-two percent of the caregivers in

this study were educated to university level or higher (n=83) with 38% educated below University level (n=50).

8.3.2 Investigating differences in reoffering of vegetables to, and consumption of vegetables by, children categorised as either fussy or not fussy with vegetables

There was no significant difference in the number of times children defined as fussy or not fussy were reoffered rejected vegetables (Mdn=11.00 and Mdn=10.50 respectively, $U=1964.00$, $z = -.52$, $p=.30$). However, weekly vegetable consumption was significantly higher amongst children who caregivers reported as not fussy (Mdn=21.00 portions) compared to children who were reported as fussy (Mdn=8.00 portions, $U=791.50$, $z=-5.76$, $p<.001$). Furthermore, there was no significant difference in caregivers consumption of vegetables between caregivers of children defined as fussy or not fussy (Mdn=19.24 and Mdn=24.00 respectively, $U=1637.50$, $z= -1.74$).

8.3.3 Differences in children's eating behaviours, general caregiver feeding practices, and the frequency of methods used by caregivers to encourage not fussy versus fussy children to eat vegetables

A series of Mann-Whitney U tests were run to assess differences in the frequency of methods of offering between caregivers of children who were categorised as either not fussy or fussy with vegetables (Table 8.1). Caregivers of children who were fussy with vegetables used significantly more food and non-food rewards, more encouragement/pressure to eat vegetables, and hid vegetables within foods more frequently than caregivers of children who were not fussy.

There were no significant differences in the general feeding practices used by caregivers according to how fussy with vegetables caregivers perceived their children to be. However, children who were classified as fussy were significantly less responsive to food, showed significantly lower enjoyment of food, were fussier with food, and slower eaters when compared to children who were not fussy (Table 8.1).

Table 8.1: Mann-Whitney U tests examining differences in children's eating behaviours, general caregiver feeding practices, and frequency of methods used by caregivers to offer vegetables to not fussy (n=50) and fussy (n=73) children.

	Not fussy (Mdn)	Fussy (Mdn)	U	z	P
Vegetable specific feeding practices					
Modelling	5.00	5.00	2081.50	-.043	0.48
Food rewards	2.00	3.00	1222.50	-2.97	0.00
Other rewards	1.00	2.00	1215.50	-2.89	0.00
Threats	1.00	1.00	1480.00	-1.21	0.11
Encouragement/pressure	3.00	4.00	1596.00	-2.46	0.01
Games	2.00	3.00	1798.50	-0.57	0.29
Involvement	3.00	3.00	1779.00	-1.31	0.10
Hiding	2.00	3.00	1035.00	-4.50	0.00
Compromise	1.00	1.00	1489.50	-1.98	0.02
Different forms	3.00	3.00	1538.00	-1.96	0.03
General feeding practices					
CFPQ Pressure	3.25	3.25	2034.50	-0.84	0.20
CFPQ Involvement	3.50	3.33	2192.50	-0.14	0.45
CFPQ Encouraging balance and variety	4.75	4.50	1815.00	-1.85	0.03
CFPQ Modelling	4.50	4.50	2094.00	-0.60	0.28
CFPQ Environment	4.00	3.67	2007.50	-0.97	0.17
Children's eating behaviours					
CEBQ Food responsiveness	2.80	2.40	1649.50	-2.56	0.01
CEBQ Enjoyment of food	4.50	3.50	975.50	-5.59	0.00
CEBQ Food fussiness	2.00	3.33	281.50	-8.66	0.00
CEBQ Slowness in eating	2.50	3.00	1345.00	-3.93	0.00

CFPQ: Comprehensive Feeding Practices Questionnaire

CEBQ: Children's Eating Behaviour Questionnaire

Significant differences are presented in bold

8.4 Discussion

The study aimed to investigate whether there were differences between children defined as fussy or not fussy by their caregivers in terms of (1) the number of times they were reoffered previously rejected vegetables, (2) the methods their caregivers use to offer them vegetables, (3) the general feeding practices their caregivers use with them, (4) their consumption of vegetables, and (5) their general eating behaviours. It was hypothesised that fussy children would be reoffered rejected vegetables fewer times and consume fewer vegetables than not fussy children. It was also hypothesised that caregivers of fussy children would consume fewer vegetables, use more pressure and controlling feeding practices, whilst fussy children would have lower enjoyment of food. These hypotheses were partially supported.

It was found that while fussy and not fussy children were reoffered vegetables an approximately equal number of times, fussy children were reported to consume

significantly fewer vegetables. There were no significant differences between these two groups in the general feeding practices caregivers used (including pressure to eat), or in caregivers' consumption of vegetables. However, caregivers with fussy children used more rewards and pressure specifically when reoffering vegetables, and hid vegetables more frequently than did caregivers with not fussy children. Finally, fussy children were less responsive to food, demonstrated lower enjoyment of food, had higher levels of general food fussiness, and were reported to be slower eaters.

Contrary to the study hypotheses and previous research suggesting a relationship between parental and child consumption of vegetables (e.g., Cooke et al., 2004; Palfreyman et al., 2014), caregivers of fussy children did not eat fewer vegetables than caregivers of not fussy children. Although unexpected, this finding may be promising when considering how best to tackle fussy children's consumption of vegetables as it suggests that caregivers may be similarly prepared to make vegetables available within the home and consume vegetables in front of their child regardless of how fussy their child is.

The children who were reported as being 'fussy' about vegetables in this study were also reported to have higher general food fussiness and lower consumption of vegetables than 'not fussy' children. This is in line with previous research where children who are higher in neophobia also seem to be fussier eaters, and consume less fruits and vegetables (Wardle et al., 2005). Interestingly, children in this study were reoffered rejected vegetables a similar number of times, regardless of whether their caregiver perceived them as difficult to feed vegetables. This is counter to research by Tan and Holub (2012), where mothers of children high in neophobia reported not making healthy foods readily available for their children. However, it should be noted that although difficulty getting children to eat vegetables may be common in children with high levels of neophobia, it is not certain that the fussy children in this sample are high in neophobia.

In a qualitative study conducted by Russell et al. (2015), strategies used by caregivers of children with healthy food preferences, unhealthy food preferences and high levels of neophobia were compared. Caregivers of children with unhealthy food preferences and caregivers of children with high levels of neophobia reported hiding disliked foods while caregivers of children with healthy preferences did not. Furthermore, caregivers of the fussy and neophobic children reported regularly using rewards or bribes to influence their child's food preferences, while caregivers of children with healthy

preferences used these less often. The current study builds on this qualitative research by providing large scale quantitative data, and investigating these relationships with specific reference to vegetables. No methods of offering were more commonly used with the not fussy groups compared to the fussy group. This suggests that rather than caregivers of not fussy children using more adaptive and successful methods, caregivers of fussy children seem to use additional practices which may be less successful, possibly as alternatives once other methods have failed. One such method is the use of pressure to encourage children to eat vegetables. This practice has been shown in previous research to lead to lower consumption of the pressured food (Galloway et al., 2006), indicating the detrimental effect this could have on children's consumption of vegetables. The finding that caregivers of fussy children use methods such as pressure and hiding vegetables may also be indicative of these caregivers using methods which may achieve short-term consumption, rather than long-term changes in food preferences. This finding is particularly significant, and as well as caregivers being informed of methods for successfully achieving consumption in their children, education for which methods to avoid may be appropriate, particularly amongst caregivers with children who are fussy eaters.

This study is novel in that it makes a quantitative comparison of caregivers' use of feeding practices with children who are fussy and not fussy consumers of vegetables. The relatively large sample allows comparison between these groups on a number of caregiver and child factors, as well as children's vegetable consumption. This study also extends the findings of previous qualitative research (e.g., Russell et al., 2015; Chapter 6). However, the caregiver-reported nature of these data prevents true classification of these children as either fussy or not fussy with vegetables, and caregivers' reported feeding practices may also not be wholly representative.

In conclusion, this study highlights the significant role that child characteristics such as their fussiness with vegetables can play in the methods which caregivers use when reoffering vegetables. It also underlines the substantial influence that child characteristics can have on children's consumption of vegetables. The findings of this study suggest that information given to caregivers should provide advice on which feeding practices to avoid when faced with a child who is fussy with vegetables, particularly where these practices may further hinder children's consumption of vegetables.

Chapter 9: General discussion

General discussion

9.1 Introduction

The closing Chapter of this thesis provides an overview and discussion of the results from the empirical chapters (Chapters 3 to 8) of this thesis. First, the aims of the thesis (as stated in Section 1.5.1), will be recapped. Second, the results relating to these aims will be summarised and discussed. Third, the methodological strengths and weaknesses of the thesis will then be outlined, along with suggestions for future directions. The chapter will then close with a summary of the conclusions which can be drawn from the research reported on within this thesis.

9.2 Aims of the thesis

The over-arching aim of this thesis was to investigate possible ways of increasing vegetable consumption in preschool children, with an emphasis on parents/primary caregivers as facilitators. This aim was addressed in two parts. The first part investigated the efficacy of an intervention for parents to implement to promote vegetable consumption in their children and explored the short and long-term efficacy of this intervention. The second part gathered information on the effective methods naturally used by caregivers with a view to using this to help improve available information for parents aimed at increasing children's vegetable consumption.

This thesis also had a number of specific aims which are restated below, along with the relevant chapter numbers.

Part I

1. To investigate the efficacy of a parent led home-based intervention for increasing children's consumption and liking of a disliked vegetable (Chapter 3).
2. To investigate whether parent and child factors play a significant role in the outcome of a parent led home-based intervention (Chapter 4).
3. To investigate whether increases in liking and consumption of vegetables resulting from a parent led home-based intervention can be maintained longitudinally (Chapter 5).

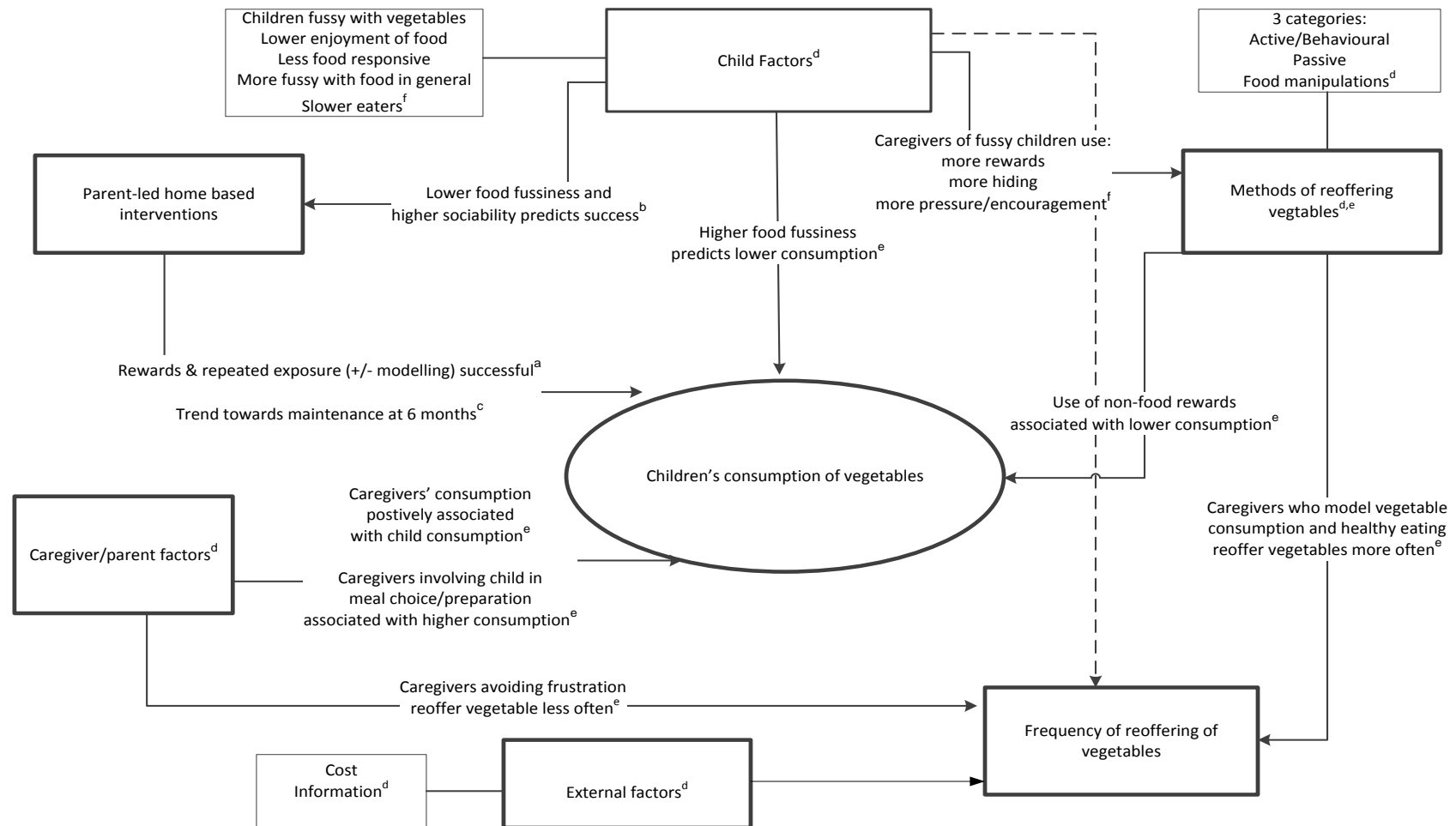
Part II

4. To investigate which methods caregivers use to offer vegetables to their children (Chapters 6 & 7).
5. To investigate caregivers' perceived barriers to offering vegetables to their children (Chapter 6).
6. To investigate which methods of offering vegetables caregivers use and perceive as successful (Chapter 7).
7. To investigate whether caregivers' reoffering of vegetables are related to child, caregiver, or external factors (Chapter 7).
8. To investigate the relationships between children's consumption of vegetables and child, caregiver and external factors (Chapter 7).
9. To explore differences between children who are fussy and not fussy with vegetables on a number of caregiver and child factors (Chapter 8).

9.3 Summary of results

9.3.1 *Pathways tested and relationships found*

A summary of the pathways identified between factors investigated within this thesis and children's consumption of vegetables can be seen in Figure 10.1. These pathways are discussed in more detail in Section 9.3.2.



-----> Relationship inferred from qualitative research but not supported by regression analyses

^a Chapter 3; ^b Chapter 4; ^c Chapter 5; ^d Chapter 6; ^e Chapter 7; ^f Chapter 8

Figure 10.1 Model to show the relationships found in this thesis between various factors investigating children's consumption of vegetables

9.3.2 Summary of chapter findings

A chapter-by-chapter breakdown of the findings of the studies presented in this thesis is outlined below.

9.3.2.1 Chapter 3: *'Why don't you try it again?'* A comparison of parent led, home-based interventions aimed at increasing children's consumption of a disliked vegetable

Previous research suggests that repeated exposure may be an effective method for increasing children's liking and consumption of disliked vegetables (see Cooke, 2007, for a review). Furthermore, 14 day interventions for increasing children's liking and consumption of vegetables which include a reward element have shown promising findings (e.g., Corsini, Wilson, Kettler, & Danthiir, 2010; Remington, Añez, Croker, Wardle, & Cooke, 2012). School-based repeated exposure interventions which include rewards and peer-modelling have also shown promise (e.g., Lowe, Horne, Tapper, Bowdery, & Egerton, 2004), but are costly to implement and may miss the earliest window for improving children's intake of vegetables. Moreover, previous parent led repeated exposure interventions have not explored the possible utility of parent models. Chapter 3 sought to build on previous research by replicating and extending investigations into the efficacy of parent led home-based interventions with the additional inclusion of a modelling element.

Chapter 3 investigated the efficacy of four versions of a 14-day parent led home-based repeated exposure intervention. The four versions of this intervention were repeated exposure; modelling and repeated exposure; rewards and repeated exposure; or modelling, rewards and repeated exposure. The findings of Chapter 3 support previous research, suggesting that parent led home-based interventions may well be successful for increasing children's liking and consumption of a previously disliked vegetable (e.g., Wardle et al., 2003). Post-intervention liking and consumption were significantly higher among the modelling, rewards and repeated exposure group and the rewards and repeated exposure group when compared to the control group. Furthermore, the modelling, rewards and repeated exposure group and the rewards and repeated exposure groups achieved almost twice as many tastings over the intervention period when compared to the modelling and repeated exposure or repeated exposure groups. This suggests that rewards such as stickers are an important component of these interventions, where rewards may help to encourage children to make the tastings necessary to accept previously disliked vegetables. Indeed, other such studies have also found that an intervention with a reward component helped children to achieve

significantly more tastings than an exposure alone intervention (Corsini et al., 2013). These findings support a body of previous research which also promotes the use of rewards to encourage tasting of food, as well as using rewards as a central component of such interventions (e.g., see Cooke, Chambers, Añez, & Wardle, 2011, for a review).

A combined programme of modelling and repeated exposure without the use of rewards was not successful for increasing children's liking or consumption of a disliked vegetable when compared to a control group. This is counter to previous research, where parental modelling has been suggested as effective for increasing children's vegetable consumption (e.g., Palfreyman, Haycraft, & Meyer, 2014; Pearson, Biddle, & Gorely, 2009; Tibbs et al., 2001). Although this suggests that modelling alone may be unsuccessful for achieving the tastings necessary to increase children's liking and consumption, this may be because this condition was inadvertently made to be unnatural. Under day-to-day conditions parents might automatically praise their child for tasting foods, while parents in this study were specifically instructed to remain neutral during tastings (in order to unpack the effects of modelling from those of rewards). Furthermore, children may have found their parents modelling to be contrived, which may have limited the impact of this modelling.

Repeated exposure alone was not found to be successful for increasing children's consumption or liking of a disliked vegetable. While previous research has found repeated exposure to be successful (e.g., Cooke, 2007), it is known that only taste exposures can increase acceptance of a food (Birch et al., 1987), and children in the repeated exposure group achieved half the number of tastings as the more successful groups. With this in mind, it is likely that other methods need to be employed in order to encourage children to make the tasting necessary to reach acceptance of a disliked vegetable.

In summary, Chapter 3 found that a 14 day repeated exposure intervention including rewards, with or without the inclusion of parental modelling, can successfully increase children's liking and consumption of a disliked vegetable. It further found that neither repeated exposure alone nor parental modelling with repeated exposure are sufficient for altering children's acceptance of a previously disliked vegetable. These findings suggest that home-based parent led interventions may be a viable cost-effective alternative to school-based interventions. Furthermore, they hold promise for parents who do not eat meals with their child or who dislike vegetables, where parental

modelling of consumption among parents may not be necessary to achieve consumption in children.

9.3.2.2 *Chapter 4: Investigating the role of parent and child characteristics in intervention outcomes*

Both parent and child factors have previously been linked to children's fruit and vegetable consumption (e.g., Cooke & Wardle, 2005; Wardle, Carnell, & Cooke, 2005). However, it was not known what influence these parent and child factors may have on the outcome of interventions aimed at increasing children's consumption of disliked vegetables. Chapter 3 (Holley et al., 2014) focused on investigating the efficacy of a 14 day parent led home-based repeated exposure intervention aimed at increasing children's liking and consumption of a disliked vegetables. While the findings of this study suggested that 14 daily exposures to a disliked vegetable combined with either rewards or modelling and rewards can successfully increase both children's liking and consumption, significant increases in consumption across the intervention period were seen in all groups. Furthermore, there was a large degree of variability in post-intervention consumption within each group, suggesting that other factors may be influencing the outcome of these interventions.

With this in mind, Chapter 4 sought to investigate the role of parent factors (such as feeding practices) and child factors (such as eating behaviours and temperament) in intervention outcomes. No parental feeding practices were significantly associated with intervention outcomes. This could be because parents who volunteered to participate in the study were more likely to use particular feeding practices, resulting in the low variance in feeding practices seen in this study, or it could be that feeding practices were not relevant within the context of these interventions, as parents were instructed about how to offer their child the disliked vegetable and which methods to employ.

No significant relationships were found between child food approach behaviours and intervention outcomes, contrary to research by Caton et al. (2014) who found that consumption change across an intervention was predicted by children's enjoyment of food. However, the methods used in Caton et al.'s intervention which were additional to repeated exposure were flavour-flavour learning and flavour-nutrient learning, rather than parental modelling and rewards. It is possible and plausible that children's enjoyment of food may be more relevant to these two types of learning than the methods used in the intervention implemented in Chapter 3 and investigated in Chapter 4.

In line with Social Learning Theory (Bandura, 1977), children's sociability was significantly related to their consumption of the disliked vegetable post intervention, as well as being associated with greater increases in consumption across the intervention period. This association may be due to less sociable children having a reduced ability to learn through others (in this instance through parental modelling that vegetables are good to eat). Alternatively, more sociable children may be more susceptible to the influence of parent models or rewards. It is also possible that more sociable children are more prone to demand characteristics, where their desire to please their parents results in them making more advanced tastings of the vegetable which involve them consuming the vegetable, rather than merely sucking or biting the piece. No other aspects of child temperament were associated with intervention outcomes.

Children's food fussiness was significantly associated with intervention outcomes, where more fussy children consumed less of the target vegetable both pre and post intervention, but fussiness was not significantly associated with consumption change across the intervention. This suggests that fussiness impacts upon vegetable consumption more broadly rather than influencing intervention outcomes per se. This is further supported by the finding that although when combined with sociability food fussiness could predict intervention success, only sociability was a significant individual predictor of intervention success.

In summary, Chapter 4 found that home-based parent led repeated exposure interventions are likely to be more successful for children who are more sociable. With this in mind, interventions may be more suitable if tailored to children's temperament traits. Chapter 4 also indicates that food fussiness may have an overarching impact on children's consumption of vegetables. For fussy children, interventions may be better targeted at lowering their level of fussiness, rather than directly at increasing their consumption of vegetables.

9.3.2.3 *Chapter 5: Exploring the longitudinal efficacy of home-based parent led interventions aimed at increasing children's liking and consumption of a disliked vegetable*

In order for interventions aimed at increasing children's acceptance of vegetables to be of greatest benefit, changes in liking and consumption should be sustained across time. Although school-based interventions such as the 'Food Dudes' and 'Kids Choice' have shown to be successful in the short-term, support for the long-term efficacy of

these programmes has not been found (e.g., Hendy, Williams, & Camise, 2005; Upton, Upton, & Taylor, 2013). The one exception to this is Cooke et al.'s (2011) school-based study which investigated the potential for 12 daily offerings of a disliked vegetable paired with tangible or social rewards to increase liking and consumption of 4 to 6 year-old children. In this study changes in children's consumption of a target vegetable were seen in both reward groups and sustained at 3 month follow-up.

Chapter 5 sought to build on this previous research and that of Chapter 3 to investigate whether a home-based parent led repeated exposure intervention can result in sustained increases in children's liking and consumption of a target vegetable at two, six and 12 months post-intervention. Contrary to the findings of Chapter 3 (Holley et al., 2014), there were no significant differences in liking or consumption between any of the four intervention groups and the control groups at two, six or 12 months post-intervention. However, there was a trend towards higher vegetable consumption in children in the modelling, rewards and repeated exposure group and the rewards and repeated exposure group at six months post-intervention when compared to the control group. Post hoc power calculations determined that there was a lack of statistical power to detect effects similar to those seen in Chapter 3.

There were two main reasons for the lack of statistical power. First, participant attrition exceeded the 50% expected attrition which was accounted for in the original recruited sample. Participants were often uncontactable or could no longer accommodate the study into their day-to-day routine. Second, the effects detected in the original intervention study (Chapter 3) were small effects but the sample size recruited was based on detecting large effects. With this in mind, larger scale longitudinal studies should be conducted in order to determine the long-term efficacy of such interventions.

It should be noted that vegetable consumption increased markedly across the 12 month follow-up in all groups. This is likely due to the fact that by the end of the 12 month follow-up even children in the control group had received up to five exposures to the target vegetable, which can be considered a repeated exposure intervention in itself. In this way, the lack of between group differences during longitudinal follow-ups could be considered evidence for the efficacy of repeated exposure, rather than against the efficacy of these interventions. Indeed, research supports the use of repeated exposure for increasing children's acceptance of vegetables (see Cooke, 2007, for a review), with this study suggesting that previous estimates of 10 to 15 exposures to a

disliked food being necessary to achieve acceptance (Birch & Marlin, 1982; Sullivan & Birch, 1994) are perhaps higher than necessary.

In summary, though non-significant, the findings of a trend towards higher consumption at six months seen in Chapter 5 indicates that a home-based parent led repeated exposure intervention utilising rewards, with or without parental modelling, may be successful for achieving sustained increases in children's acceptance of disliked vegetables. In order to further explore this, future research should focus on testing such interventions longitudinally with larger samples, where small but significant (clinically relevant) increases in consumption could be detected.

9.3.2.4 Chapter 6: Investigating offering of vegetables by caregivers of preschool age children: A qualitative study.

It is known that simply providing a food for children does not guarantee its consumption, and that vegetables are commonly rejected by children. Chapter 6 sought to investigate the methods caregivers use to offer their children vegetables and the perceived barriers to caregivers offering vegetables. Although there are measures already developed to assess caregivers use of general feeding practices (e.g., the CFPQ - Musher-Eizenman & Holub, 2007), such measures have generally been developed with little input from caregivers and have not been developed specifically with methods used to feed children vegetables in mind. In response to this, Chapter 6 used a qualitative approach to develop a broad picture of the methods which caregivers use to offer their children vegetables and the barriers which they may encounter along the way.

The methods which caregivers in Chapter 6 reported using to encourage their child to eat vegetables formed three broad categories: active/behavioural methods; passive methods and food manipulations. Caregivers suggested a number of active/behavioural methods to be successful, an assertion supported by previous research. Two of these methods, modelling and non-food rewards have been successfully used in interventions (e.g., Holley et al., 2014: Chapter 3). Caregivers perceptions of use of authoritarian practices (such as pressure) being unsuccessful is also supported, where it's use has been linked to lower consumption of fruits and vegetables among children (Fisher et al., 2002). Caregivers also suggested passive methods of offering vegetables which are in line with previous literature (e.g., Cooke, 2007). Food manipulations suggested by caregivers as successful - such as hiding

vegetables and using sauces – are likely to be successful within a meal rather than achieving long-term acceptance. With this in mind, it may be useful for caregivers to use these food manipulations in combination with other methods proposed by caregivers. Here, methods such as hiding and sauces could be used to achieve short-term consumption, while methods such as serving vegetables in different forms and normalising vegetables may be more successful for achieving long-term acceptance.

The influences to caregivers offering fell into four categories: information; cost; caregiver factors and child factors. Caregivers in Chapter 6 reported a general lack of information about how to successfully offer children vegetables, a point also raised by researchers (e.g., Mitchell, Farrow, Haycraft, & Meyer, 2013). Caregivers also raised cost (whether financial, time or effort) as a central influence to their offering of vegetables. This suggests a possible utility of resources for caregivers on how to cook vegetables simply and prepare in bulk, methods previously reported as used by high vegetable consumers (Kilcast et al., 1996). Caregivers raised a number of personal factors as influential to their offering, including their own tastes, and acceptance over their children's rejection of vegetables, which may prevent them from reoffering. One solution to this could be the provision of information on the success of repeated exposure (Cooke, 2007). Caregivers in Chapter 6 expressed concern about creating greater feeding difficulties by persisting in offering vegetables when their child became upset. To combat this caregivers could be educated about the appropriate level of persistence to use when offering, where it is known that repeated exposure is necessary for acceptance (Cooke, 2007) but that excess pressure has been associated with lower preferences for vegetables (Galloway et al., 2006, 2005).

In summary, Chapter 6 outlined a wide variety of methods of offering employed by caregivers of young children. The findings suggested that information for caregivers on how to successfully offer vegetables to their young children could be used to overcome a number of the influences to offering outlined in this study. However, in order to achieve this, quantitative information on the impact of methods of offering and influences on offering was deemed necessary.

9.3.2.5 *Chapter 7: If at first you don't succeed: Methods used by caregivers to reoffer vegetables to preschool age children*

With it known that children need to try rejected foods (including vegetables) a large number of times in order to accept them (e.g., Birch & Marlin, 1982; Birch, Gunder,

Grimm-Thomas, & Laing, 1998; Sullivan & Birch, 1990), it is necessary to consider the influences to caregivers reoffering of vegetables, as well as which methods of offering are successful. Using a quantitative cross-sectional approach, Chapter 7 investigated associations between a number of caregiver, child and external factors and caregivers' reoffering of vegetables as well as children's consumption of vegetables.

A number of factors combined to produce a model which could predict caregivers reoffering of vegetables in Chapter 7. This model was comprised of caregivers modelling of vegetable consumption and healthy eating in general, as well as caregivers' acceptance of their child's consumption of vegetables. Here, caregivers who modelled eating healthy foods, and who did not accept their child's rejection of vegetables, reoffered vegetables more frequently.

A number of factors combined to produce a model which could predict children's consumption of vegetables in Chapter 7. These central factors were caregivers' consumption of vegetables, use of involvement and non-food rewards and children's level of food fussiness. Here, children who were less fussy with food in general and had caregivers who consumed more vegetables, involved their child in vegetable choice and preparation, and used fewer non-food rewards consumed more vegetables. This highlights the importance of the development of whole family interventions, where tackling caregivers' consumption of vegetables could facilitate increasing child consumption. The finding that use of non-food rewards was associated with lower consumption of vegetables is counter to previous research (e.g., Cooke, Chambers, Añez, & Wardle, 2011; Holley et al., 2014 - Chapter 3). This may be due to the way in which some caregivers (including those in this study) use rewards, a point which further research should seek to address. This also suggests that information for caregivers could benefit from the inclusion of how to effectively use non-food rewards to encourage children to try vegetables they dislike.

By measuring caregivers' perceptions of which methods of offering are successful, Chapter 7 was able to reveal any discrepancies between perceptions of what works and those methods which were correlated with children's consumption. Three main discrepancies were revealed. First, caregivers were split as to whether food and non-food rewards were successful for encouraging consumption, while both of these methods were associated with lower reported consumption of vegetables in children. Second, caregivers believed that use of pressure or encouragement was successful for achieving consumption while use of general pressure in feeding was associated with

children's lower consumption of vegetables. Third, caregivers perceived hiding vegetables to be successful for achieving consumption, whereas this method was also associated with lower reported consumption of vegetables in children. It is likely that all of these methods may be successful for achieving consumption of vegetables within a mealtime, rather than more desirable long-term increases in consumption. The findings from Chapter 7 indicate that in order to achieve both short and long-term increases in consumption, caregivers should be informed of the methods which may be more successful for achieving these long-term increases, as well as avoiding methods which may be detrimental to vegetable consumption.

In summary, Chapter 7 confirmed the importance of caregiver and child factors in both reoffering of, and children's consumption of vegetables. It further suggests utility in providing caregivers with information on which methods of reoffering vegetables are successful to achieve long-term consumption in children, particularly where these may be contrary to those thought of by caregivers as successful.

9.3.2.6 Chapter 8: Investigating differences between children who are fussy or not fussy with vegetables: Feeding practices, eating behaviours and methods of offering vegetables

Chapter 7 indicated the importance of children's general food fussiness on their consumption of vegetables. Therefore, Chapter 8 aimed to investigate whether children defined as fussy or not fussy with vegetables differ on a number of caregiver and child factors.

It was found that while children categorised as fussy with vegetables consumed significantly fewer vegetables than not fussy children, they were reoffered rejected vegetables an approximately equal number of times. Furthermore, there were no significant differences between these groups in the general feeding practices caregivers used with their children. However, children's eating behaviours did vary significantly between these groups. Children rated as fussy with vegetables were also more fussy with food in general, less food responsive, had lower enjoyment of food, and were slower eaters.

In line with previous qualitative research, caregivers of the fussy children in Chapter 8 used more food and non-food rewards, as well as hiding foods they wish their child to eat within other foods more often (Russell et al., 2015). Whilst some methods were

more commonly used with children in the fussy group, no caregiver methods of offering vegetables were more commonly used with children in the not fussy group. This suggests that caregivers of children who are fussy with vegetables employ additional strategies for offering, rather than these caregivers missing practices which may be successful for achieving consumption. It is likely that these additional methods which were used more frequently with the fussy children are employed when others fail to achieve consumption, where these less successful methods (such as hiding and use of food rewards) may serve to exacerbate children's fussiness with vegetables rather than increasing their consumption.

In summary, Chapter 8 suggests that children's eating behaviours play a significant role in the methods which caregivers use to offer their children vegetables, as well as having a major impact on children's consumption of vegetables. This advocates a provision of information for caregivers on methods to avoid when faced with a child who is fussy with vegetables, so as to avoid common pitfalls of child feeding.

9.3.3 General findings

When considering all of the research reported on in this thesis, two possible areas of disparity can be seen: 1) the impact of rewards and 2) the impact of parental modelling on children's consumption of vegetables. In Chapter 3 it was shown that a repeated exposure intervention which utilised rewards to encourage tastings can successfully increase children's liking and acceptance of disliked vegetables. Furthermore, caregivers in Chapter 6 suggested the use of rewards as a method which could be used to encourage children to eat vegetables. However, in Chapter 7 caregivers were split as to whether or not rewards were successful for encouraging consumption. It was also revealed that caregivers' use of non-food rewards was one of a number of predictive factors for children's consumption of vegetables, where caregivers who used more non-food rewards had children who consumed fewer vegetables. It is likely that this discrepancy arises due to the way in which caregivers are utilising these rewards, or the situations in which rewards are employed. In Chapter 3, the use of rewards was clearly instructed by the researcher, where caregivers were instructed to use non-food rewards as an incentive for children to try the target vegetable, and that these rewards were used in combination with lots of praise. Furthermore, children in Chapter 3 were allowed to choose the sticker they wanted in return for tasting the vegetable, which may well have increased the rewarding value of the sticker. It is likely that caregivers in Chapter 7 were not using rewards in the same way, where children may have been offered rewards which were not novel or appealing for them. It is also possible that

these rewards were not always given along with praise, which may have lowered the value of these rewards. Finally, it is possible that for these caregivers rewards were offered as a 'last resort', where children had already refused to try or consume the vegetable during the meal or snack time. This is likely to alter the impact which rewards would have, where children may sense their caregivers' desperation for them to try the vegetable. This may in turn have made the child wary of trying the vegetable, or caused them to be more stubborn against trying. As suggested by the findings from Chapter 8, it is also likely that caregivers use rewards with children who are fussier with vegetables and for whom the likelihood of achieving consumption is lower. This being the case, it is possible that the use of rewards here is associated with children being fussier, which means that consumption is less likely, rather than rewards causing lower consumption of vegetables.

In Chapter 3, parental modelling was not found to be a necessary component of a repeated exposure intervention in order to achieve increases in children's liking and consumption of a vegetable. In fact, when modelling was used alongside repeated exposure, without the inclusion of rewards, no increases in liking or consumption were seen when compared to a control group. This suggests that under these intervention conditions, modelling may be an ineffective method. However, in Chapters 6 and 7 modelling was raised by caregivers as a successful method for achieving vegetable consumption. Furthermore, in Chapter 7 modelling of vegetable consumption was significantly associated with reoffering of rejected vegetables, and modelling of healthy eating in general was associated with both reoffering and children's consumption of vegetables. There are several possible explanations for these discrepancies, where modelling was not effective in Chapter 3 but was seen as effective in Chapters 6 and 7. First, it is possible that caregivers in Chapter 3 did not model effectively, or that their modelling was seen as contrived. Second, it is likely that natural modelling (such as that measured in Chapters 6 & 7) is associated with caregivers' own diets. As such, caregivers who naturally model both vegetable consumption and healthy eating are likely to have more healthful diets, and as such are likely to be more motivated to achieve a similar diet in their children. Furthermore, caregivers own diet is likely to inform the provision of food in the house, which is likely to further influence children's consumption. It is also important to note that an intervention comprised of modelling and rewards was similarly as effective as one comprised of just rewards. This suggests that while modelling may need to be implemented in a particular way to be of benefit, there is little danger in suggesting modelling to caregivers as a possible method of achieving tastings and consumption of vegetables among children.

As well as two main areas of disparity across the thesis, two particularly important factors which the studies of this thesis corroborate can be seen: children's food fussiness and the central role of caregivers in children's consumption of vegetables. Children's food fussiness emerged as a significant predictor of the success of intervention outcomes in Chapter 4, with children higher in fussiness showing smaller changes in consumption of a target vegetable across the course of these interventions. Food fussiness was also associated with children's consumption of the target vegetable pre-intervention, suggesting that it may impact on children's consumption of vegetables more generally. This assertion was supported by the findings of Chapter 7, where children's level of food fussiness was significantly associated with their consumption of vegetables. Again, children who were fussier with food in general consumed fewer vegetables. Owing to this, Chapter 8 investigated the possible impact of whether or not children are fussy with vegetables on the methods which caregivers employ when feeding their children, as well as their general eating behaviours. Here it was found that caregivers of children who were fussy with vegetables employ some methods more frequently to offer their children vegetables, including use of rewards, hiding vegetables in other foods, and using pressure/encouragement. This suggests that rather than caregivers of fussy children lacking some successful strategies for feeding, they use some additional practices in an effort to achieve consumption when other methods may have failed. It should however be noted that the use of these methods may serve to exacerbate their child's fussiness with vegetables, such as the previously outlined possible negative effects of using pressure to encourage consumption (e.g., Galloway et al., 2005; Chapter 7).

While no significant role was found for caregiver factors in relation to intervention success in Chapter 4, the findings from Chapters 6, 7 and 8 suggest that caregivers play an important role in both reoffering of vegetables and children's consumption of vegetables. In Chapter 6, caregivers raised a number of ways in which their thoughts or actions can influence their offering of vegetables, including fears over creating larger feeding problems and developing acceptance of their child's rejection of vegetables. Chapter 7 confirmed that caregivers avoiding frustration was associated with reoffering rejected vegetables significantly fewer times, highlighting the impact that such caregiver opinions can have. Furthermore, Chapter 7 revealed that caregivers' consumption of vegetables is significantly correlated with that of their children, where caregivers who eat more vegetables also have children who eat more vegetables. Finally, Chapter 7 showed that caregivers who model vegetable consumption and

general healthy eating reoffer rejected vegetables to their children more often. This may well be because these caregivers have a stronger interest in healthy eating and as such are more motivated to transform their child's rejection of vegetables. As mentioned previously, Chapter 8 suggested that caregivers adopt additional methods of offering with children who they categorise as fussy with vegetables. Together these findings underline the crucial role that caregivers play in preschool children's vegetable consumption, which it is imperative to consider when planning health initiatives aimed at increasing consumption among this age group.

Looking at this thesis as a whole, a shift can be seen in the perceptions of the effect that caregivers' methods and children's fussiness can have on children's vegetable consumption. Chapter one describes a number of feeding practices which can be detrimental to children's consumption of vegetables, and how these have been associated with fussy eating. However, after conducting study two it became apparent that caregivers with fussy children seemed to report their feeding practices as a response to their children's eating behaviour. Here, caregivers of fussy children reported reaching a level of desperation to increase their child's consumption of vegetables, which led them to use practices they were not confident would be successful, as well as some caregivers developing a level of acceptance towards their child's rejection of vegetables. These findings were supported by chapter 8, which reported that there were no methods of offering vegetables which were used more frequently by caregivers of children who were not fussy with vegetables. This suggests that rather than caregivers employing methods which cause their child to become a fussy eater whilst other caregivers employ successful methods, children's fussiness results in caregivers attempting additional methods of offering. In this way, it is possible that feeding practices which are seen as detrimental are in fact more often a response to fussiness rather than a cause of it.

9.4 Strengths and limitations

This research in this thesis has a number of strengths, the first being its focus on increasing consumption of vegetables in preschool age children, where a considerable amount of the previous literature has focused on early school years. By focusing on this early stage of childhood, the health benefits of increasing consumption can have the largest impact, by having the potential to be exerted across the lifespan. Furthermore, focusing on children of this age allows caregivers to be utilised, while they are heavily involved in feeding and before children attend school. Once children are attending school, caregivers lose control of at least one mealtime a day, and their

influence may well be lessened. Furthermore, children of school age are open to the influences of peer models, where these peers may facilitate the development of unhealthy preferences as well as diminishing the impact of healthy eating initiatives (e.g., Salvy, de la Haye, Bowker, & Hermans, 2012). By tackling children's consumption of vegetables before school age it is hoped that these other influences can be lessened and health outcomes improved. Moreover, as outlined in Chapter 3, Study 1 of this thesis developed an intervention to be administered by caregivers in the home environment. This provides a cost-effective alternative to school-based interventions which present a greater economic burden.

This thesis also benefits from using a mixed methodology combining experimental, longitudinal, qualitative, and cross-sectional research. The use of an experimental design for Study 1 allowed accurate assessment of the efficacy of a parent led home-based intervention while the inclusion of questionnaire data permitted investigation of the associations between a range of parent and child factors with intervention outcomes. Furthermore, Study 1 benefitted from longitudinal data collected up to 12 months post-intervention, data severely lacking from previous intervention studies. The use of qualitative methods in Study 2 (Chapter 6) was essential for creating a good picture of the broad range of methods which caregivers use to offer their children vegetables, as well as influences to caregiver offering. This then facilitated the cross-sectional, large scale investigation of the association between these various factors with caregivers reoffering of vegetables and children's consumption, which would not have been possible had previously developed measures been used. Generally, the studies within this thesis had more than adequately sized samples, allowing accurate statistical assessment of the data. The only exception to this is the longitudinal aspect of Study 1(c), where unforeseen participant attrition left the sample size smaller than recommended (Cohen, 1992).

However, the research in this thesis also has some limitations. Studies 1(b) and 3 utilised self-report measures where caregivers' responses may well have been influenced by demand characteristics or not representative of their and their child's actual behaviours. Nonetheless, use of these measures is commonplace in this field of research and replacement with more objective measures would be extremely difficult and costly to implement. A second limitation of these measures is that they were used for cross-sectional analysis, preventing the investigation of causality in these associations. A further limitation is that the intervention implemented by parents in Study 1 was executed in the home environment, meaning that it was not strictly

controlled. Although this prevents us from being certain that parents in this study followed the protocol they were given, this is an unavoidable limitation if such home-based parent led interventions are to be naturalistically trialled. Caregivers/parents in all of the studies in this thesis were self-selected, which must be considered when thinking about the wider applications of this research. Here, it is possible that adult participants in this study had a vested interest in participating due to being particularly focused on increasing their child's intake of vegetables, or may have been happy to participate as they felt comfortable with the practices they use along with their child's consumption. Furthermore, it is possible that the caregivers who dropped out of the longitudinal follow-ups of the intervention were the ones for whom the intervention was not successful, which may have positively biased the results. The samples in this thesis were also relatively homogenous, with the majority of participants of white ethnicity and relatively high SES, meaning that these findings can only be generalised to similar groups. Finally, the chosen sample sizes for the studies in this thesis were based upon power calculations generated for specific expected effect sizes. With this in mind, it is possible that other significant findings may well have emerged from these studies, were larger samples to be employed. For example, in studies 1a and 1c, sample sizes were based on detecting a large effect. Study 1a in fact generated small effects on children's eating behaviour which are likely to still have significant effects on children's longer term eating behaviours and health. As previously mentioned, study 1c was under powered to detect these small effects, which may explain the non-significant longitudinal effects of these repeated exposure interventions. Conversely, it is possible that associated variables such as those investigated in study 1b may each exert small effects on intervention success, rather than the medium effects this study (along with study 3a and 3b) was powered for.

9.5 Future directions

The findings from the research conducted in this thesis suggest several possible avenues for future research. First, home-based parent led repeated exposure interventions utilising rewards and modelling should be tested using larger samples. Investigating the efficacy of such interventions with larger samples would also allow more accurate assessment of the longitudinal effects of such interventions, where participant attrition could be better controlled for and statistical power would be sufficient.

Chapter 7 of this thesis confirmed the significant influence of caregivers' consumption of vegetables on that of their children. With this in mind, another future direction would

be to investigate the efficacy of whole family interventions aimed at increasing consumption of vegetables. This could be as simple as the modelling, reward and repeated exposure paradigm which showed success with children in Chapter 3. This could be adapted to target both caregiver and child consumption, with both measured as outcomes.

A third possible future direction from this research would be to investigate how information for caregivers could be usefully provided to support those wishing to increase vegetable consumption in their child, perhaps in the form of an intervention. This information could include details on which methods of offering are the most successful, how to implement these, and which to avoid. Furthermore, this information could help caregivers to assess which methods may be most successful for their child, based on their child's temperament. In order to achieve this, further research should also aim to investigate which types of intervention may be successful for less sociable children as well as other temperament factors. Finally, interventions which aim to lower children's level of food fussiness should also be explored. These may be interventions which lower children's anxiety about foods, by helping children to explore food in a less fear-inducing way than attempting consumption such as messy play or other interactive interventions.

9.6 Conclusions

In conclusion, the findings from this thesis suggest that caregivers are of central influence to preschool children's consumption of vegetables, exerting their influence in a number of ways. The studies of this thesis indicate that the methods which caregivers employ, along with their own consumption of vegetables and cognitions about their child's consumption of vegetables all impact upon children's consumption. Furthermore, it is suggested that a parent led home-based intervention may be a viable method of increasing preschool children's liking and acceptance of disliked vegetables. The findings of this thesis also indicate that child factors such as their temperament and general eating behaviours may influence their consumption of vegetables, as well as the methods which caregivers use to offer vegetables and the success of such interventions. The support found for a parent led home-based intervention builds upon the previous knowledge base (e.g., Remington et al., 2012; Wardle et al., 2003), strengthening the case for these caregiver implemented alternatives to other more costly school-based initiatives. The finding that the methods which caregivers use, along with their cognitions about their child's consumption of vegetables strongly suggest the provision of information to caregivers of preschool children, advising them

about the best methods to use in order to achieve a vegetable-rich diet for their child. Lastly, the finding that children's consumption of vegetables is associated with their caregivers' consumption of vegetables alludes to the utility of whole family interventions, where increases in caregivers' consumption could boost the positive effects seen in the interventions implemented in this thesis, as well as improving health outcomes for caregivers.

In summary, the research in this thesis has made a valuable contribution to the field by providing information about how best to increase consumption among preschool age children. By increasing vegetable intake among this age group the significant lifetime health benefits of a diet rich in vegetables can be maximised. In order to achieve this, future research should seek to build on the research undertaken in this thesis by further investigating intervention efficacy and the potential for provision of information for caregivers.

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Appendix A: Example recruitment email

Dear XXXX,

I am a PhD student studying at Loughborough University and would like, with your permission, to offer parents of children at your group the opportunity to participate in exciting new research.

I would also be very happy to come and give a talk on healthy eating in children and techniques parents could use to the group.

I am interested in looking at ways that parents may increase vegetable consumption in early childhood and am conducting a large study comparing the use of several methods that parents might use to help children to eat their vegetables.

For this particular study I am looking for parents/primary caregivers and their 3-year-old children to take part in a two week programme of offering a vegetable to their child. Parents will also be asked to take part in a brief pre-study session as well as brief follow-up sessions which will allow us to assess any changes in their child's vegetable consumption. All materials needed for the study will be provided for the parents and children by us and, with your permission, the brief introductory and follow-up sessions would be conducted in a small, convenient area of your centre.

All information gathered about parents and children during the study will be anonymous and confidential, and held in a locked cabinet at Loughborough University, which only the experimenters will have access to. This information will be destroyed after a period of 10 years. When the full set has been gathered, all of the data will be analysed as a group, preventing identification of individuals within the set so that no-one will be able to tell who has participated.

Participation in this study is entirely voluntary and parents and children have the right to withdraw from this study at any time without penalty. If you are willing for me to approach parents in your group or would like any further information about the study, please contact me or my supervisor (Dr Emma Haycraft) using the details listed below.

I look forward to hearing from you and thank you, in anticipation, for your help.

Kind regards,

Clare Holley

Researchers' contact details

Clare Holley (PhD student)

07706 772727/01509 228151 - C.Holley@lboro.ac.uk

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Dr Claire Farrow (supervisor): 01212 045384 - C.Farrow@aston.ac.uk

Appendix B: Study 2 Recruitment posters



Do you have a child aged 2-4?



We'd love to hear all
about your
experiences with
getting your child to
eat fruits and
vegetables, both
good and bad

Come along for an informal chat with
other parents - with free hot drinks
and snacks!

For more details, call or text Clare on
07706 77 27 27
or email C.Holley@lboro.ac.uk



Loughborough
University



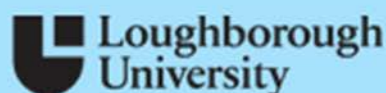
Do you have a 2-4 year-old who doesn't like vegetables?



We'd love to hear all
about your
experiences with trying
to get your child to eat
fruits and vegetables.

Come along for an informal chat with
other parents - with free hot drinks
and snacks!

For more details, call or text Clare on
07706 77 27 27
or email C.Holley@lboro.ac.uk



Appendix C: Study 3 recruitment flyer



CALLING ALL CARERS OF CHILDREN AGED 2-4!

We'd love to hear about how you get your child to eat vegetables and any difficulties you encounter.



Please get involved by filling in our short questionnaire **online** or send a **text** message to 07706 772727

<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>

<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>

<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>

<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>

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<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>

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<https://lboro.onlinesurveys.ac.uk/offering-young-children-vegetables>

Appendix D: Child information sheet



I will give you a
vegetable to try



I would like you to tell me how much
you like it



You can eat as much as
you want!



You don't have to eat
it, you won't get in
trouble.



Appendix E: Comprehensive Feeding Practices Questionnaire (CFPQ)
Musher-Eizenman and Holub (2007)

	Never	Rarely	Sometimes	Mostly	Always
Parents take many different approaches to feeding their children and may have different concerns about feeding depending on their child. Please answer the following questions as honestly as possible with this child in mind.					
1. How much do you keep track of the sweet foods (e.g. sweets, chocolate, confectionary, ice cream, cake, biscuits) that your child eats?	1	2	3	4	5
2. How much do you keep track of the snack food (e.g. crisps, Doritos, cheese puffs) that your child eats?	1	2	3	4	5
3. How much do you keep track of the high-fat foods that your child eats?	1	2	3	4	5
4. How much do you keep track of the sugary drinks (e.g. fizzy drinks, sugary squashes) this child drinks?	1	2	3	4	5
5. Do you let your child eat whatever s/he wants?	1	2	3	4	5
6. At dinner, do you let this child choose the foods s/he wants from what is served?	1	2	3	4	5
7. When this child gets irritable, is giving him/her something to eat or drink the <i>first</i> thing you do?	1	2	3	4	5
8. Do you give this child something to eat or drink if s/he is bored even if you think s/he is not hungry?	1	2	3	4	5
9. Do you give this child something to eat or drink if s/he is upset even if you think s/he is not hungry?	1	2	3	4	5
10. If this child does not like what is being served, do you make something else?	1	2	3	4	5
11. Do you allow this child to eat snacks whenever s/he wants?	1	2	3	4	5
12. Do you allow this child to leave the table when s/he is full, even if your family is not done eating?	1	2	3	4	5
13. Do you encourage this child to eat healthy foods before unhealthy ones?	1	2	3	4	5

Please answer the following questions as honestly as possible with your child in mind.

	Disagree	Slightly disagree	Neutral	Slightly agree	Agree
14. Most of the food I keep in the house is healthy.	1	2	3	4	5
15. I involve my child in planning family meals.	1	2	3	4	5
16. I keep a lot of snack food (e.g. crisps, Doritos, cheese puffs) in my house.	1	2	3	4	5
17. My child should always eat all of the food on his/her plate.	1	2	3	4	5
18. I have to be sure that my child does not eat too many high-fat foods.	1	2	3	4	5
19. I offer my child his/her favourite foods in exchange for good behaviour.	1	2	3	4	5
20. I allow my child to help prepare family meals.	1	2	3	4	5
21. If I did not guide or regulate my child's eating, s/he would eat too much of his/her favourite foods.	1	2	3	4	5
22. A variety of healthy foods are available to my child at each meal served at home.	1	2	3	4	5
23. I offer sweet foods (e.g. sweets, chocolate, confectionary, ice cream, cake, biscuits) to my child as a reward for good behaviour.	1	2	3	4	5
24. I encourage my child to try new foods.	1	2	3	4	5
25. I discuss with my child why it's important to eat healthy foods.	1	2	3	4	5
26. I tell my child that healthy food tastes good.	1	2	3	4	5
27. I encourage my child to eat less so he/she won't get fat.	1	2	3	4	5
28. If I did not guide or regulate my child's eating, s/he would eat too many junk foods.	1	2	3	4	5
29. I give my child small helpings at meals to control his/her weight.	1	2	3	4	5
30. If my child says, "I'm not hungry," I try to get him/her to eat anyway.	1	2	3	4	5
31. I discuss with my child the nutritional value of foods.	1	2	3	4	5
32. I encourage my child to participate in grocery shopping.	1	2	3	4	5
33. If my child eats more than usual at one meal, I try to restrict his/her eating at the next meal.	1	2	3	4	5
34. I restrict the food my child eats that might make him/her fat.	1	2	3	4	5
35. There are certain foods my child shouldn't eat because they will make him/her fat.	1	2	3	4	5
36. I withhold sweets/dessert from my child in response to bad behaviour.	1	2	3	4	5
37. I keep a lot of sweet foods (e.g. sweets, chocolate, confectionary, ice cream, cake, biscuits) in my house.	1	2	3	4	5
38. I encourage my child to eat a variety of foods.	1	2	3	4	5
39. If my child eats only a small helping, I try to get him/her to eat more.	1	2	3	4	5
40. I have to be sure that my child does not eat too much of his/her favourite foods.	1	2	3	4	5
41. I don't allow my child to eat between meals because I don't want him/her to get fat.	1	2	3	4	5
42. I tell my child what to eat and what not to eat without explanation.	1	2	3	4	5
43. I have to be sure that my child does not eat too many sweet foods (e.g. sweets, chocolate, confectionary, ice cream, cake, biscuits).	1	2	3	4	5
44. I model healthy eating for my child by eating healthy foods myself.	1	2	3	4	5
45. I often put my child on a diet to control his/her weight.	1	2	3	4	5
46. I try to eat healthy foods in front of my child, even if they are not my favourite.	1	2	3	4	5
47. I try to show enthusiasm about eating healthy foods.	1	2	3	4	5
48. I show my child how much I enjoy eating healthy foods.	1	2	3	4	5
49. When he/she says he/she is finished eating, I try to get my child to eat one more (two more, etc.) bites of food.	1	2	3	4	5

Comprehensive Feeding Practices Questionnaire: Subscales and scoring

Subscale	Corresponding Items
Child Control	5, 6, 10, 11, 12,
Emotion regulation	7, 8, 9
Encourage balance and variety	13, 24, 26, 38
Environment	14, R16, 22, R37
Food as reward	23, 36, 19
Involvement	15, 20, 32
Modelling	44, 46, 47, 48
Monitoring	1, 2, 3, 4
Pressure	17, 30, 39, 49
Restriction for Health	21, 28, 40, 43
Restriction for weight control	18, 27, 29, 33, 34, 35, 41, 45
Teaching about nutrition	25, 31, R42

Note:

- Items numbered 1–13 utilize a five-point response scale “never, rarely, sometimes, mostly, always.” Never = 1; Rarely = 2; Sometimes = 3; Often = 4; Always = 5
- Items numbered 14–49 utilize a five-point scale with different anchors, “disagree, slightly disagree, neutral, slightly agree, agree.” Disagree=1; Somewhat disagree=2; Neutral=3; Slightly agree=4; Agree=5
- Items marked with an R are reverse coded.

Scoring:

For each subscale calculate means from the responses to the questions that comprise it. Make sure that any questions marked with R are reverse coded prior to scoring (Qs 16, 37, 42).

Appendix F: The EAS Child Temperament Questionnaire
Bus and Plomin (1984)

Instructions: Using the scale below, please circle one number for each question which best corresponds to your child. If a question is irrelevant because of your child's age, please leave it out.

		Not characteristic or typical of your child		Neutral		Very characteristic or typical of your child	
1	Child tends to be shy	1	2	3	4	5	
2	Child cries easily	1	2	3	4	5	
3	Child likes to be with people	1	2	3	4	5	
4	Child is always on the go	1	2	3	4	5	
5	Child prefers playing with others rather than alone	1	2	3	4	5	
6	Child tends to be somewhat emotional	1	2	3	4	5	
7	When child moves about, s/he usually moves slowly	1	2	3	4	5	
8	Child makes friends easily	1	2	3	4	5	
9	Child is off and running as soon as s/he wakes in the morning	1	2	3	4	5	
10	Child finds people more stimulating than anything else	1	2	3	4	5	
11	Child often fusses and cries	1	2	3	4	5	
12	Child is very sociable	1	2	3	4	5	
13	Child is very energetic	1	2	3	4	5	
14	Child takes a long time to warm to strangers	1	2	3	4	5	
15	Child gets upset easily	1	2	3	4	5	
16	Child is something of a loner	1	2	3	4	5	
17	Child prefers quiet, inactive games to more active ones	1	2	3	4	5	
18	When alone, child feels isolated	1	2	3	4	5	
19	Child reacts intensely when upset	1	2	3	4	5	
20	Child is very friendly with strangers	1	2	3	4	5	

The EAS temperament questionnaire: Subscales and scoring

Subscale	Corresponding items
Shyness (SH)	1,8r,12r,14,20r
Emotionality (EM)	2,6,11,15,19
Sociability (SO)	3,5,10,16r,18
Activity (AC)	4,7r,9,13,17r

Note:

- Questions 7, 8, 12, 16, 17 & 20 are reverse scored
- Sum the responses for each of the four subscales and divide by number of answers in each subscale to calculate a mean for each of the four subscales.

Appendix G: Children's Eating Behaviour Questionnaire (CEBQ)
Wardle, Guthrie, Sanderson and Rapoport (2001)

Instructions: Please read the following statements and tick the boxes which are most appropriate to your child's eating behaviour. **Please answer these questions about your child who is in this study.** If a question is irrelevant because of your child's age, please leave it out.

	Never	Rarely	Sometimes	Often	Always
1. My child loves food					
2. My child eats more when worried					
3. My child has a big appetite					
4. My child finishes his/her meal quickly					
5. My child is interested in food					
6. My child is always asking for a drink					
7. My child refuses new foods at first					
8. My child eats slowly					
9. My child eats less when angry					
10. My child enjoys tasting new foods					
11. My child eats less when s/he is tired					
12. My child is always asking for food					
13. My child eats more when annoyed					
14. If allowed to, my child would eat too much					
15. My child eats more when anxious					
16. My child enjoys a wide variety of foods					
17. My child leaves food on his/her plate at the end of a meal					
18. My child takes more than 30 minutes to finish a meal					
19. Given the choice, my child would eat most of the time					
20. My child looks forward to mealtimes					
21. My child gets full before his/her meal is finished					
22. My child enjoys eating					
23. My child eats more when s/he is happy					
24. My child is difficult to please with meals					
25. My child eats less when upset					
26. My child gets full up easily					
27. My child eats more when s/he has nothing else to do					
28. Even if my child is full up s/he finds room to eat his/her favourite food					
29. If given the chance, my child would drink continuously throughout the day					
30. My child cannot eat a meal if s/he has had a snack just before					
31. If given the chance, my child would always be having a drink					
32. My child is interested in tasting food s/he hasn't tasted before					
33. My child decides that s/he doesn't like a food, even without tasting it					
34. If given the chance, my child would always have food in his/her mouth					
35. My child eats more and more slowly during the course of a meal					

Children's Eating Behaviour Questionnaire: Subscales and scoring

Scoring

Never = 1; Rarely = 2; Sometimes = 3; Often = 4 ; Always = 5

Reverse scoring*

Never = 5; Rarely = 4; Sometimes = 3; Often = 2; Always = 1

Subscales Calculate mean subscale scores by summing the numbers corresponding to boxes ticked in response to the following questions:

Subscale	Corresponding items
Food Responsiveness	12, 14, 19, 28, 34
Enjoyment of Food	1, 5, 20, 22
Satiety Responsiveness	3*, 17, 21, 26, 30
Food Fussiness	7, 10*, 16*, 24, 32*, 33
Slowness in Eating	4*, 8, 18, 35
Emotional Over-Eating	2, 13, 15, 27
Emotional Under-Eating	9, 11, 23, 25
Desire to Drink	6, 29, 31

Appendix H: Demographic questions

Please tell us a bit about you:

What is your gender? Male ☐ Female ☐

What is your date of birth? _____

Which race/ethnic group best describes you?

White/Caucasian ☐ Black/Black British ☐ Asian/Asian British ☐
Chinese ☐ Mixed ☐ Other (specify _____)

Which of the following best describes your educational background? (tick only your **highest** qualification)

- | | |
|--|--|
| <input type="checkbox"/> Some secondary school education | <input type="checkbox"/> Post-graduate certificate (e.g. PGCE) |
| <input type="checkbox"/> GCSEs | <input type="checkbox"/> Master's degree |
| <input type="checkbox"/> A-levels | <input type="checkbox"/> Professional or Doctorate degree (e.g. PhD) |
| <input type="checkbox"/> University graduate (e.g. Bachelor's degree [BA/BSc]) | <input type="checkbox"/> Other: _____ |

Please state your current or most recent occupation (please specify position & type of institution e.g. manager of a restaurant) _____

Please tell us a bit about your child who is taking part in this study:

What is your child's gender? Male ☐ Female ☐

What is your child's date of birth? _____

How many siblings does the child have? _____

Has this child ever been hospitalized for a feeding related problem? Yes ☐ No ☐

If yes please give details _____

Appendix I: Parent/caregiver instructions for daily vegetable tasting

- Outside of a mealtime, taste a small piece of the **raw** vegetable in front of your child and show him/her that you enjoy it. Tell your child that the vegetable is “good”, “tasty”, “yummy”, or use a statement such as “Oh [name of your child], this carrot is yummy!”.
- Immediately afterwards, offer your child a small piece of the chosen vegetable, using a phrase such as “would you like to try this carrot?”.
- Tell your child that if they try one small piece of the vegetable, they can choose a sticker and show your child the sticker sheet (at this point your child may like to choose the sticker that they will receive for tasting the vegetable, which is fine, but they may only have the sticker if they try one small piece).
- If your child successfully tastes one piece of the **raw** vegetable, praise them by saying something like “Well done! You’re a great taster!” or “You did really well, trying your carrot!”.
- Allow your child to choose a sticker, telling them why they received a sticker – e.g., “you got a sticker for tasting your vegetable”.
- Record whether your child successfully tasted the vegetable (tasting includes licking, biting, sucking or making any contact between the piece and the mouth) in the vegetable diary by putting a tick in the appropriate columns.
- Repeat this procedure in the same way every day for 14 days.

		Did you taste and offer your child the vegetable?		Did you give praise and sticker?		Did your child taste the vegetable?	
	Date	Yes	No	Yes	No	Yes	No
Day 1							
Day 2							
Day 3							
Day 4							
Day 5							
Day 6							
Day 7							
Day 8							
Day 9							
Day 10							
Day 11							
Day 12							
Day 13							
Day 14							

Frequently Asked Questions

What is tasting?

By tasting we mean any behaviour which means that the vegetable comes into contact with your child's mouth. This can include biting, licking, sucking, as well as eating. The piece of vegetable does NOT have to be swallowed to count as tasted.

Why are we being asked to taste the vegetable ourselves, before offering it to our child?

Previous research has found that by showing children how to taste and eat foods, it makes them more likely to do the same and eat and like a vegetable. Therefore, we want parents/caregivers to show their children how much they enjoy eating the vegetable. We want to compare this method to other methods to see which might be most effective at getting children to try vegetables.

Why am I offering this vegetable to my child so many times?

Evidence says that for many children to like and eat a vegetable, they must try it several times so that it becomes familiar to them.

Why am I being asked to stay neutral?

We want to know that the children are liking and eating the vegetable because they have become used to it from tasting it lots of times, not to try and please their parents or stop them being cross!

What should I do if my child doesn't want to taste the vegetable?

Nothing, just try again tomorrow! Don't try to force your child to try it if he/she is not keen. However, please make sure that you record that your child didn't taste the vegetable in the vegetable diary.

Why must my child choose the sticker?

Research suggests that children find prizes which they choose themselves to be more rewarding than if they are given a prize that somebody else has chosen.

If you have any other questions, please do not hesitate to contact the researcher:

Clare Holley

07706 772727- C.Holley@lboro.ac.uk

Appendix J: Revised Brief Food Frequency Questionnaire

Adapted from Cooke, Wardle and Gibson (2003)

Instructions: The following questions ask about **your own AND your child's** usual eating habits, specifically focusing on vegetables and salad.

Please indicate how often **YOUR CHILD** eats the following items using a **C**

Please indicate how often **YOU** eat the following items using a **P**

(For guidance on what counts as a portion of vegetables, please see the information on the last page of this pack- Appendix R)

	Never / rarely	1-2 portions a week	3-4 portions a week	5-6 portions a week	1 portion a day	2 portions a day	3 portions a day	4+ portions a day
<i>Example</i>				C		P		
Raw vegetables (e.g. carrot sticks, celery)								
Cooked vegetables (including sweet potato but not potato)								
Salad (e.g. tomatoes, lettuce)								

Scoring (for number of portions consumed per week):

Never/rarely=0;

1-2 portions a week=1.5,

3-4 portions a week=3.5;

5-6 portions a week=5.5;

1 portion a day= 7;

2 portions a day=14;

3 portions a day=21;

4 or more portions a day=28

To calculate total veg consumption per week add together portion scores for raw, cooked and salad categories.

Appendix K: Caregivers use of methods of offering
(Newly developed items)

Please read each of the following statements carefully. Select the answer that best describes how often you do each of the following.

How often do you...

	Never	Rarely	Sometimes	Often	Always
1. Encourage your child to eat vegetables by avoiding presenting them alongside other more tempting foods	1	2	3	4	5
2. Offer your child a non-food reward (e.g. a sticker or a trip to the park) if he/she eats vegetables	1	2	3	4	5
3. Compromise with your child regarding the order in which they eat their meal (e.g. dessert first/at same time as main meal)	1	2	3	4	5
4. Give your child small amounts of other foods to encourage them to eat their vegetables	1	2	3	4	5

Thinking about offering your child vegetables, please indicate how much you agree with the following statements.

	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree
5. It is important that my child thinks vegetables are a normal part of a meal	1	2	3	4	5
6. I tell my child that if they do not eat their vegetables they cannot do something they enjoy (e.g. play with a certain toy)	1	2	3	4	5
7. I tell my child that if they do not eat their vegetables they will have to go to bed	1	2	3	4	5
8. I try preparing vegetables in different ways to encourage my child to eat them	1	2	3	4	5

Scoring:

Never = 1; Rarely = 2; Sometimes = 3; Often = 4 ; Always = 5

Disagree=1; Somewhat disagree=2; Neutral=3; Slightly agree=4; Agree=5

To score methods assessed with two items calculate a mean score

Method	Corresponding item(s)
Covert restriction	1
Non-food rewards	2
Compromise/flexibility	3 & 4
Normalise	5
Threats	6 & 7
Different forms	8

Appendix L: Frequency of use of and success of methods of offering vegetables
(Newly developed items)

Please indicate whether you think the following practices work to encourage your child to eat vegetables (yes/no) and tell us how often you use them

	Yes	No	Never	Rarely	Sometimes	Often	Always
Modelling (e.g. eating vegetables in front of your child)							
A. How often do you use this method?							
Giving food as a reward (e.g. offering dessert or sweets if children try or eat a vegetable)							
A. How often do you use this method?							
Other rewards (e.g. stickers, toys, play if children try or eat a vegetable)							
A. How often do you use this method?							
Threats (e.g. "you'll go to bed" or "you can't watch television")							
A. How often do you use this method?							
Encouragement or pressure (e.g. "eat up", "one more bite")							
A. How often do you use this method?							
Games (e.g. "who can eat their vegetables fastest?")							
A. How often do you use this method?							
Involving your child (e.g. cooking, preparing, choosing vegetables)							
A. How often do you use this method?							
Hiding vegetables (e.g. sauce, flavour or chopping up really small)							
A. How often do you use this method?							
Compromise (e.g. letting your child eat their dessert first)							
A. How often do you use this method?							
Offering vegetables in different forms							
A. How often do you use this method?							

Note: Items are considered individually, to allow assessment of perception of success of/frequency of use of each method.

Scoring:

Success of method:

Yes=1; No=2

Frequency of use:

Never = 1; Rarely = 2; Sometimes = 3; Often = 4; Always = 5

Appendix M: Influences on reoffering and consumption of vegetables
(Newly developed items)

Thinking about offering your child vegetables, please indicate how much you agree with the following statements.	Disagree	Somewhat disagree	Neither disagree nor agree	Somewhat agree	Agree
1. The mood that my child is in influences whether I offer them vegetables they don't like	1	2	3	4	5
2. I do not offer my child vegetables they dislike to avoid tantrums	1	2	3	4	5
3. I do not offer my child vegetables they don't like as it frustrates me if they do not eat them	1	2	3	4	5
4. I do not offer my child vegetables they don't like as I know they will not eat them	1	2	3	4	5
5. I do not offer my child vegetables they don't like as I am satisfied with the other vegetable they eat	1	2	3	4	5
6. I do not offer my child vegetables they don't like because it takes so much time to buy and prepare them	1	2	3	4	5
7. I do not offer my child vegetables they don't like because of the waste involved	1	2	3	4	5
8. I do not offer my child vegetables they don't like because of the cost	1	2	3	4	5
9. How hungry my child is influences whether I offer them a vegetable they don't like	1	2	3	4	5

Please read the following statement carefully. Select the answer that best describes how often you do the following. How often do you...	Never	Rarely	Sometimes	Often	Always
10. Offer your child vegetables that you do not eat yourself	1	2	3	4	5

Influences on reoffering and consumption of vegetables: Constructs and scoring

Influences	Corresponding item(s)
Mood	1
Tantrums	2
Frustration	3
Acceptance	4 & 5
Time	6
Waste	7
Cost	8
Hunger	9
Caregiver tastes	10

Scoring:

Disagree=1; Somewhat disagree=2; Neutral=3; Slightly agree=4; Agree=5
 Never = 1; Rarely = 2; Sometimes = 3; Often = 4; Always = 5

To score influences assessed with two items calculate a mean score

Appendix N: Assessing caregiver feeding of vegetables
(newly developed items)

Do you have difficulty getting your child to eat vegetables?

☐ Never ☐ Occasionally ☐ Often ☐ Always

How many times will you re-offer your child a vegetable they have previously refused to eat on another occasion? Please circle the appropriate number.

0 1 2 3 4 5 6 7 8 9 10 10+

Scoring:

Difficulty: Never = 1; Occasionally= 2; Often = 3; Always = 4

Frequency of reoffering: Simple frequency score

Appendix O: Smiley Faces Rating Scale
Birch, Zimmerman, and Hind (1980)



Scoring:

Face 1=Yummy; face 2=Just ok; face 3= Yucky

Appendix P: Study 1 information sheet

Centre for Research into Eating Disorders

Ways of helping children to eat their vegetables**INFORMATION SHEET****What the study involves**

Initially, you and your child will be asked to attend a session at the centre where you signed up for the study. Here, you will be asked to complete some questionnaires while your child's liking of a raw vegetable chosen by you will be measured by the experimenter. This session should last no more than 20 minutes.

Next, you will be provided with an ample supply of the chosen raw vegetable. You will be asked to offer your child a small piece of every day for two weeks. You will also be asked to keep a record of your experiences with the offering each day by filling in a few simple tick box questions.

After this two week period the closing session will be held, again in the centre where you signed up for the study. Here, your child's liking of the chosen vegetable will again be assessed by the experimenter. This process should take no longer than 20 minutes. An identical session will also take place one, three and six months later. The experimenter may also ask you to take part in a further session 1 year later.

All information gathered about both you and your child during the study will be anonymous and confidential, and held in a locked cabinet at Loughborough University, which only the experimenters will have access to. This information will be destroyed after a period of 10 years. When the full set has been gathered, all of the data will be analysed as a group, preventing identification of individuals within the set so that no-one will be able to tell who has participated. Your participation in this study is entirely voluntary, and you and your child have the right to withdraw from this study at any time without penalty. If at any time you have questions about the study, or do not understand any aspect of the study (including after participation), further information can be gained from the researchers listed at the bottom of this page. Please keep this sheet for your records.

I hope that you and your child agree to participate in this study and look forward to hearing from you.

Best wishes,

Clare Holley

Researchers' contact details

Clare Holley

07706 772727- C.Holley@lboro.ac.uk

Dr Emma Haycraft

01509 228160 – E.Haycraft@lboro.ac.uk

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01509 228487 - C.V.Farrow@lboro.ac.uk

Appendix Q: Study 3 recruitment poster



School of Sport, Exercise & Health Sciences, **Centre for Research into Eating Disorders**

Loughborough University,
Loughborough, Leicestershire LE11 3TU

Investigating how caregivers offer vegetables to young children

What does the study involve?

The study will involve filling in a short questionnaire. The questionnaire will initially ask you for some basic information about you and your child, as well as how many portions of vegetables you and your child eat. Guidance on what constitutes a portion of vegetables is provided in the questionnaire pack.

You will then be asked a series of questions about how you go about feeding your child vegetables.

How long will the study take?

The questionnaire should take approximately 10-15 minutes to complete.

What else might I need to know?

All information gathered about from this questionnaire will be anonymous, confidential and securely stored at Loughborough University. All of the data will be analysed as a group, so that no-one will be able to tell who has participated. Your participation in this study is entirely voluntary, and you have the right to withdraw from at any time without penalty. If you have questions about the study, further information can be gained from the researchers listed at the bottom of this page. Please keep this sheet for your records.

Thank you for your interest in this study, I hope that you can help by taking part.

Best wishes,

Clare Holley

Researchers' contact details

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Dr Emma Haycraft

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Dr Claire Farrow

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Appendix R: Guidance on vegetable portion sizes for 2-4 year-olds
 Infant and Toddler Forum (2013)

Vegetable	Range of portion size
Bamboo shoots	1/2 - 2 tablespoons
Beetroot	1/2 - 2 tablespoons
Broccoli / cauliflower	1 - 4 small florets or 1/2 - 2 tablespoons
Brussels sprouts	1/2 - 3 sprouts
Cabbage	1 - 3 tablespoons
Carrot	1 - 3 tablespoons / 2 - 6 carrot sticks
Celery / cucumber / radishes / peppers / other salad vegetables	2 - 8 small sticks / slices
Cherry tomatoes	1 - 4 cherry tomatoes
Courgettes / squash / okra / aubergine	1/2 - 2 tablespoons
Green / French beans	1/2 - 2 tablespoons
Leeks / onions / shallots	1/2 - 2 tablespoons
Lettuce	1 - 2 small leaves
Mange tout	2 - 8 mange touts
Mixed vegetables	1/2 - 2 tablespoons
Mushrooms	1 - 4 button mushrooms
Parsnip	1/2 - 2 tablespoons
Peas	1/2 - 2 tablespoons
Spring greens / spinach (cooked)	1/2 - 2 tablespoons
Stir fried or roasted vegetables	1/2 - 2 tablespoons
Swede / turnip	1/2 - 2 tablespoons
Sweet corn	1/2 - 2 tablespoons
Tomato	1/4 - 1 small tomato
Vegetable soup	1/2 - 1 small bowl (60 - 125ml)