Does the family environment contribute to food habits or behaviours and physical activity in children?

A report prepared by the
Scientific Committee of the
Agencies for Nutrition Action
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1.1 Background

The family environment is typically the centre of people's lives, providing a place to feel safe, to be supported, and to access the resources for daily life. These benefits are not universally experienced by all families, however, and may not be experienced by all individuals within a family. Such disparity prompts government interest in what families experience, and how they might shape individuals and influence society.

The New Zealand Government has a focus on promoting healthy eating and healthy action in a variety of ways: via schools, workplaces, within the food and marketing industries and at the family level, targeting Māori, Pacific and low socio-economic status people, as well as children.

Although parents know they are hugely important in determining the eating and physical activity patterns of their own children, Agencies for Nutrition Action (ANA) believed it was timely to undertake this review of the evidence on the role the home environment and families have on healthy eating and physical activity. Unhealthy eating and low levels of physical activity are unevenly distributed throughout New Zealand society, and the causes of this are largely structural. This review acknowledges that fact and presents the findings as part of the evidence for the influence on food and physical activity levels in families.

1.2 Aim

The aim of the report was to answer the following questions:

1) What is the context of the family food and physical activity environment in New Zealand?
2) Is the "family food environment" associated with food habits or behaviours, and if so, how?
3) Is the "family physical activity environment" associated with physical activity, and if so, how?

1.3 Methods

Databases of scientific publications and relevant websites were searched, covering January 1996 to July 2007, an arbitrary starting point to make the analyses manageable. Only English-language references and human studies were included in the review. The reference lists from papers selected in the literature search were used to identify earlier publications, and more recent publications up to December 2007 were also identified. Considerable attention was paid to study design, with intervention studies and longitudinal studies with appropriate sample sizes and adjustment for confounders considered "stronger" evidence than smaller studies or cross-sectional studies (see Appendix M for a full description of the methods).

1.4 Studies investigating family meals and food habits and behaviours

Eleven cross-sectional studies investigating family mealtimes and dietary intake were identified. Of the eleven studies, nine reported an association with shared family mealtime frequency and at least one of the dietary outcomes assessed. Of these, seven were positively associated with vegetable intake, six with fruit intake, four with dairy/calcium/milk intake, two with micronutrient intake, and one with fibre intake. An inverse association was found between family mealtimes and soft-drink consumption, fast food intake, snack food intake, less unhealthy eating, fat intake, and skipping meals. Only two studies failed to show any association with dietary intake.

Although all studies were cross-sectional and thus unable to determine causality, the results are consistent. The studies were carried out in a variety of countries, suggesting that family mealtimes are important in a number of different countries and cultures.

Recommendation for parents: Family mealtimes should be maintained as positive occasions as much as possible.

Strategies:

- Eat as a family as much as possible (try for most nights and for most breakfasts).
- Describe mealtimes as a family tradition.
- Help all family members to learn to prepare quick, healthful meals.
- Look for realistic ways to increase the number of family meals, taking into account work, school, and extracurricular activities.
- Adopt age-appropriate ways to involve children and adolescents in meal planning and preparation; for example, young children can open tinned ingredients, stir meals, set the table, get the water jug for the table, decide what to have tomorrow night.
- Prepare vegetables in imaginative ways – mixed into meals or cut into different shapes.
- Encourage children to sit down with you to share a meal (at a table, or in a designated eating space facing each other – not in front of the TV).
- Set a time when you'll be eating together and let the family know in advance.

1.5 Studies investigating television (TV) viewing during mealtimes and food habits and behaviours

Five cross-sectional studies investigating the effects of TV viewing during mealtimes on dietary intake among families were identified. All five studies reported an inverse association between TV viewing and fruit and vegetable intake, while two studies showed higher intakes of high-energy drinks with higher levels of TV viewing. Lower intakes of grains, nuts and energy from carbohydrate were seen in one of the studies reviewed, along with higher intakes of pizza, caffeine and fat.

In summary, although only five studies were identified investigating the effects of TV viewing during family mealtimes, all studies consistently reported a negative influence on diet quality among families routinely watching TV during mealtimes.

Recommendation for parents: Turn the TV off during mealtimes.

Strategies:

- Permanently move the TV set out of view of the dining table.
- Place clear maximum limits of one hour of TV per day.[a]
- Designate times and days to be TV free.[a]
- Negotiate and plan the number of TV programmes the family wants to watch at the beginning of the week and don't watch any others.[a]

1.6 Studies investigating parental modelling and food habits and behaviours

In total, 25 studies examined the relationship between parental modelling and dietary intake: 24 observational studies (23 cross-sectional and one cohort) and one intervention study. All 23 cross-sectional studies reported an association with family modelling and at least one dietary outcome measured. Fourteen studies showed a positive relationship between parental modelling and fruit and vegetable intake, three with dairy/milk intake, two with low fat eating patterns, and one for each of the following outcomes: general healthy eating, snacks and breakfast intake.

Children also appeared to be influenced by their parents' modelling of unhealthy dietary behaviours. Higher levels of parental modelling were associated with higher intakes of soft drinks in four studies, and sweet and savoury snack intake, fat intake, energy-dense foods, take-out foods and general unhealthy eating in one study each.

The single cohort study reported that breakfast intake by parents was significantly, positively associated with adolescent breakfast eating. The one intervention study, which by design provides more rigorous evidence, reported higher fruit and vegetable intakes with increased maternal modelling.

In summary, the studies show consistent results. Twenty-two studies reported that healthful parental modelling is positively associated with healthy eating patterns among children. Of the 10 studies that investigated unhealthy modelling by parents, seven showed an increase in unhealthy eating among children.

Recommendation for parents: Eat a healthy diet every day.

Strategies:

- Eat meals together as a family.
- Make a healthy lunch and take it to work.
- Follow the *Food and Nutrition Guidelines for Healthy Adults*, available under the heading "Nutrition and physical activity" at http://www.healthed.govt.nz
- Both parents should act as role models.
- Back up "what you say" with "what you do".
- Put a healthy diet and activity at the top of your "to do" list, not at the bottom.

[a] These recommendations have been added based on a previous ANA report by Scragg et al 2006 "Does TV watching contribute to increased body weight and obesity in children". The authors believe these recommendations compliment those highlighted in the current literature review.

1.7 Studies investigating parental support and food habits and behaviours

We identified only four studies that investigated parental support in relation to food habits and behaviours among children. All studies were cross-sectional. Three of the four studies reported a positive association between healthful eating and increased parental support. Parental support was positively associated with fruit and vegetable intake in two studies, and with dairy intake in one, although only in girls. One study showed a positive relationship between parental facilitation (making the behaviour easier) and fruit and vegetable intake.

In summary, although only a few studies have investigated this construct, the research provides consistent evidence of a positive relationship between parental support and enhanced diet quality.

Recommendation for parents: Support and encourage all attempts by the child to follow healthy eating patterns.

Strategies:

- Create a supportive food environment by having healthy foods easily available, and keeping unhealthy foods to small portions or out of the house altogether.
- Pack a healthy lunch rather than giving children "lunch money".

1.8 Studies investigating family interaction and food habits and behaviours

We identified four cross-sectional studies assessing the relationship between family interaction and food habits and behaviours. All four studies produced consistent results reporting healthful intakes with positive family interactions (cohesion and connectiveness), and less healthful intakes with increased levels of family conflict and arguments.

Recommendation for parents: Maintain a positive emotional atmosphere during family meals.

Strategies:

- Avoid arguments during family mealtimes.
- Think about conversation topics before the meal.
- Encourage all family members to talk during mealtimes, perhaps by:
  - taking turns in the family to talk about a good thing that happened to you that day
  - taking turns in the family to talk about a good thing that you did for someone that day.

1.9 Studies investigating self-efficacy and food habits and behaviours among children

Fourteen studies were identified that examined the relationship between self-efficacy and dietary intake among children. These included 12 cross-sectional studies and two intervention studies. All 12 cross-sectional studies reported a positive association with at least one healthful dietary outcome assessed. Ten studies reported a positive

relationship with fruit and intake, and nine studies reported a positive relationship with vegetable intake. In addition, at least one study reported a positive relationship between self-efficacy and higher intakes of calcium, general healthy eating and lower fat and soft-drink intake.

Both intervention studies were largely school-based, with some family involvement. In the first study, although the increases in self-efficacy were not significant, after three years of intervention involving both school and family input, fruit and vegetable intake was higher compared to the control group. A second intervention study involved Native North American families. The intervention focused on knowledge and skill development related to healthy eating, physical activity and diabetes prevention. Self-efficacy scores increased from baseline to post-intervention. The percentage of energy from fat decreased, although only significantly in boys.

In summary, although the cross-sectional studies cannot be used to determine causality, the findings are consistent, especially for fruit and vegetable intake. Also, the two intervention studies reported more healthful intakes with increases in self-efficacy.

Recommendation for parents: Ensure children have the confidence to make healthy dietary choices, especially in what might be difficult situations (e.g eating with friends).

Strategies:

- When children talk about eating well, tell them that you believe in them and that you know they can eat more healthy foods (or less of foods considered unhealthy).
- When you see other children eating well, point out to your child how well the other child is doing.
- Provide specific feedback to your child about his or her healthy eating efforts in a positive manner. Congratulate successful behaviour – small victories are critical for success and boosting confidence.
- Encourage other parents to do the same for your child, but sensitively − children don't want everyone to know they're trying to eat better or be more physically active.
- Have healthy foods available when friends share snacks and meals with your child.
- Make the healthy choice the easy choice by having plenty of healthy food available and accessible.
- Buy in treat foods as needed so that children are not faced with difficult choices on a day-to-day basis.

1.10 Studies investigating work−family spillover and food habits and behaviours

We identified eight observational studies that investigated the relationship between work−family spillover and dietary patterns among families. Seven studies were cross-sectional, but somewhat heterogeneous in nature. Four of the seven studies reported negative associations between healthful eating and higher levels of work−family spillover, while four studies showed no association. One study showed a negative

relationship with healthy eating with some individuals but not others, possibly reflecting the success of different coping strategies used by different participants. Studies showing a negative relationship reported lower intakes of fruit, vegetables and dairy, less healthy food habits, higher intakes of fast foods, convenience foods and junk food, and increased incidence of skipping meals.

One cohort study examined dietary change from adolescence into adulthood. Participants cited employment as influencing dietary change by reducing the time available to cook and prepare foods. This "time famine" induced by employment and family commitments was associated with smaller increases in intakes of fruit and vegetables over the 20-year assessment period.

In summary, work−family spillover appears to affect dietary intake in some families whereas others appear to have developed coping strategies to negate potential problems. For those who struggle for balance, the response appears to include higher intakes of take-out food, junk food and convenience food, meal skipping, and reduced family meals. This is associated with feelings of limited time and energy available for food preparation or shopping. Although they are in the minority, those who find work and family life manageable employ strategies such as planning and cooking ahead, preparation of multiple meals, and sharing food preparation, cooking and shopping within the family

Recommendation for parents: Acknowledge that work commitments in family time may limit the availability of time to spend with family and can be damaging to family food and activity patterns.

Strategies:

- Share meal planning, shopping and preparation among the family.
- Cook and plan meals ahead. Where possible, cook multiple meals for later use.
- Talk to the boss about greater work flexibility.
- Have confidence in your food preparation and cooking skills (or increase your confidence by learning quick healthy cooking from friends and family, taking a community course, using a slow-cooker, or getting cookbooks or magazines out of the library).

1.11 Studies investigating parental feeding styles and food habits and behaviours

Parents use a variety of strategies and behaviours to control their children's food intake. This construct proved to be the most complicated behaviour to evaluate, largely due to the number of different styles assessed in the literature and the different cultural interpretations of each style. In all, 19 cross-sectional, one cohort and three intervention studies assessing parental style and dietary patterns were included in this review.

There is some evidence that an authoritative feeding style is positively related to healthful dietary outcomes, whereas an authoritarian style is inversely associated with diet quality. For the following parental styles:

- involvement/monitoring

- discipline
- obligation rules / eating rules
- reinforcement/praise/encouragement

there is weak evidence supporting a positive association with healthful eating, in as much as for each style at least one study reported a positive association with healthful eating and no studies reported negative outcomes. Conversely, there is weak evidence suggesting that the styles:

- indulgent
- uninvolved
- neglectful
- pressure

are negatively associated with healthful eating, in as much as for each style there was at least one study showing a negative association with healthful eating and no studies showing a positive relationship. The negative influence of parental pressure was further supported by an intervention study. The remaining styles:

- controlling
- permissive
- restriction

tended to produce conflicting findings, making interpretation difficult.

The evidence suggests that feeding practices are influenced by culture and parental goals for their children. Most of the feeding practices identified have been evaluated in predominantly white, middle-class populations and could potentially differ for different ethnic groups. Therefore caution should be used when analysing the results from different cultures, and especially when extrapolating results to different cultures.

Recommendation for parents: Regulate the quality and patterns of food intake, and allow children to choose how much they should eat (known as authoritative parenting).

Strategies:

- Avoid parenting styles with high levels of pressure, restriction and control.
- Provide a variety of healthful foods, and give children the freedom to choose how much of this food they will eat.
- Once dinner is finished, offer dessert.

1.12 Studies investigating food availability/accessibility and food habits and behaviours

Eighteen studies were identified that assessed whether food availability and/or accessibility was associated with food habits and behaviours. Twelve of the 15 cross-sectional studies and two of the three intervention studies supported a positive association between increased availability and accessibility of healthy food and diet quality in children. Three cross-sectional studies reported an increase in unhealthy

food intake among children when the availability and/or accessibility of these foods was high.

Accessibility *per se* was measured in four of the cross-sectional studies and two intervention studies. Three of the four cross-sectional studies and one intervention study reported a positive association between diet quality and accessibility. This indicates that both availability and accessibility are important influences on dietary intake among children.

In summary, all of the cross-sectional studies support an association between availability and/or accessibility and food intake among families. Increased availability of both healthy and unhealthy foods influenced children's intake. However, the intervention studies produced mixed results, with two studies showing higher intakes of fruit and/or vegetable intake with higher availability, and one study showing that increasing fruit and vegetable fruit availability did not increase intake. The lack of agreement among the intervention studies makes it difficult to draw definitive conclusions.

Recommendations for parents: Have lots of healthy foods easily accessible in the home, and have small portions of, or no, "treat" food in the home.

Strategies:

- Pre-prepare healthy foods (e.g. slice vegetables such as carrots, celery, peppers and fresh beans, and store them in the refrigerator for easy access).
- Make the healthy choice the easy choice.
- Make tap water the first choice − chilled in the fridge is good. Low-fat milk is a good second choice. Don't offer sweet drinks.
- Put a jug of water on the table at meal times.
- Buy "treat" foods as needed for special occasions − don't stock up.
- Have a full fruit bowl readily available for snacks.
- If treat foods are in the house, keep them out of sight and in a place where you need to go to some effort to eat them.

1.13 Studies investigating parental physical activity and child physical activity

Fifteen out of 23 cross-sectional studies, three out of six cohort studies, and the single interventions study reported significant positive associations between parent and child physical activity levels. Overall, 19 out of 30 studies (63%) reported significant positive associations. The remaining 11 studies reported no association. Importantly, no study reported an overall inverse association between parental and child physical activity.

Recommendation for parents: Undertake 30 minutes of moderate-intensity physical activity on at least five days per week yourself.

Strategies:

- Go out and play with your child.
- Walk, play, dance and be active together as a family. Make activity fun to do.
- Use active transport (walk or cycle) for trips less than 2 kilometres.
- Make some family treats/experiences activity based.

1.14 Studies investigating parental support and child physical activity

Twenty-two out of 29 cross-sectional studies and five out of six cohort studies reported significant positive associations between parental support and children's physical activity levels. Overall, 27 out of 35 studies (77%) reported significant positive associations. The remaining eight studies reported no association. Importantly, no study reported an inverse association between parental support and children's physical activity. There was no clear pattern between the type of parental support and the finding of a significant positive association between parental support and child physical activity levels.

Recommendation for parents: Support and encourage all attempts by the child to be active.

Strategies:

- Create a supportive activity environment by providing safe play spaces and by helping children get to play spaces and activities/sports.
- When affordable for the family, pay for any activity fees, buy uniforms and equipment, etc.
- Promote physical activity by saying how it is a great way to "have fun", "hang out with friends" or "keep fit".
- Transport children to their sports and activities, and watch them.

2 Background

2.1 Overview

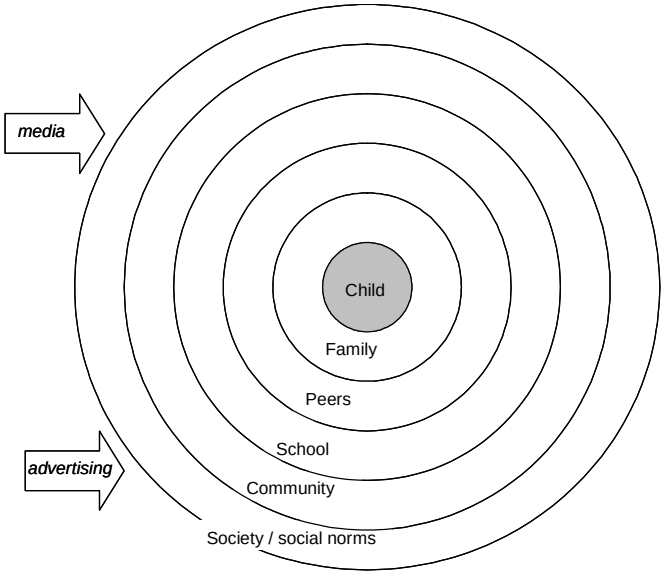
The family environment is typically the centre of people's lives, providing a place to feel safe and be supported, and to access the resources for daily life. These benefits are not universally experienced by all families, however, and may not be experienced by all individuals within a family. Such disparity prompts government interest in what families experience, how families might shape individuals and influence society, and how this might affect behaviour. Other reviews have already considered issues such as what makes families resilient and what leads to good child outcomes[1], the importance of families[2], and what makes family life good[3]. These broader reviews set the context for this current work on healthy eating and physical activity within the family environment.

The New Zealand Government has a focus on promoting healthy eating and healthy action in a variety of ways − via schools, workplaces, within the food and marketing industries, and at the family level, targeting Māori, Pacific and low socio-economic status people, as well as children. Within the broader Healthy Eating − Healthy Action strategy, the Government's social marketing campaign on healthy eating (Feeding Our Futures, developed by the Health Sponsorship Council) has chosen parents and caregivers (particularly Māori, Pacific and low socio-economic people) as the target intervention audience, with the aim of creating a home environment that supports healthy eating. Parents and caregivers are believed to be those most able to adopt the key messages from such a campaign[4].

To frame this work, the Health Sponsorship Council has developed a model to describe the multiple spheres of influence on a child (see Figure 1) and to show how the family is a key actor. Agencies for Nutrition Action (ANA) is a partner agency with the Health Sponsorship Council on Feeding Our Futures, and so it was timely to undertake this review of the role the home environment and families have on healthy eating and physical activity.

Although parents know they are hugely important in determining the eating and physical activity patterns of their own children, the Health Sponsorship Council noted that there had been a lack of nationwide family- and parent-focused interventions in New Zealand. This was one of the driving factors behind the Health Sponsorship Council's decision to choose parents as the agents of change in Feeding our Futures[4]. There is general consensus within the New Zealand public health community that choosing parents as the agents of change was a good decision for Feeding our Futures, but naturally in a new area there has been less consensus about *how* the home environment is important and *what* should be done. The authors hope this review will assist with such questions.

Figure 1. The multiple spheres of influence on a child



Source: reproduced with permission from the Health Sponsorship Council[4]

To provide an example of how important the family environment is, obesity treatment programmes are now largely family based, reflecting the fact that these provide significant and reliable outcomes for treating established obesity. This is particularly so when parents are the agents of change in a treatment programme (rather than the child) and where the treatment programme includes parenting skills, role-modelling, home environmental changes and other similar topics[5, 6]. The same is true for many other public health issues; for example, the family environment is also a significant predictor of adolescent smoking[7].

When deciding the outcomes of interest for this literature review, diet and physical activity were acknowledged to be influenced by the home environment, and diet and physical activity outcomes are areas of concern within New Zealand. For example, although many children have good diets and are physically active, there are increasingly large numbers of families and children where this is not the case. The New Zealand Children's Nutrition Survey showed that children aged 5−15 years in the most deprived geographical areas of New Zealand were more likely to eat lamb or mutton chops, canned corned beef, fish cake, fish fingers or fish pie, shellfish, meat pies, burgers, sausages and sausage rolls on a weekly basis than children from the least deprived geographical areas of New Zealand.[b] The same trends exist for other foods such as butter, doughnuts and croissants, and sweetener added to breakfast cereals, etc[8].

Between 1997 and 2001 in New Zealand, 68% of our young people (5−17-year-olds) and adults were active (they did 2.5 hours or more of sport and active leisure per week), but 32%, or around 233,000 young people, were inactive. More girls (36%) were inactive than boys (27%), and physical activity levels for young people declined from 69% in 1997/98 to 66% in 2000/01. The proportion of young people who were

[b] Here we have simply highlighted differences in diet based on geographical area of deprivation. We have not attempted to categorise healthy and unhealthy dietary intakes.

sedentary (no physical activity in the last two weeks) increased from 8% in 1997/98 to 13% in 2000/01[9].

The three previous ANA reviews have all included overweight or obesity as one of the outcome measures studied. For this review, to keep the size of the work manageable, the focus is on food practices and behaviours, and physical activity levels − not obesity or overweight. Unhealthy eating and low levels of physical activity are unevenly distributed throughout New Zealand society and are largely structural in their causes. This review acknowledges this reality and presents these findings as one part of the evidence about the influence on food and physical activity levels in families.

2.2 Aim of the report

The aim of the report was to answer the following questions (see Appendix M for a full description of the approach and methods):

1) What is the context of the family food and physical activity environment in New Zealand?
2) Is the "family food environment" associated with food habits or behaviours, and if so, how?
3) Is the "family physical activity environment" associated with physical activity, and if so, how?

2.3 Family food and physical activity environment models

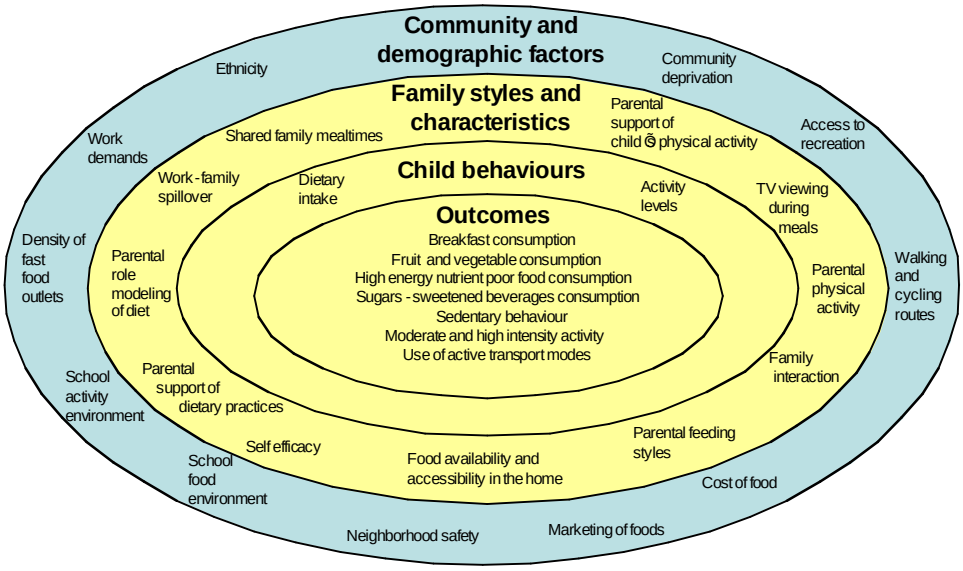
The family food and physical activity environment is set within a broad array of influences and components. For example, Davison and Birch[10] developed a model to describe how children's weight is influenced not only by immediate factors such as dietary intake, but also by more distant factors such as foods available in the home, parenting styles, parents' work demands, and society's expectations for how families and individuals should act.

Understanding the potential causal pathways and possible intervention points for promoting physical activity and improving diet within a family setting depends on the theoretical model underpinning the work. The authors of this review, building on Davison and Birch's[10] model for children's weight, have developed a model that reflects how the family food and family physical activity environments might have an impact on diet and physical activity outcomes (not on weight outcomes) within the wider community context (see Figure 2). The area shaded in light grey within the model is that covered by this literature review.

Birch[11] notes that "a child is influenced first by the family environment and parent's characteristics and then by community and demographic factors, which may be more important influences for older children". For young children, all environments are socially constructed because they do not choose where they live, where they play or what they will eat. The framework in Figure 2 also conveys the notion that what happens in one environment influences and is influenced by what happens in another.

The Families Commission[2] uses a similar ecologic framework in their work when describing the relationship between families and wider environments.

Figure 2. A model of the determinants of family food and family physical activity environments



Ecologic models (and other models) often do not state or investigate how past experiences have helped form current dietary and physical activity patterns. A life-course approach provides a way to understand behaviours within a changing world, since trajectories, transitions and turning points, place and time, and timing of events in lives are likely to affect current food choices as well. For example, there are many possible transition points within families – adults moving in together, the birth of a child, adults divorcing, a child going to school, a child becoming an adolescent − which may affect the dietary or physical activity patterns of the family[12]. Life-course models complement rather than replace ecologic models.

2.4 What is physical activity?

New Zealand children's own description of sport and physical activity is a useful construct to bear in mind. Sport typically involves commitment, regular training, official or formal competition, and rules and regulations, and it uses the whole body; whereas physical activity was described by New Zealand children as being more informal and social, less competitive, offering more variety (i.e. participants can pick and choose what they do) and with fewer rules and regulations[13]. This contrasts in turn with the accepted definition of physical activity used by the research community: "any bodily movement produced by skeletal muscles that results in energy expenditure"[14]. In this report "physical activity" is used as an umbrella term under which sport is just one domain, along with active transport, leisure-time physical activity and household duties.

2.5 Factors in the family food and physical activity environment studied in this review

In this review we have derived a set of factors about the family food and family physical activity environments from those described in the review documents[15, 16] and included studies (see Table 1).

Table 1: Factors relating to family food and physical activity environments

Factor	Examples of factor description
TV viewing during mealtimes	Families routinely watching TV while eating the family meal.
Parental physical activity levels	The effect of parental physical activity levels on those of the child.
Parental support of child's physical activity	Encouragement, watching their child do physical activity, having supportive beliefs about the benefits of physical activity, playing with their child, providing home activity equipment, transporting their child to sports or physical activity events, and paying for fees for their child to participate in physical activity.
Parental role modelling of diet	Parental intake of vegetables and dairy/milk, low-fat eating patterns, general healthy eating, eating breakfast, intakes of soft drinks, sweet and savoury snacks, fat intake, energy-dense foods, take-out foods or general unhealthy eating.
Parental support of dietary practices	Support and encouragement to develop healthy eating patterns of the child, such as eating fruit and vegetables, and dairy intake.
Shared family mealtimes	Where most or all of the family are present during mealtimes.
Family interaction at mealtimes and throughout the day	Negative behaviours such as conflict and arguments, and positive behaviours such as family cohesion (a positive family climate), family connectiveness (family and parental care, understanding and attention children receive from their family).
Self-efficacy of the child	The belief and confidence of the child in their own ability to successfully perform a specific behaviour; in this case to eat more healthy foods and fewer foods that are considered unhealthy.
Food availability/accessibility in the home	Fruit and vegetable condition and/or variety at the shopping store. Whether food is available in the home environment. Foods being accessible in a form, time and location that facilitates their consumption (e.g. carrot sticks on a shelf in the fridge at afternoon teatime).
Work−family spillover	Before or after work trying to fit in all of the necessary activities; feeling too tired, exhausted or stressed to prepare or purchase food[17].
Parental feeding styles or parenting styles	Many different "styles" are described and they appear to overlap, though the two major ones are: authoritative (parents are both firm and supportive and assume a leadership role in the environmental change with appropriate granting of the child's autonomy; and authoritarian (complete control of child feeding practices).

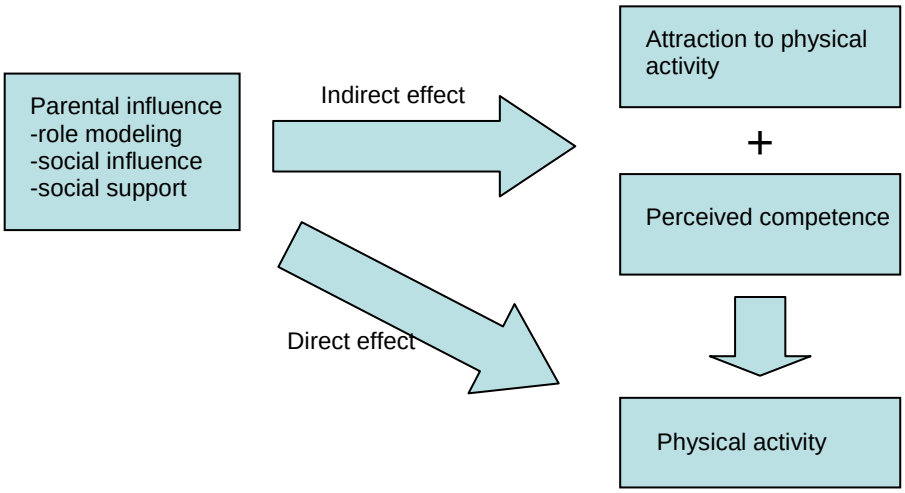
2.6 Concepts and theories about parental influence on children's diet and physical activity

In some of the first successful family-based obesity treatment programmes for children, Epstein et al[18] discussed how the home environment and parental behaviour interact. Parental behaviour was theorised to help children acquire and gain new food and physical activity skills, and parental changes to the home environment ("stimulus variables") were theorised to reinforce these new eating and exercise behaviours over

the long term[18]. This is likely to be overly simplistic, as parental behaviour over the long term would also likely reinforce new behaviours, and initial control of environmental stimuli would also likely help children acquire new skills because there would be less "competition" from alternative practices. Regardless, the concept of the separation of parental behaviour and environmental stimuli is highly useful when considering possible intervention points, because it implies that influences are not part of a single component (either the parent or the constructed environment).

In contrast, Welk et al[19] describe a model for parental influence on physical activity. Their model (see Figure 3) suggests that parental influence (made up of role modelling, social influence and social support) indirectly affects children's attraction to physical activity and their perceived competence, which in turn affects the child's physical activity. Parental influence was also suggested as having a direct effect on physical activity. Note that Welk et al[19] have not included a component for parental changes to the home environment, as was included in the food and physical activity model by Epstein et al.[18]

Figure 3. A conceptual model of parental influence on children's physical activity[19]



Source: Welk et al[19]

Many other theories and models attempt to explain the complex behaviours of families. Crossman et al[20] suggest that parents teach children values and norms by communicating their views, and then selectively reinforcing or discouraging behaviours. For example, control theory uses encouragements to children such as "eat your vegetables and I will be pleased with you" and "eat your vegetables and you can have pudding"[20]. Parental modelling theory suggests that parents' behaviour affects children's behaviour[20]; for example, parents eating a food will increase the likelihood of a child also eating that food.

Such theories are both supported and refuted by many cross-sectional studies[c] because the examples above usually don't say which came first: the chicken or the egg; that is, did the controlling behaviour of the parents pre-date the eating practices and weight of

[a] See the findings of this review to determine the relevant merits of different parenting styles.

the child, or did the child's eating practices and weight lead the parents to be more controlling[20]? This indicates the importance of separating out observational studies from prospective studies, as the authors have done with this review.

2.7 Families in New Zealand

On Census night in 2006 there were 641,589 families with dependent children, of which 70% (447,894) were couples with child(ren) and 30% (193,695) were one parent with child(ren)[21]. The proportion of one-parent families has increased over time, up from 14% in 1981 to 24% in 1991, and to 30% of families with dependent children in 2006. In 2001 over 4000 grandparents had taken on the role of parents through legal guardianship (less than 1% of families with dependent children). Workforce participation has also changed rapidly in the last 25 years, with an increase in the number of families in which both parents work. The Families Commission[2] summarises New Zealand's family demographic as follows:

> *families in New Zealand are becoming more diverse. The married, one income, two or more children with a male breadwinner and female housewife family model no longer represents the majority of New Zealand families*.[2]

2.7.1 Successful parent−child relationships in New Zealand

Positive parent−child relationships are a key component of successful parenting and positive outcomes across many domains for children. Key traits for successful parenting include parental warmth, appropriate provision of parental guidance, and consistency and clarity in the use of discipline, collectively known as "authoritative parenting". Less successful parenting styles are authoritarian (high on control and low on warmth), indifferent (low on control and low on warmth) and permissive (low on control and high on warmth)[2].

2.7.2 Principles underlying effective family interventions

(a) Ecological perspective of families
When considering interventions within a family food and physical activity environment, it is important to consider the principles under which families are likely to work. Firstly, as described above, families are embedded within a larger, multi-layered environment that provides opportunities and resources, and sets constraints on choices. For example, this broader environment defines how families make a living, the number of members within a family (extended or not), and the physical location of where the family lives in relation to other families and services, and also determines the social living skills passed on to a child to live within that environment. Some families have more resources to change their environment and pick the environment in which they live than others[22].

Within this larger ecology, families act as systems − displaying interconnectedness, openness and resistance to change[22].

(b) Interconnectedness of families
Parents do not uniformly impose their social living skills onto different children. Instead, they react to each child's individual characteristics, so that children influence

a parent's strategy for dealing with them. Also, a change in one part of the family system may have an impact on other parts of the family.

(c) Openness of families
Not only are families influenced by outside influences (the ecologic perspective, see above), but individual family members can also cause change in a whole or part of a family.

(d) Resistance to change
Families tend to resist change, but this is modifiable by outside influences (the ecologic perspective) and from natural or developmental changes that are already occurring within the family (e.g. transition to parenthood, a child entering school, a youth's transition to adolescence).

McHale[22] notes that this complexity of families means there is no single point at which to effect change, but this also means there are multiple entry points for interventions, encouraging multi-pronged interventions.

2.8 The family physical activity environment in New Zealand

2.8.1 New Zealand prevalence data on home environment factors that determine sport and physical activity

A substantial international review of physical activity and sport interventions[23] concluded that a number of factors determine adolescent physical activity behaviour, including age, gender, ethnic group, socioeconomic status, television (TV) watching, transport options and the physical environment. Only the final four factors have direct relevance to the family physical activity environment, but we have included the first factors to provide a complete physical activity picture. We have also added Families; to this grouping and have further populated the concepts described by Kolt et al[23] with New Zealand prevalence data.

(a) Age
Physical activity typically declines with age during adolescence. Six out of ten New Zealand European females aged five to six years (62.8%) and seven to ten years (60.3%) were active in the weekends on more than four occasions, but this dropped sharply at 11 to 14 years to four out of ten (42.8%). This is also reflected in the proportion of New Zealand children who were inactive in the weekend, with the highest rates of inactivity experienced by 11−14-year-old females[8]. Overall, physical inactivity (defined as less than 2.5 hours of physical activity per week) was age-dependent, rising from 30% in 13−15-year-olds to 47% in 16−17-year-olds[9].

(b) Gender
Boys were generally more physically active than girls in all age groups and categories. For example, males (29%) were more likely than females (15.6%) to be in the highest physical activity quartile, more likely to be very active during the lunchtime break, and more likely to cycle. There were exceptions: females were more likely to be active in the after-school time slot than males, and females (39.8%) were more likely to participate in tramping/climbing at least once in the last seven days than males (33.4%)[8].

(c) Ethnic group

This is a complicated picture for New Zealand. Results from the 1997, 1998 and 2000 Sport and Physical Activity Surveys[9] showed that Māori (71%) and European (70%) children were the most active, followed by Pacific (59%) and other ethnic groups (59%). Results from the 2001 Children's Nutrition Survey[8, 24] (using a different questionnaire) showed that NZ European and Other children were more likely to be in the least active group (males 23.1%; females 37.7%) and less likely to be in the most active group (27.7 %; 12.9%) than Māori or Pacific children. This held true for both males and females across nearly all measures of physical activity. Utter found that in many instances Māori and Pacific children were doing more physical activity than NZ European/Other children and that this was:

> *somewhat unexpected since overweight/obesity rates are highest among Pacific and Māori children … For New Zealand children, it may be that excessive consumption of high-fat/ high-sugar foods is driving excessive weight gain more so than inadequate physical activity*.[25]

High school students' perceptions of physical activity were investigated by Hohepa et al[26] to determine how their family, school and neighborhood could help them to be more active. The barriers and supports to physical activity (parental logistical support, parental encouragement and parental policies), plus the strategies to combat these as suggested by the high school students, were similar across Māori and New Zealand European students, suggesting that intervention approaches can be based on this common data[26].

Sport and Recreation New Zealand (SPARC) commissioned TNS New Zealand Ltd[13] to undertake qualitative research on 59 participants aged 11−14 years to understand the value of sport and their attitudes, motivations and barriers to participation in sport. Pacific participants experienced specific barriers, whereby sport participation was a lower priority than other commitments (religion and part-time work to support the family), and Pacific females were expected to focus on academic or musical activities as these were perceived to be more "ladylike" or respectful[13].

(d) Socioeconomic status

For family socioeconomic status (SES), Kolt et al[23] concluded that associations with physical activity were inconsistent across studies, with some international studies finding a positive association with high SES and others a negative association. Kolt et al[23] went on to show that international work on type of physical activity by SES was more consistent, with high SES being associated with more organised activities, possibly reflecting an ability to pay for any associated costs such as fees and uniforms.

The Children's Nutrition Survey[8] found clear differences in one measure of SES – the New Zealand Deprivation Index (NZDep)[d]. Children living in the most deprived geographic areas of New Zealand were more likely to be in the most active group (NZDep01-V: males 31.4 %; females 20.8 %) compared with those living in the least

[d] For the report on the National Children's Nutrition Survey the NZDep categories were collapsed into quintiles. Quintile 1 is defined as children living in the least deprived areas and quintile V as children living in the most deprived areas.

deprived geographic areas of New Zealand (NZDep01-I: males 20.7%, females 13.1%). The same trends held for active travel to and from school. An exception to this was for those children who were most inactive − a small proportion of New Zealand children, but with a strong inequalities gradient by NZDep. For example, children from the most deprived geographic areas of New Zealand were more likely to watch more than 8 hours of TV or videos during the weekend (males 10.9%; females 7.9%) than those from the least deprived geographic areas of New Zealand (males 2.8%; females 2.3%)[8].

(e) Television watching

The New Zealand Television Broadcasters' Council[27] presents annual data on total population viewing, which show that most New Zealanders sit in front of the TV a lot. On average, 2 hours and 56 minutes per person per day was spent in front of the TV in 2006, up from 2 hours 47 minutes in 2005. Also, over 97% of homes have a TV set, and 65% of homes have multiple TVs.

New Zealand Television Broadcasters Council research in 2005 showed that 5−13-year-old children spent an average of 2 hours 7 minutes watching TV every day, with 40% watching more than 2 hours every day and 5% watching more than 4 hours. Children's viewing data are no longer presented on the New Zealand Television Broadcasters Council website, so 2006 data are not presented, although total population viewing time has increased by nearly 10 minutes per person per day in the last year alone[27].

Throughout 2006, at peak viewing hours (18:00−22:30) one in five (20.8%) 5−12-year-olds and one in four (24.5%) 15−24-year-olds were watching TV at any given time. For the "household shopper with children" (a key demographic of interest to marketing companies), at any given time more than one in three (38.6%) were watching TV during peak viewing hours[27].

The National Children's Nutrition Survey[8] reported that 27% of New Zealand children watched more than 10 hours during the week (5% watched more than 4 hours per day) and 40% watched more than 4 hours per weekend (7% watched 8 hours or more). This study also examined computer or video games, and found that approximately six out of ten New Zealand children did not play these games during the weekend or week; the proportion playing more than 10 hours per week was less than 2% for all ages and genders.

The nationwide New Zealand CensusAtSchool survey of more than 25,000 year 5 to 13 students at New Zealand schools (voluntary participation) showed that 82% of the children surveyed said they had access to the internet at home, and 45% said they had their own TV in their room[28].

High school students' perceptions of physical activity were investigated by Hohepa et al[26] to determine how their family, school and neighborhood could help them to be more active. Electronic devices – talking on the phone, listening to the radio or watching TV − were considered to be a major home-based barrier to physical activity (along with passive transportation). Parents setting policies (TV limits) was suggested as a way to support physical activity.

(f) Transport options

According to the National Children's Nutrition Survey[8], nearly five out of ten children aged 5−15 years (46.9%) were transported to and from school, whereas one-third (37.2%) actively travelled to and from school on at least six occasions during the week. As children got older they were more likely to actively travel to school, and children in the most deprived geographical areas were more likely to actively travel to school (NZDep01-V males 51%; females 46%) than those from the least deprived areas (NZDep01-I males 27%; females 32%).

Hohepa et al[26] found that one of the main home-based barriers to physical activity identified by high school students was passive transportation – parents giving children a ride in a car or children taking the bus. On the flip side, parents providing logistical support (transport to and from activities and help with enrolling) were suggested as ways to support physical activity[26].

(g) Physical environment

The physical environment is thought to be highly influential on physical activity levels. For example, Kolt et al[23] describe qualitative interview results from Auckland students where the students' perceived environment was seen to be more supportive of sedentary activity than of physical activity. Studies of environment have focused on community facilities, street layout, parks, school facilities etc, rather than the home environment, leaving a substantial gap in our understanding of how the home physical environment might influence physical activity.

Kolt et al[23] describe the key motivators of physical activity for youth as being that physical activity:

- must be fun and enjoyable
- improves body image by "not being fat"
- increases social acceptance and interaction with friends
- provides a sense of achievement
- enhances their sport performance.

The key barriers to participation were felt to be:

- lack of transportation and/or family support
- lack of energy and motivation
- time constraints
- many sedentary activities on offer.

The Youth2000 national youth health survey of 9699 randomly selected high school students showed that neighborhood safety and ease of perceived access from home to recreational facilities (specifically parks, skateboard ramps, sports fields, swimming places, gyms and bicycle tracks) were positively associated with physical activity. Youth who reported there was nothing to do in their family neighbourhood were significantly less likely to exercise[29].

Hohepa et al[26] noted that high school students from low SES schools described physical environment barriers. For example, the distances required to walk from home to a point of interest (say a school) influenced their decision. Neighborhood safety

was also described as a barrier by some students, both in terms of the layout of parkland and the threat from other people. The students suggested ways to overcome these barriers, including modifying the neighborhood to create more spaces for activity (basketball court, bike track, etc.), through to creating more activities (fun days, sports days).

2.8.2 Families as a motivator for physical activity in New Zealand.

The Youth2000 national youth health survey has been further analysed to provide information on motivations for physical activity. Just 8.6% of youth said they exercised because "parents or school made them", whereas "it's fun" (85.7%), "to keep fit" (77.0%), "to hang out with friends" (63.4%) and "I'm good at it" (53.7%) were far more common responses[29].

SPARC commissioned TNS New Zealand Ltd[13] to undertake qualitative research of 59 participants aged 11−14 years to understand the value of sport and their attitudes, motivations and barriers to participation in sport. Families were identified as a strong influencing factor in shaping positive attitudes to sport for active children, and teachers for both positive and negative attitudes for active and non-active children. These attitudes were shaped by the age of 7 to 8 years. Parents were particularly mentioned when it came to functional barriers to sport, such as pressure from parents to prioritise educational achievement and parental financial constraints), or threats to the children's safety, perceived or real (e.g. restrictions due to asthma or injury risk). Parents also strongly supported involvement in sport by providing access to sport (transport and financial cost) and emotionally helping youth to feel confident, encouraged, supported and engaged with sport.

The emotional benefits of sport described by youth point to ways in which youth can be encouraged into sport; that is, by developing their own self-identity (being an individual), balanced with a desire to connect with others by being part of a group (that defines where they belong). Health benefits are not relevant or effective motivators for youth participation in sport. The researchers also noted that developing and reinforcing desired attitudes needed to start in the early years, given that attitudes were shaped by 7 to 8 years old[13].

2.9 The family food environment in New Zealand

The Families Commission[2, 3] consulted with New Zealand families about issues families were facing. Among many other concerns, families noted that healthy fresh food was important for family health but that such foods were costly and some could not afford it. In response, the Health Sponsorship Council[4] is undertaking a programme of work on family/whānau eating environments to inform the Feeding Our Futures social marketing campaign. A major qualitative research study has just been released, which describes healthy eating within the context of the New Zealand family/whānau. One of the many strengths of this work was the quantity of interviews (12 focus groups, 18 family/whānau groups, 48 individual in-depth interviews with parents/caregivers, and 10 interviews with children), and the mix of Pākehā, Māori, Pacific and Asian participants[30].

The research highlighted that:

- time, effort, planning, commitment and persistence are required by parents and caregivers to achieve healthy eating in their families/whānau
- healthy eating and intentions to eat healthily can be undermined by lack of buy-in by the wider family/whānau
- generally mothers have greater influence than fathers about what goes into the supermarket trolley, irrespective of income earner role(s)
- role modelling by parents is instrumental in establishing healthy eating patterns (or otherwise) in children
- parents sometimes say one thing to their children and do another themselves (e.g. in relation to eating fruit and vegetables)
- "partner drag" can undermine the effort of the adult in the household most concerned about healthy eating, resulting in unhealthy eating behaviours becoming the household norm[30].

2.9.1 Roles and responsibilities for food planning, preparation and cooking in New Zealand

The Health Sponsorship Council research also described a number of factors that are important in relation to the roles and responsibilities for food planning, preparation and cooking. The adults who regularly care for children during the day have the greatest influence on children's eating. This is because they prepare the meals and select snacks for children. In comparison, the adults who are in full-time work are not at home during working hours and so have less scope to influence healthy eating. In contrast to the parents, grandparents and other regular caregivers often follow their own rules regarding what to feed the children in their care. Grandparents in particular often regard it as their prerogative to "treat" their grandchildren[30].

Food planning and cooking are typically done by mothers, regardless of whether they are in paid work, although when mothers re-enter the paid workforce this sometimes encourages fathers to get more involved in both food planning and cooking. Overall, mothers are the main decision-makers about which foods are purchased. Children are not heavily involved in food planning, but parents generally take children's food preferences into account when meals are planned, and children are often involved in food shopping. Children specifically request "fancy" breakfast cereals and snack foods such as chippies, chocolate, biscuits, muesli bars and lollies, and usually children have seen these products advertised on television. When choosing what packaged lunchbox snacks are bought, children have a much greater role, yet some parents still have the final say over lolly lunchbox snacks and high-priced items[30].

An interest in baking and cooking simple meals develops in children from 5 years onwards. Many parents restrict baking and cooking to weekends or special occasions because it is "easier, quicker and less messy to keep children out of the kitchen". Some children cook for the whole family/whānau on an occasional or regular basis once they are teenagers[30].

2.9.2 Family decision-making about meals and snacks in New Zealand

Parental purchases of breakfast cereals are related to both the perceived "healthiness" of the cereals (primarily related to sugar content and use of colourings) and cost (the least healthy cereals, from parents' point of view, are often the most

expensive). The key decision-maker regarding what goes into children's (up to 10 years old) lunchboxes is the mother. Beyond 10 years old those children who purchase their lunch generally make their own decisions regarding what they buy and from where. Locations of purchase for lunches include dairies, service stations, take-away outlets and school canteens[30].

Two factors govern decisions about dinner: the time grocery shopping is completed and when the cook "gets on with it". Factors such as mood, available time and energy levels all influence what gets cooked or whether takeaways are on the menu. Treats such as lollies or packaged snacks are asked for by children when they know these are in the house. While many parents have rules and limits relating to such snacks, treats and snacks are sometimes given to "buy peace" from the demands of children[30].

2.9.3 Rules and guidelines for eating in New Zealand families

The TNS New Zealand Ltd (2007)[30] study identified many family/whānau rules for healthy eating, but they were far from universal and were sometimes randomly enforced. For example:

- families/whānau have a general rule that children must eat breakfast, but once they are older than 10 years the enforcement of this reduces
- enforcement of rules relating to lunch gets harder as children get older and the social acceptability of a lunchbox wanes, and some parents do not attempt to regulate what their older children buy for lunch
- any rules regarding lunches are aided by schools, many of which discourage or ban chocolate or lollies being taken to school as part of lunch, and encourage water consumption over fizzy or other sugary drinks (these are also often banned)
- dinner rules were found in most families/whānau and at least one parent was likely to be present to monitor children's eating, although parents' own eating habits sometimes undermine their own dinner rules, particularly in relation to eating vegetables
- snack rules focus on limiting less healthy snacks such as chippies and biscuits, and ensuring that children do not fill up on snacks at the expense of eating proper meals, but snack rules are more likely to change according to the parents' mood and stress levels.

2.9.4 Further information on Pacific families in New Zealand

As well as the work described by TNS New Zealand Ltd[30] above, the Pacific Islands Family Study, a cohort study of 1398 Pacific babies born in the year 2000, provides additional information about foods and Pacific families[31]. Firstly, when the children were just 6 weeks old mothers were concerned about family food issues, and experienced a high level of stress about providing food for the family and not being able to provide food for social occasions. At 4 years of age, six out of every ten Pacific children had snacks or soft drinks before going to bed, which the authors described as putting children's teeth at risk for dental decay, and two out of five mothers had concerns their child was overweight (37.2%). By 6 years of age, 35% of mothers were concerned about their child's weight, and most children (85.6%) ate at least one meal per day with their parents, liked to run and play hard (86.9%), and enjoyed sports and games (91%). In the summary of the work, the authors stated that

a stronger alignment to Pacific culture fostered significantly better health outcomes for both mother and child[31].

2.9.5 Food security for New Zealand families.

The Ministry of Health's Children's Nutrition Survey (2003)[8] provides robust data on the proportion of households in New Zealand that have difficulties affording to eat properly and experience food running out, use food banks, and other indicators. The data are a rich source, providing information by number of family members, number of children in families, deprivation level of families, urban/rural location, and ethnic group. For example, eight out of ten households overall can "always afford to eat properly", whereas only six out of ten households with five or more children, or four out of ten Pacific households with five or more children can "always afford to eat properly".

"Food runs out sometimes or often" in nearly half of the most deprived households in New Zealand (45.2% of NZDepV households), compared with just 1 in 16 of the least deprived households in New Zealand (6.2% of NZDepI). Nearly one in seven NZ European households with four or fewer members (15.2%) were often or sometimes stressed about a lack of money for food, compared with more than one in three Māori households with four or fewer members (36.1%)[8]. These trends exist across all of the information types, showing that Pacific families (especially), Māori families, large families (seven or more members or five or more children) and deprived families are most vulnerable; while New Zealand European families, smaller families (four or fewer members, or two or fewer children) and the least deprived families are the most privileged regarding food security.

2.9.6 International perspective on the family food environment

One Australian study[15] looked at parents' views of home environment factors that affect children's food choices by interviewing parents. Using thematic analysis, the major influences mentioned by parents were found to be:

- food advertising (11 out of 17 parents – "effective and pervasive influence on children's food choices")
- food availability in the home and exposure to that food (14 out of 17 parents – "likely to influence what a child eats")
- using food as a reward when children were considered to have not eaten enough (7 out of 17 parents – "a reasonable and practical solution according to parents, yet also known to be undesirable by parents")
- role modelling eating (11 out of 17 parents – "opportunity to eat the evening meal at the dining table", to have a family discussion (4/11), to learn table manners (4/11) and to teach children about what to eat (4/11)
- providing opportunities for involvement with food (11 out of 17 parents) – "involving children in the preparation, cooking or growing of food had a positive impact on food choices".

The authors conclude that the relationships between home food environment and children's eating patterns are complex[15]. For example, availability of foods such as fruit and vegetables within the home is important, as further confirmed in this qualitative study, but the study also suggests that intake determines availability in

many families. This suggests that including an understanding of the attitudes and beliefs behind why parents offer foods is also required, particularly for foods already rejected by a child. The authors suggest understanding more about the values and beliefs of the population so that future messages/interventions can be better targeted, as is being done by the Health Sponsorship Council for the Feeding our Futures social marketing campaign.

A far larger US study involved 112 participants within focus groups, six in-home observations and in-depth interviews of families, and 10 interviews with 46 child and parent participants with the aim of developing meaningful and relevant messages for children and their families[32]. Many of the parents were reluctant to take on "new battles" and instead tended to downplay any issues, hoping the child would outgrow the issue. Children expressed a desire to change eating and physical activity habits but needed help. Parents knew they should set examples, but most had limited time and some parents were overweight themselves and did not feel they could act as an example without changing their own behaviours.

For children, small victories were critical to boost self-esteem and sustain interest. This could be achieved by setting attainable goals requiring small rather than drastic changes in eating and physical activity habits. Children wanted parents to be positive rather than critical, participate in physical activity with them, and help them make healthy food choices. Children didn't want "everybody" to know they were making changes for fear of being teased. A big and complex issue was children's self-esteem. Children did not want to be nagged all the time, and parents did not want to damage what were seen to be fragile self-esteems. There was a fine line between parents suggesting alternatives and providing other options (positive) and critically telling children what to eat and what to do (negative)[32].

Borra et al[32] have suggested a number of ideas for transmitting knowledge to parents and children, revolving around websites, toll-free phone lines and information about community organisations that might help. Given the communication issues parents and children had around self-esteem, it was surprising no mention was given of how critical it is to get other components of the family environment right so that potential conflicts and criticisms (implied or not) could be minimised (e.g. TV removed from bedrooms, limiting the availability of high-energy nutrient-poor foods available in the home, etc).

Low-income parents in the USA presented a different set of influences when queried about spillover from work, such as "treating" children with food after a bad day at work, reduced time and effort for preparing meals, lowered family expectations for mealtimes, and trading off good nutrition against other family activities/quick meals[17]. This reflects the blurred lines between home environments and external environments, and also reflects the need for "real" recommendations and practical interventions when dealing with time-pressured and financially pressured parents.

The size of food portions consumed at home is increasing within the US home environment for many food products, in line with the increasing trend of portion size increases for fast food outlets. The researchers described the increase in the size of food portions consumed at home as "the most surprising result", and "a shift that

indicates marked changes in eating behaviours in general"[33]. Time-series data are not yet available to confirm such a trend in New Zealand.

2.10 The complexity of the family food and physical activity environment

Many factors complicate the relationships between family food and physical activity environments and dietary and physical activity outcomes of interest. For example, studies sometimes find that family food and physical activity environments affect male children in a different way to female children. Simple differences such as the differing age of puberty (9−13 years for females, 10−16 years for males) complicate age-based analyses by gender because pre-pubescent children are typically shorter and thinner than post-pubescent children, all other things being equal[20, 34].

Cultural differences are also likely to be important. For example, Chinese−American parents who are deeply involved in, supervise and encourage academic achievement were categorised as "restrictive" and "authoritarian" in one study, whereas for Chinese such a style actually reflects caring and loving parenting[35]. The label applied to the Chinese−American parents in the study was wrong, as they should have been categorised as authoritative (high on control and high on warmth) rather than as authoritarian (high on control and low on warmth). Because the Chinese−American parents were mislabelled by the study authors, the study results for authoritarian families were conflicting within the study: they showed that "authoritarian" Chinese−American parents produced improved health outcomes for their Chinese−American children, whereas similarly labelled authoritarian white American families produced reduced health outcomes for their white children.

For each variable, several sub-categories can be analysed and each sub-category might produce different results. For example, a retrospective study into how adult eating behaviours are affected by childhood food rules showed that only "control" food rules[e] were related to binge eating and dietary restraint as adults, regardless of body mass index (BMI), ethnicity, age or childhood weight status, whereas restriction food rules[f] and encouragement food rules[g] were unrelated to binge eating or dietary restraint as adults[36].

A further complicating factor is that parents and adolescents may perceive the family environment entirely differently. A US study showed that adolescents perceived they were more helpful at mealtimes than parents perceived, and that adults perceived their adolescents ate breakfast and had family dinners more frequently compared with adolescent perceptions[37]. Parents and adolescents had matching frequencies on only one question out of eight: the frequency of arguments about eating. Besides the obvious issues for researchers wanting to find out what is actually happening in families, the authors suggest that different messages during interventions may be needed for adults and adolescents, as parents might perceive no need to make a change in adolescent breakfast frequency if they think it is adequate, even though the adolescent perceives their personal frequency of breakfast intake to be lower.

[e] Control food rules − those that withhold favourite foods as a punishment for bad behaviour, or reward good behaviour or accomplishments with sweets or favourite foods.

[f] Restriction food rules – those that restrict certain foods. For example, you cannot have dessert until you finish your dinner, do not eat or snack between meals, sweets are bad for you, you are not allowed to eat junk food.

[g] Encouragement food rules – those that promote or encourage the intake of foods. For example, clean your plate at each meal, if you put it on your plate you have to eat it, you must eat your vegetables at dinner, you have to at least try or taste new foods, you must sit at the table until you are finished.

It is common for there to be a number of difficulties getting accurate data for nutrition research, as described above. One example within the family food environment is that mothers and fathers can differ in their accounts of their child's eating habits. Pickiness at mealtimes and struggles for control at mealtimes were reported differently by both parents, whereas refusal-of-food behaviours by the child was reported the same by both parents. This is likely to reflect the overt nature of refusal, which is easy for both parents to notice, compared with the more conspicuous topic of pickiness and the differential struggle for control by the child with each parent[38]. This is important as each parent within the household might need a slightly different message in a nutrition intervention.

Furthermore, most studies investigating this area are likely to underestimate the full effect of the family environment because studies typically limit the amount of data collected to make the studies achievable within budgets and timeframes, and therefore the studies only consider a component of the whole possible effect.

Finally, to underline the inter-related nature of the family food environment, in a large US cross-sectional study the presence of children in a household was associated with significantly higher adult total fat and saturated fat intakes compared with households without children. Adults with children ate more high-fat foods more frequently, such as salty snacks, pizza, cheese, beef, ice-cream, cakes or cookies, bacon, sausage or processed meats, and peanuts[39]. Adults don't just influence children: children also influence adults.

3 Is the family food environment associated with food habits and behaviours?

The studies reported in this section were identified from the initial literature search, and from references listed in individual research papers. The current review covers papers published from 1996 to 2007. In total, 64 studies were identified which met our criteria for examining the relationship between the family food environment and food habits and behaviours. We did not include studies whose only outcomes involved overweight and/or obesity.

From this review of the literature nine variables contributing to the family food environment were identified as important predictors of diet quality:

- shared family mealtimes
- television viewing during mealtimes
- parental modelling
- parental support
- family interactions
- self-efficacy
- work−family spillover
- parental feeding style
- food availability and accessibility.

We examine each of these in the following sections.

3.1 Are shared family mealtimes associated with food habits and behaviours?

Shared family meals are times when children can learn about nutrition, and may allow parents to improve family relationships, provide structure, and model healthful eating. Studies investigating shared family mealtimes have assessed the frequency with which most or all of the family are present during mealtimes. In total, 11 studies investigating family mealtimes and dietary intake were identified (see Tables 1a and 1b, and Appendix A). Most of the studies included all daily meals in the analysis, whereas four specifically referred to the evening meal[40-43]. All studies were cross-sectional and thus do not provide a particularly strong evidence base. However, the findings are consistent.

Of the eleven studies, nine reported an association with shared family mealtime frequency and at least one of the dietary outcomes assessed[40-48]. Of these, seven were positively associated with vegetable intake[40-44, 46, 47], six with fruit intake[40, 41, 43, 44, 46, 47], four with dairy/calcium/milk intake[40, 43, 47, 48], two with micronutrient intake[41, 47] and one with fibre intake[41]. An inverse association was found between family mealtimes and soft drink consumption[41, 47], fast food intake[41, 45] and snack food intake / less unhealthy eating[45, 47] in two studies, and fat[41] and sweet[45] intake, and skipping meals[43] in one study each. Of the studies showing at least one related dietary factor, three also reported no association with family mealtimes and one of the other dietary outcomes assessed[46-48].

Only two studies failed to show any association with dietary intake[49, 50]. Several reasons may account for these discrepant findings. The data collected by Sweeting et al[50] were analysed 10 years after collection and some important foods currently available were not assessed. Also, the healthy food index used to measure dietary intake in this study was not validated against actual intake, whereas other studies used validated food frequency questionnaires to assess dietary intake[41, 47-49]. The study by De Bourdeaudhuij et al[49] used a validated food frequency questionnaire, but had a modest response rate and the smallest sample size of the studies reviewed on this topic (n = 104 parent−child dyads). Whereas there were no associations with family mealtimes and dietary intake among adolescents in this study, increased frequency of family mealtimes was associated with lower soft-drink and snack food consumption among parents.

Seven studies involved large samples (over 1000 participants), ranging from 1336 to 76,201 participants[40-43, 47, 48, 50]. Studies were carried out in a variety of countries, including four from the United States[40, 41, 46, 48], two from the United Kingdom[44, 50] and five from Europe[42, 43, 45, 47, 49], suggesting that family mealtimes are important in a number of different countries and cultures.

There are several limitations worthy of note. Firstly, all studies include self-reported data. Secondly, two studies reported low-to-moderate response rates of 48% and 64%[44, 49]. Thirdly, cross-sectional studies are unable to determine causal relationships because of the presence of other potentially confounding variables and their inability to assess the temporal direction of the association.

In summary, although all studies were cross-sectional and thus cannot be used to determine causality, the results are consistent. In nine of the eleven studies, higher frequency of family mealtimes was positively associated with at least one healthy dietary outcome. Importantly, no studies reported a negative association between shared family meals and dietary intake. Over half of the studies were performed with adolescents. Mealtimes may become increasingly important as a child moves into adolescence, a time marked by greater freedom in decision-making and independence. In one study, both parents and adolescents perceived family mealtimes positively[51]. These positive attitudes could be capitalised on by both parents and public health programmes. Unfortunately there are no intervention studies investigating the relationship between shared family mealtimes and dietary intake. Such studies are required to provide stronger evidence of this relationship.

Table 1a. Summary of studies investigating the relationship between shared family meals and healthful eating among families

Study	A positive association between healthful eating and increased frequency of family meals	No association	A negative association between healthful eating and increased frequency of family meals
Cross-sectional studies			
De Bourdeaudhuij & Van Oost 2000[49]		Soft drinks, fruit, vegetables, fat, general healthy eating, snacks	
Gillman et al 2000[41]	↑ Fruit, vegetables, energy, fibre, micronutrients ↓ Trans and saturated fat, glycaemic load, fried food, and soda		
Roos et al 2001[42]	↑ Raw vegetables		
Cooke 2003[44]	↑ Fruit and vegetables		
Haapalahti et al 2003[45]	↑ Juice ↓ Sweets, fast food, and unhealthy eating		
Hannon et al 2003[46]	↑ Fruit and vegetables	Fat	
Neumark-Sztainer et al 2003[47]	↑ Fruit, vegetables, calcium-rich foods, micronutrients ↓ Soft drinks and snacks	Fat	
Videon & Manning 2003[43]	↑ Fruit, vegetables, dairy ↓ Skipping meals		
Sweeting & West 2005[50]		Less healthy eating or unhealthy snacking	
Larson et al 2006[48]	↑ Milk, ↑ Dairy	calcium	
Fitzpatrick et al 2007[40]	↑ Fruit and vegetables, milk		
Total number of studies = 11	**9**	**5**	**0**

Table 1b. Summary of studies investigating the relationship between shared family meals and dietary outcomes among families

Dietary outcome	Number of studies showing a positive association between dietary outcome and increased frequency of family meals	Number of studies showing no association	Number of studies showing a negative association between dietary outcome and increased frequency of family meals
Cross-sectional studies			
↑ Fruit	6	1	0
↑ Vegetables	6	1	0
↑ Dairy/calcium/milk	4	1	0
↑ General healthy eating	0	1	0
↑ Micronutrients	2	0	0
↑ Fibre	1	0	0
↓ Fat/fried foods	1	3	0
↓ Soft drinks	2	2	0

↓ Fast food	2	0	0
↓ Less healthy eating/snacking	2	2	0
↓ Skipping of meals	1	0	0
Total number of studies = 11	**9**	**5**	**0**

3.2 Is television viewing during mealtimes associated with food habits and behaviours?

Shared family mealtimes appear to positively influence diet quality among children. However these beneficial effects may be compromised if mealtimes are associated with television (TV) viewing. Five cross-sectional studies investigating the effects of TV viewing during mealtimes on dietary intake among families were identified[15, 40, 52-54] (see Tables 2a and 2b, and Appendix B).

One of these studies included only adult dietary intake as a means of assessing family intake[52]. In this study, increased TV viewing during mealtimes was associated with a reduction in fruit and vegetable intake, along with increased fat consumption among parents. The four remaining studies reported similar findings among children[15, 40, 53, 54]. All five studies reported an inverse association between TV viewing and fruit and vegetable intake, while two studies showed higher intakes of high-energy drinks with higher levels of TV viewing[53, 54]. Lower intakes of grains, nuts and energy from carbohydrate were seen in one of the studies reviewed, along with higher intakes of pizza, red meat, caffeine[53] and fat[52] .

The studies were carried out in a variety of countries, including three in the USA[40, 52, 53], one in Australia[15] and one in the Netherlands[54]. This suggests the detrimental effects of TV viewing during mealtimes affect a number of countries.

Again, all of the information collected in these studies was based on self-report. Other limitations include low response rates in two studies[15, 52], and because all studies are cross-sectional causality cannot be determined. Despite these limitations, the results are consistent.

In summary, although only five studies were identified investigating the effects of TV viewing during family mealtimes, all studies consistently reported a negative influence on diet quality among families routinely watching TV during mealtimes. Importantly, no studies reported healthier intakes with increased TV viewing. The apparent benefits seen with increased shared family meals may therefore be compromised by routine TV viewing during meals. Therefore, attempts to increase shared family mealtimes should be accompanied by the recommendation to limit TV viewing during this time.

Table 2a. Summary of studies investigating the relationship between TV viewing during dinner and healthful eating among families

Study	A positive association between healthful eating and increased TV watching during dinner	No association	A negative association between healthful eating and increased TV watching during dinner
Cross-sectional studies			
Coon et al 2001[53]			↓ Grains, fruit, vegetables, nuts, energy from carbohydrate ↑ Pizza, soda, caffeine
Boutelle et al 2003[52] (adult intake only)			↓ Fruit and vegetables ↑ Fat
Campbell et al 2006[15]		Vegetables, savoury and sweet snacks, high-energy drinks	↑ Energy intake
Fitzpatrick et al 2007[40]		Dairy	↓ Fruit and vegetables
Kremers et al 2007[54]			↑ Sweetened beverages
Total number of studies = 5	**0**	**2**	**5**

Table 2b. Summary of studies investigating the relationship between television viewing during dinner and dietary outcomes among families

Dietary outcome	Number of studies showing a positive association between dietary outcome and increased TV watching during meals	Number of studies showing no association	Number of studies showing a negative association between dietary outcome and increased TV watching during meals
Cross-sectional studies			
↑ Fruit	0	0	3
↑ Vegetables	0	1	3
↑ Dairy	0	1	0
↑ Grains	0	0	1
↑ Energy from carbohydrate	0	0	1
↑ Nuts	0	0	1
↓ Fat	0	0	1
↓ High-energy drinks/sweetened drinks	0	1	2
↓ Sweet and savoury snacks	0	1	0
↓ Energy	0	0	1
↓ Pizza	0	0	1
↓ Caffeine	0	0	1
Total number of studies = 5	**0**	**2**	**5**

3.3 Is parental modelling associated with food habits and behaviours?

Serving as role models may be one pathway by which parents shape their children's dietary habits. Clustering of dietary habits within families indicates that children may mimic the behaviour of their parents.

In total, 25 studies examined the relationship between parental modelling and dietary intake (see Tables 3a and 3b, and Appendix C). Twenty-four observational studies (23 cross-sectional and one cohort) and one intervention study were identified. In 16 studies, parental modelling was assessed by comparing dietary intakes of parents and their children[44, 55-68], whereas 14 studies used specific questionnaires to measure parental modelling[15, 49, 55, 56, 66, 67, 69-76].

All 23 cross-sectional studies reported an association between family modelling and at least one dietary outcome measured. Fourteen studies showed a positive relationship between parental modelling and fruit[44, 46, 49, 55, 59, 61, 62, 66-69, 72, 73, 76] and vegetable intake[15, 44, 46, 55, 59, 60, 62, 66-69, 72, 73, 76], three with dairy/milk intake[58, 62, 63], two with low-fat eating patterns[49, 69], and one for each of the following outcomes: general healthy eating[56], snacks[49] and breakfast intake[65]. Children also appeared to be influenced by their parents' modelling of unhealthy dietary behaviours. Higher levels of parental modelling were associated with higher intakes of soft drinks in four studies[57, 58, 67, 71], and sweet and savoury snack intake[57], fat intake[46], energy-dense foods[74], take-out foods[57] and general unhealthy eating[56] in one study each. This indicates that children tend to model both their parents' healthy and unhealthy dietary patterns.

The single cohort study reported that breakfast intake by parents was significantly positively associated with adolescent breakfast eating[64]. This study involved a sample of 5448 participants. Only the breakfast meal was assessed, so information on modelling of other parental food habits is unknown.

The one intervention study, which by design provides more rigorous evidence, reported higher fruit and vegetable intakes with increased maternal modelling. This study randomised families to either an intervention group, which received dietary counselling to reduce cardiovascular risk over a 10-year period, or a control group. Increases were reported in fruit and vegetable intake among intervention children compared to control children, which matched their mothers' intakes[75]. Limitations of this study are that only one-day food records were used to measure parental intake, and parental modelling was only one aspect of the intervention.

The studies were performed in a number of countries, including 10 in the USA[46, 58-60, 63, 69, 71, 72, 74], four in the UK[44, 56, 61, 68], nine in Europe[49, 55, 64-67, 73, 75, 76] and two in Australia[15, 57]. A number of different ethnic groups were investigated, including African-American[69] and Mexican-American[74] samples. Consistent results across a number of different countries and ethnic groups suggest that parental modelling is important across a range of cultures. Seven analyses included large (over 1000 participants) and/or representative samples[55, 63-66, 75, 76], including the results of the 1994/95 USDA Continuing Survey of Food Intakes by Individuals (CSFII)[63]. These large sample sizes strengthen the level of evidence.

There are limitations in some of the studies, however. Observational studies rely on self-report and are unable to determine a causal relationship. One study assessed attitudes to modelling as opposed to actual modelling[74]. Some of the studies that assessed modelling by comparing dietary intakes of parents and their children used different methods to assess parental and child food intake (e.g. a food frequency questionnaire versus a 24-hour recall)[58-61]. The cohort study was performed with a sample of twins, making the generalisability of results to non-twin populations questionable. A concern with the intervention study is that modelling was only one aspect of the intervention and so it is unclear whether modelling is the primary cause of dietary change in these studies.

In summary, the studies show consistent results. Twenty-two studies reported that healthful parental modelling is positively associated with healthy eating patterns among children. Of the 10 studies that investigated unhealthy modelling by parents, seven showed an increase in unhealthy eating among children. Importantly, no studies showed decreased healthy eating with increased healthy parental modelling. Hence most studies show that there are similarities between parents' and children's intakes. Parental modelling appears to have the potential to both positively and negatively influence the dietary intake of children, and parents should be aware that their dietary behaviour is likely to influence the dietary intake of their children.

Table 3a. Summary of studies investigating the relationship between parental modelling and healthful eating among children

Study	Increased intake with increased *healthful* parental modelling	No association with *healthful* parental modelling	Decreased intake with increased *healthful* parental modelling	Increased intake with *unhealthy* parental modelling	No association with increased *unhealthy* parental modelling	Decreased intake with increased *unhealthy* parental modelling
Cross-sectional studies						
Gibson et al 1998[61]	Fruit	Vegetables			Confectionery	
De Bourdeaudhuij & Van Oost 2000[49]	Fruit, snacks and lower fat intake	Diet quality			Soft drinks	
Fisher et al 2000[58]	Milk			Soft drinks		
Johnson et al 2001[63]	Milk intake					
Tibbs et al 2001[69]	Fruit, vegetables and low fat intake					
Fisher et al 2002[59]	Fruit and vegetables					
Cooke et al 2003[44]	Fruit and vegetables					
Galloway et al 2003[60]	Vegetables			Neophobia		
Hannon et al 2003[46]	Fruit and vegetables			Fat		
Wardle et al 2003[77]	Fruit and vegetables					
Bere & Klepp 2004[55]	Fruit and vegetables					
Brown & Ogden 2004[56]	General healthy eating			General unhealthy eating		
Grimm et al 2004[71]				Soft drinks		
Keski-Rahkonen et al 2004[65]	Breakfast					
Vereecken et al 2004[67]	Fruit and vegetables			Soft drinks, confectionery		
Young et al 2004[72]	Fruit and vegetables					
Hanson et al 2005[62]	Fruit and vegetables (girls), dairy	Fruit and vegetables (boys)				

Vereecken et al 2005[73]	Fruit and vegetables					
Campbell et al 2006[15]	Vegetables				Energy, high-energy fluids, sweet and savoury snacks	
Matheson et al 2006[74]		Fruit, vegetables, % energy from fat, sweet and savoury snacks		Energy-dense foods		
Wind et al 2006[76]	Fruit and vegetables					
Campbell et al 2007[57]				Savoury and sweet snacks, take-out, high-energy drinks		
Reinaerts et al 2007[66]	Fruit and vegetables					
Total number of studies = 23	**20**	**4**	**0**	**8**	**3**	**0**
Cohort studies						
Keski-Rahkonen et al 2003[64]	Breakfast					
Total number of studies = 1	**1**	**0**	**0**	**0**	**0**	**0**
Intervention studies						
Talvia et al 2006[75]	Fruit and vegetables					
Total number of studies = 1	**1**	**0**	**0**	**0**	**0**	**0**

Table 3b. Summary of studies investigating the relationship between parental modelling and dietary outcomes among children

Dietary outcome	Number of studies showing higher intakes with increased *healthful* parental modelling	Number of studies showing no association with increased *healthful* parental modelling	Number of studies showing lower intakes with increased *healthful* parental modelling	Number of studies showing higher intakes with increased *unhealthy* parental modelling	Number of studies showing no association with increased *unhealthy* parental modelling	Number of studies showing lower intakes with increased *unhealthy* parental modelling
Cross-sectional studies						
Fruit	14	2	0			
Vegetables	14	3	0			
Milk/dairy/calcium	3	0	0			
General healthy eating / diet quality	1	1	0			
Breakfast	1	0	0			
Low fat intake	2	1	0			
High fat intake				2	0	0
High-energy drinks				4	2	0
Sweet/savoury snacks				2	1	0
Take-out foods				1	0	0
General unhealthy eating				1	0	0
Energy-dense foods				1	0	0
Confectionery				1	1	0
Energy				0	1	0
Total number of studies = 23	**20**	**4**	**0**	**8**	**3**	**0**
Cohort studies						
Breakfast	1	0	0			
Total number of studies = 1	**1**	**0**	**0**	**0**	**0**	**0**
Intervention studies						

Fruit	1	1				
Vegetables	1	1				
Total number of studies = 1	**1**	**0**	**0**	**0**	**0**	**0**

3.4 Is parental support associated with food habits and behaviours?

Parents may be able to influence their children's dietary practices by providing support and encouragement to develop healthy eating patterns. However, few studies have investigated this construct in relation to food habits and behaviours among children (see Tables 4a and 4b, and Appendix D). In total, we identified four studies meeting our criteria[48, 72, 76, 78]. All studies were cross-sectional and therefore do not provide a particularly strong evidence base, but the studies are consistent. Three of the four studies report a positive association between healthful eating and increased parental support[48, 76, 78]. Parental support was positively associated with fruit and vegetable intake in two studies[76, 78], and with dairy intake in one, although only in girls[48]. One study showed a positive relationship between parental facilitation (making the behaviour easier) and fruit and vegetable intake[76]. However, this study failed to show a relationship between parental encouragement and fruit and vegetable intake.

Three of the studies were performed in the USA[48, 72, 78] and one in Europe[76]. Two analyses involved large samples (over 1000 participants)[48, 76]. All studies used questionnaires to assess parental support.

There are limitations in some of these studies. All data were self-reported, and because all studies are cross-sectional causation cannot be inferred. The one study failing to show an association between parental support and dietary intake had a modest response rate[72]. Further studies are required to see whether parental support has different effects on girls and boys, as seen in one of the studies[48].

In summary, although only few studies have investigated this construct, the research provides consistent evidence of a positive relationship between parental support and enhanced diet quality.

Table 4a. Summary of studies investigating the relationship between parental support and healthful eating among children

Study	A positive association between healthful eating and increased parental support	No association	A negative association between healthful eating and increased parental support
Cross-sectional studies			
Young et al 2004[72]		Fruit and vegetables	
Larson et al 2006[48]	↑ Calcium (girls)	Calcium (boys)	
Wind et al 2006[76]	↑ Fruit and vegetables (facilitation)	Fruit and vegetables (encouragement)	
Zabinski et al 2006[78]	↑ Fruit and vegetables	Fat	
Total number of studies = 4	**3**	**4**	**0**

Table 4b. Summary of studies investigating the relationship between parental support and dietary outcomes among children

Dietary outcome	Number of studies showing a positive association between dietary outcome and increased parental support	Number of studies showing no association	Number of studies showing a negative association between dietary outcome and increased parental support
Cross-sectional studies			
↑ Fruit	2	2	0
↑ Vegetables	2	2	0
↑ Calcium	1	1	0
↓ Fat	0	1	0
Total number of studies = 4	**3**	**4**	**0**

3.5 Is family interaction associated with food habits and behaviours?

Family interaction encompasses both positive and negative behaviours. Family conflict and arguments, including arguments over food intake, could potentially negatively influence dietary quality and eating behaviour. Alternatively, family cohesion (a positive family climate or bonding) and connectiveness (family and parental care, understanding and attention children receive from their family) may positively influence dietary intake.

Few studies have investigated the relationship between family interaction and food habits and behaviours (see Tables 5a and 5b, and Appendix E). We identified four studies assessing this relationship[49, 52, 57, 79]. Again all the studies were cross-sectional, but all four studies produced consistent results, reporting healthful intakes with positive family interactions (cohesion and connectiveness)[49, 79] and less healthful intakes with increased levels of family conflict and arguments[52, 57]. In two studies, family arguments and conflict were associated with unhealthy dietary outcomes; namely, increased fat, sweet snacks and take-out intake[52, 57]. Boutelle et al[52] reported that family arguments during dinnertime were unrelated to two dietary outcomes: fruit and vegetable intake. This study, however, only reported adult intake as a reflection of family intake and suffered from a low response rate. One study reported that increased family cohesion was positively associated with general healthy eating and vegetable intake[49], while another reported that lower levels of family connectiveness were associated with a greater risk of inadequate fruit and vegetable intake[79]. The latter study involved a large sample of over 32,000 children, strengthening the evidence for this association.

There are limitations in some of the studies. Two papers suffered from low response rates[49, 52] and all studies relied on self-reported data. The cross-sectional nature of the studies indicate correlations without allowing for any inference of causality.

In summary, although there are few studies investigating the association between family interaction and dietary intake, the results from all four cross-sectional studies are consistent. Lower levels of family conflict and arguments and higher levels of family

cohesion and connectiveness are associated with more healthful dietary patterns among families.

Table 5a. Summary of studies investigating the relationship between family interaction and healthful eating among children

Study	A positive association between healthful eating and positive family interaction	No association	A negative association between healthful eating and positive family interaction
Cross-sectional studies			
Neumark-Sztainer et al 1996[79]	↑ Fruit and vegetables		
De Bourdeaudhuij and Van Oost 2000[49] (higher levels of family cohesion)	↑ Vegetables, general healthy eating	Fruit, fat, soft drinks, snacks	
Boutelle et al 2003[52] (less conflict)	↓ Fat	Fruit and vegetables	
Campbell et al 2007[57] (less conflict)	↓ Sweet snacks and takeout	Savoury snacks and high-energy drinks	
Total number of studies = 4	**4**	**3**	**0**

Table 5b. Summary of studies investigating the relationship between family interaction and dietary outcomes among children

Dietary outcome	Number of studies showing a positive association between dietary outcome and positive family interaction	Number of studies showing no association	Number of studies showing a negative association between dietary outcome and positive family interaction
Cross-sectional studies			
↑ Fruit	1	2	0
↑ Vegetables	2	1	0
↑ General healthy eating	1	0	0
↓ Fat	1	1	0
↓ High-energy drinks/soft drinks	0	2	0
↓ Fast foods / take-out	1	0	0
↓ Savoury snacks/ sweet snacks	0	2	0
Total number of studies = 4	**4**	**3**	**0**

3.6 Is self-efficacy associated with food habits and behaviours among children?

Self-efficacy is confidence in one's ability to successfully perform a specific behaviour[80]. Increasing a child's self-efficacy to consume more healthful foods and less unhealthy food in a variety of situations could potentially improve dietary intake. Fourteen studies were identified which examined the relationship between self-efficacy and dietary intake among children (see Tables 6a and 6b, and Appendix F). There were 12 cross-sectional studies[48, 49, 55, 66, 72, 73, 76, 78, 81-84] and two intervention studies [85, 86].

All 12 cross-sectional studies reported a positive association with at least one healthful dietary outcome assessed. Ten studies reported a positive relationship with fruit[49, 55, 66, 72, 73, 76, 78, 81-83] and nine with vegetable[49, 55, 66, 72, 76, 78, 81-83] intake. In addition at least one study reported a positive relationship between self-efficacy and higher intakes of calcium[48], general healthy eating[49] and lower fat [49] and soft-drink intake[84]. Four studies also reported no association with at least one dietary outcome assessed. This included snack[49], vegetable[73], calcium (among boys)[48] and fat intakes[78].

We only identified two intervention studies with a family component that proved successful at increasing self-efficacy [85, 86]. The study by Baranowski et al[85] was largely school-based, with family involvement through newsletters, home assignments and family nights. There was also a tendency for self-efficacy in the intervention group. After three years of intervention involving both school and family input, fruit and vegetable intake was higher compared to the control group. A second intervention study also involved both school and family components, this time in a group of Native North American families[86]. The intervention focused on knowledge and skill development related to healthy eating, physical activity and diabetes prevention. The family component informed parents of the healthy food and activity messages their children were learning at school. This included weekly messages on community radio stations, information booths at parent−teacher nights, and newsletters sent home with students. Messages included encouraging parents to turn off the TV and how to prepare healthy lunches and snacks for their children. Self-efficacy scores increased from baseline to post-intervention. The percentage of energy from fat decreased, although only significantly in boys.

Six of the analyses involved large samples (over 1000 participants) and/or representative samples from a variety of countries[48, 55, 76, 82, 85]. Six studies were performed in the USA[48, 72, 78, 81, 82, 85], seven in Europe[49, 55, 66, 73, 76, 83, 84] and one in Canada[86]. Although most of the studies used appropriate adjustment for multiple confounders, there were limitations in some. There were low to modest response rates in three studies[49, 72, 83]. Most studies used food frequency questionnaires (FFQs) to assess dietary intake. Some FFQs were comprehensive (containing 149 food items), whereas others contained only two to four items to evaluate intake[55, 72, 73, 76, 84]. Three studies used a single 24-hour recall to assess dietary intake[81, 82, 86].

In summary, although the cross-sectional studies are unable to determine causality, the findings are consistent, especially for fruit and vegetable intake. All cross-sectional studies reported an association with higher self-efficacy and either higher intakes of

healthful foods or lower intakes of unhealthy foods. Also, the two intervention studies reported more healthful intakes with increased self-efficacy.

Table 6a. Summary of studies investigating the relationship between self-efficacy and healthful eating among children

Study	A positive association between healthful eating and increased self-efficacy	No association	A negative association between healthful eating and increased self-efficacy
Cross-sectional			
Reynolds et al 1999[81]	↑ Fruit and vegetables		
De Bourdeaudhuij & Van Oost 2000[49]	↑Fruit, vegetables, healthy eating score ↓ Fat, less soft drink	Snacks	
Kratt et al 2000[82]	↑ Fruit and vegetables		
Kremers et al 2003[83]	↑ Fruit (indirectly)		
Bere & Klepp 2004[55]	↑ Fruit and vegetables		
Young et al 2004[72]	↑ Fruit and vegetables		
Vereecken et al 2005[73]	↑ Fruit	Vegetables	
Larson et al 2006[48]	↑ Calcium (girls)	Calcium (boys)	
Wind et al 2006[76]	↑ Fruit and vegetables		
Zabinski et al 2006[78]	↑ Fruit and vegetables (in older children only)	Fat	
Reinaerts et al 2007[66]	↑ Fruit and vegetables		
van der Horst et al 2007[84]	↓ Soft drink		
Total number of studies = 12	**12**	**4**	**0**
Intervention studies			
Baranowski et al 2000[85]	↑ Vegetables (slightly)	Fruit	
Saksvig et al 2005[86]	↓ Fat (boys)	Sugar, fibre, energy	
Total number of studies = 2	**2**	**2**	**0**

Table 6b. Summary of studies investigating the relationship between self-efficacy and dietary outcomes among children

Dietary outcome	Number of studies showing a positive association between dietary outcome and increased self-efficacy	Number of studies showing no association	Number of studies showing a negative association between dietary outcome and increased self-efficacy
Cross-sectional studies			
↑ Fruit	10	0	0
↑ Vegetables	9	1	0
↑ Calcium	1	1	0
↑ General healthy eating	1	0	0
↓ Snacks	0	1	0
↓ Fat	1	1	0
↓ Soft drinks	1	0	0

Total number of studies = 12	**12**	**4**	**0**
Intervention studies			
↑ Fruit	0	1	0
↑ Vegetables	1	0	0
↑ Fibre	0	1	0
↓ Fat	1	0	0
↓ Sugar	0	1	0
↓ Energy	0	1	0
Total number of studies = 2	**2**	**2**	**0**

3.7 Is work−family spillover associated with food habits and behaviours?

Given that the majority of adult males and females are in the workforce, the influence of work roles on family dietary behaviour is worth investigating. Work−family spillover describes the interface between work and family strains. Some families may struggle to fit in all the necessary activities before and/or after work, and as a result feel too tired, exhausted or stressed to provide healthy food on a regular basis. In total we identified eight observational studies that investigated the relationship between work−family spillover and dietary patterns among families (see Tables 7a and 7b, and Appendix G). Seven studies were cross-sectional, but somewhat heterogeneous. Three studies comprised in-depth qualitative interviews[17, 87, 88], two specifically investigated the effect of maternal employment on dietary intakes among families[47, 50], one assessed the presence of parents when children left and returned from home[43], and one study involved a self-administered questionnaire in which participants were asked to assess the extent to which their jobs interfered with family life[89].

Four of the seven studies reported negative associations with healthful eating with higher levels of work−family spillover[17, 47, 87, 88], while four studies showed no association[43, 50, 87, 89]. One study showed a negative relationship with healthy eating with some individuals but not others, possibly reflecting the success of different coping strategies used by different participants[87]. Studies showing a negative relationship reported lower intakes of fruit, vegetables and dairy, less healthy food habits, and higher intakes of fast foods, convenience foods and junk food, and an increased incidence of skipping meals.

One cohort study examined dietary change from adolescence into adulthood[90]. Participants cited employment as influencing dietary change, reducing the time available to cook and prepare foods. This “time famine” induced by employment and family commitments was associated with smaller increases in intakes of fruit and vegetables over the 20-year assessment period.

The inconsistent results of these studies may reflect the heterogeneity of the assessment of work−family spillover in the different studies, or may reflect a variety of coping mechanisms used by some families to overcome or partially negate the work−family imbalance. Studies utilising in-depth interviews provided insights into the various coping

strategies that may be useful for those struggling with work−family spillover[17, 87, 88]. These strategies included planning and cooking ahead, preparing multiple meals, sharing food and recipes at work, and sharing food preparation, shopping and cooking with other family members. Greater adoption of these coping strategies may be part of the reason why some studies have failed to show an effect of work−family spillover on eating habits. Other reasons for inconsistencies included no direct measure of dietary intake in three studies[17, 87, 88], under-reporting in another[47], and one study reported only a modest response rate[89].

The majority of studies (five) were carried out in the USA[17, 43, 47, 87, 88], with one each in Scotland[50], England [90] and Finland[89]. Four studies involved large samples (over 1000 participants)[43, 47, 50, 89]. The other studies, although smaller, provided more in-depth qualitative information on coping strategies and other factors related to work−family spillover[17, 87, 88].

In summary, work−family spillover appears to affect dietary intake in some families, whereas others appear to have developed coping strategies to negate potential problems. For those who struggle for balance, their response appears to include higher amounts of take-out food, junk food and convenience food, meal skipping, and a reduced number of family meals. This is associated with feelings of limited time and energy available for food preparation or shopping. Although they are in the minority, others who find work and family life manageable employ strategies such as planning and cooking ahead, preparing multiple meals, and sharing food preparation/cooking/shopping within the family[17, 87, 88]. In addition, those finding work−family spillover unproblematic often have more flexible jobs, and mothers who reported having the cooking skills and confidence to cook a variety of meals reported greater time and priority for cooking[88]. These parents reported a sense of pride in food management skills. Those struggling with the work−family balance could potentially adopt some of these strategies.

Table 7a. Summary of studies investigating the relationship between work−family spillover and healthful eating among families

Study	A positive association between healthful eating and increased levels of work−family spillover	No association	A negative association between healthful eating and increased levels of work−family spillover
Cross-sectional studies			
Videon & Manning 2003[43]		Fruit, vegetables, dairy	
Devine et al 2003[87]		Healthy food choice	↓ Healthy food choice ↑ Skipping meals, fast food, junk food
Neumark-Sztainer et al 2003[47]			↓ Family meals (indirectly: ↓ fruit, vegetable, calcium-rich foods ↑ Soft drink)
Sweeting & West 2005[50]		Healthy eating	

Devine et al 2006[17]			↓ Healthy food choice
Roos et al 2006[89]		Healthy food habits	
Jabs et al 2007[88]			↑ Fast food and convenience food
Total number of studies = 7	**0**	**4**	**4**
Cohort studies			
Lake et al 2004[90]			↓ Fruit and vegetables
Total number of studies = 1	**0**	**0**	**1**

Table 7b. Summary of studies investigating the relationship between work−family spillover and dietary outcomes among families

Dietary outcome	Number of studies showing a positive association between dietary outcome and higher levels of work−family spillover	Number of studies showing no association	Number of studies showing a negative association between dietary outcome and higher levels of work−family spillover
Cross-sectional studies			
↑ Fruit	0	1	1
↑ Vegetables	0	1	1
↑ Dairy / calcium-rich foods	0	1	1
↑ Healthy food habits/choice	0	2	2
↓ Soft drinks			1
↓ Fast food / convenience foods			2
↓ Junk food			1
↓ Skipping meals			1
Total number of studies = 7	**0**	**4**	**4**
Cohort studies			
↑ Fruit	0	0	1
↑ Vegetables	0	0	1
Total number of studies = 1	**0**	**0**	**1**

3.8 Are parental feeding styles associated with food habits and behaviours?

Parents use a variety of strategies and behaviours to control their children's food intake. Patterns of parental behaviour are referred to as "parenting styles". This construct proved to be the most complicated behaviour to evaluate, largely due to the number of different types of style assessed in the literature and the different cultural interpretations of each style. Also, many of the parenting styles appeared to be interrelated. In all, 19 cross-sectional, one cohort and three intervention studies assessing parental style and dietary patterns were included in this review. Eleven parental feeding styles were identified (see

Table 8, and Appendix H). Some styles were grouped together because we believed they were assessing similar behaviour.

Parental styles in general are categorised based on the quantity and quality of two underlying components: demandingness and responsiveness. Demandingness refers to the extent to which parents show control, demand maturity from their children, supervise, and confront their child when they disobey. Responsiveness refers to the extent to which parents show warmth, support, acceptance and involvement, and foster individuality, self-regulation and self-assertion[91]. In terms of feeding style, demandingness refers to *how much* a parent encourages eating, whereas responsiveness refers to *how* a parent encourages eating[91]. Different styles largely reflect differences in the amount of autonomy given to children.

Two commonly described parental feeding styles are referred to as authoritative and authoritarian. An authoritative parenting style is characterised by parental involvement, reasoning, discussion, negotiation and structure, where parents are firm and supportive (high demandingness / high responsiveness). Conversely, an authoritarian style is characterised by restrictive and power-assertive behaviours, where parents have a high degree of control over child feeding practices (high demandingness / low responsiveness).

In general an authoritative parenting style was associated with healthy dietary intakes and habits. Of the five studies assessing an authoritative parenting style, three studies reported a positive association with healthful eating[83, 92, 93], while two studies failed to show any association[57, 72]. Dietary outcomes positively associated with an authoritative style included fruit, vegetable and dairy intake. Conversely, an authoritarian style was inversely associated with diet quality in three of the four cross-sectional studies[57, 83, 93]. An authoritarian parenting style was associated with a reduced intake of fruit and vegetables and an increase in soft-drink consumption.

Chen and Kennedy[35] showed that an authoritarian feeding style was not related to dietary intake whereas a democratic style was associated with a higher sugar intake in children. However, this study may differ from others due to the different interpretations of democratic and authoritarian parenting styles. The sample included 68 Chinese-American children and their parents, and it is conceivable that an authoritarian style for this culture may not reflect strict parenting as measured in Western societies. It was suggested by the authors that a less authoritarian style in the Chinese culture may reflect less caring and loving parenting. This highlights the need to interpret parenting styles among different cultures with caution.

Studies investigating discipline, obligation rules / eating rules, reinforcement/ encouragement/praise and involvement/monitoring report that these styles are either related to healthy food intakes and patterns (healthful eating in general, lower consumption of soft drinks)[84, 94] or show no association with dietary intake[15, 57].

"Involvement and monitoring" refers to the extent to which parents supervise and keep track of their child's intake. These behaviours were measured in four studies. Two studies showed a positive association with healthful eating patterns (less sugar-sweetened beverages and more healthy eating in general)[84, 94], while two reported no relationship[15, 57]. Styles reporting negative effects on diet quality included indulgent, uninvolved, neglectful, or those using high levels of pressure. "Pressure" generally refers to the parents' attempt to make children eat more than they want to, or to finish all of the food they are served. Pressure was consistently inversely related to healthy intakes and food patterns in two cross-sectional[57, 59] and one intervention study[95]. Pressure was inversely related to fruit, vegetable and micronutrient intake, and general healthy eating, and positively related to confectionary intake. The intervention study assessed the response to a "pressure" condition to eat one type of soup compared with another type of soup consumed under a "no pressure" condition. There were significantly more negative comments during the pressure condition. These results suggest that parents' attempts to manipulate their children's intake using pressure may in fact be counterproductive.

An indulgent parenting feeding style is characterised by warmth and acceptance along with a lack of monitoring of the child's behaviour (low demandingness / high responsiveness), and was measured in only two cross-sectional studies. One study showed no association with intake[57], whereas another reported lower fruit intake in those from indulgent homes as opposed to those raised in authoritative homes. However, fruit intake in indulgent homes was higher than in those from either authoritarian or neglectful homes[83].

An uninvolved or neglectful style is characterised by little involvement with, or control over, the child (low demandingness / low responsiveness). This feeding style was assessed by two cross-sectional studies. Kremers et al[83] reported that an indulgent parenting style resulted in lower fruit intake when compared to an authoritative or indulgent style. Campbell et al[57] reported no effect on intake with an uninvolved style.

Studies assessing controlling, restrictive and permissive parenting styles produced conflicting findings, making interpretation difficult. A controlling feeding style refers to a parent's firmness regarding what their child eats, as well as use of food as a reward. Three studies reported a positive association (higher intakes of healthy snacks and fruit and vegetables, and lower intakes of soft drinks)[76, 96, 97], three showed no association[56, 57, 72] and three studies reported a negative association between control and healthful eating (increased unhealthy eating in general, higher confectionary intake, and reduced fruit and vegetable consumption)[67, 68, 94].

Differences in study findings may be due to a number of reasons. Firstly, different assessment tools were used to measure parental control (different questionnaires). There may also be differing effects on eating behaviour depending on the level of control. Perhaps some level of control is necessary, but there may be a threshold above which control begins to exert a negative influence on eating patterns among children. Therefore certain levels of control in some situations may be counterproductive to healthful eating. Finding the right degree of autonomy between parent and child may be important,

especially given the argument that children − and particularly adolescents − have more control over their food choice than ever before in history[98]. Also, different countries and/or cultures may view control quite differently. The three studies reporting a positive association on healthy eating were carried out in England[97] and the Netherlands[76, 96]. Studies reporting a negative association between control and healthful eating were performed in the USA (using a Latino sample)[94], England[68] and Belgium[67].

A restrictive parenting style is characterised by parents' restriction of "forbidden" foods. Four cross-sectional, one cohort and two intervention studies assessed a restrictive parenting style. Of the cross-sectional studies, one reported a positive relationship with healthful eating (less soft-drink intake)[84], two showed no relationship[15, 94], and one reported an inverse relationship (increased snack foods, in girls only)[99].

The cohort study followed a group of 140 girls from age 5 to 9 years[100]. The dietary pattern of eating in the absence of hunger was assessed in a laboratory setting when the children were aged 5, 7 and 9 years. At age 5 years there were no significant effects of restriction on eating in the absence of hunger. At ages 7 and 9 years, those exposed to higher levels of restriction had higher scores for eating in the absence of hunger than those exposed to low levels of restriction. Restricted children ate more energy from the sweet and savoury snacks provided.

The intervention studies, which by design provide more rigorous evidence, reported either a negative association[101] or no association between healthful eating and more parental restriction [102]. Fisher and Birch[101] carried out two experiments investigating the effects of restriction on the intake of palatable snacks. In the first experiment children's access to a palatable snack food was restricted for 5 weeks. Children were seen twice per week, attending 20-minute sessions. Access to a control food was freely available, whereas access to the restricted snack food was only permitted for a 2-minute period, half-way through each session. Children's food selection and intake was measured 3 weeks before and 3 weeks after the restriction period. Although there were more comments and requests for the restricted snack, there were no differences in intake pre- and post-restriction.

In a second experiment children participated in four unrestricted snack sessions where the restricted food was freely available, followed by four restricted sessions where the restricted food was limited. In the restricted sessions children had free access to wheat crackers for the full 15-minute session, but were only allowed access to the restricted food for a 5-minute interval. Intake and selection of the restricted food was significantly higher during the restricted sessions compared to the unrestricted sessions. This experiment suggests that restricting intake of a food may prove counterproductive, because it enhances the appeal of the restricted food. However, both experiments were carried out in a laboratory, meaning the setting was somewhat artificial. Also, long-term effects of restriction on intake were not measured.

A further study on dietary restriction was carried out in a group of 43 Native American families[102]. Participants were randomly allocated to a parenting support (PS) group or an

obesity prevention plus parenting support (OPPS) group for a period of 16 weeks. Lessons included a topic on how improved parenting skills could facilitate the development of appropriate eating behaviours. The OPPS group received specific information on reducing restrictive feeding behaviours. Although 16 weeks of intervention reduced restriction scores in the OPPS group, there were no significant differences in dietary intakes between the two groups. As this study was a pilot, the sample size was relatively small and the results may not be generalisable to other ethnic groups. Further long-term intervention trials taking place in children's habitual environments are required to provide more rigorous results.

A permissive style is where parents generally allow their children to eat whatever and/or as much as they like, indicating a lack of parental control over the child's eating. Permissive parents are more responsive than demanding. Five cross-sectional studies investigated this parental behaviour. One study reported a positive effect on healthful eating (higher intakes of vegetables)[73], three reported no association[57, 76, 83], and one reported an inverse association (increased intakes of soft drinks)[67]. It is unclear whether these conflicting results may reflect different interpretations of a permissive style or different measurement tools used to assess this behaviour.

In summary, there is some evidence that an authoritative feeding style is positively related to healthful dietary outcomes, whereas an authoritarian style is inversely associated with diet quality. This, however, may not apply to all cultures: feeding practices may be influenced by culture and parents' goals for their children. Most of the feeding practices identified have been evaluated in predominantly white, middle-class populations and could potentially differ for different ethnic groups. Therefore caution should be used when analysing results from different cultures, and extrapolating results to different cultures.

For the parental styles involvement/monitoring, discipline, obligation rules / eating rules, and reinforcement/praise/encouragement there is weak evidence supporting a positive association with healthful eating, because for each style at least one study reported a positive association with healthful eating and no studies reported negative outcomes. Conversely, there is weak evidence suggesting that the styles indulgent, uninvolved, neglectful or pressure are negatively associated with healthful eating, because for each style there was at least one study showing a negative association with healthful eating, with no studies showing a positive relationship. The negative influence of parental pressure was further supported by an intervention study.

The remaining styles − controlling, permissive and restriction − tended to produce conflicting findings making interpretation difficult. Overall, it appears that over-management or over-indulgence of children may be counterproductive to the development of healthy eating patterns. Therefore, parents need to find that fine balance of autonomy between themselves and their children.

Table 8. Summary of studies investigating the relationship between parental feeding styles and healthful eating among children

Parenting style	Studies showing a positive association between parenting style and healthful eating	Studies showing no association	Studies showing a negative association between parenting style and healthful eating
Cross-sectional studies			
Authoritarian Firm and supportive	0	1 35	3 57, 83, 93
Authoritative A high degree of control over child feeding practices	3 83, 92, 93	2 57, 72	0
Control/rewards/demand Rewarding good behaviour with food; firmness on what a child eats; treating child with food for food behaviour; whether parents demand that their children eat fruit and vegetables	2 76, 97	3 56, 57, 72	4 67, 68, 94xd f, 96
Democratic	0	0	1 v 35
Discipline Disciplining the child for snacking without permission	1 94	0	0
Indulgent Warmth and acceptance along with a lack of monitoring of the child's behaviour		1 57	1 83
Involvement/monitoring Parents make time to talk to children; encouraging to do better; keeping track of food intake of the child; how much parents supervised intake	2 84, 94	2 15, 57	0
Obligation rules/eating rules e.g. tasting food, rules regarding mealtime interruptions	2 73, 78	1 73	0
Permissive/allowance e.g. parents allowing child to eat whatever/as much as they like	1 73	2 57, 83	2 67, 76
Pressure e.g. parents pressure to eat more; always eating all food from the plate.	0	0	2 57, 59
Reinforcement/praise/ encouragement e.g. praising for eating a healthy snack	2 67, 94	0	0
Restrictive e.g. making sure child does not eat too many high-fat foods;	1 84	2 15, 94	1 99
Uninvolved/neglectful Little involvement with, and control over, the child	0	1 57	1 83
Cohort studies			
Restrictive	0	0	1 100
Intervention studies			

Pressure	0	0	1 [95]
Restrictive	0	1 [102]	1 [101]

3.9 Is food availability and/or accessibility associated with food habits and behaviours?

Parents have the opportunity to provide their children with an appreciation of a wide variety of nutritious foods by increasing exposure in childhood. Food served in the home in early childhood can set a pattern for later life. Parents control most of the food that is available in the home and can make this food more accessible (e.g. preparing cut vegetables and storing them in the refrigerator), thereby making the healthy choice the easy choice.

Eighteen studies were identified which assessed whether food availability and/or accessibility was related to food habits and behaviours among children (see Tables 9a and 9b, and Appendix I). Twelve of the 15 cross-sectional studies[34, 48, 55, 62, 66, 72-74, 76, 81, 82, 103] and two of the three intervention studies[77, 85] supported a positive association between increased availability and accessibility of healthy food and diet quality in children. Three cross-sectional studies reported an increase in unhealthy food intake among children when the availability and/or accessibility of these foods was high[57, 62, 71]. Six of the cross-sectional studies reporting an association with availability/accessibility also reported at least one dietary outcome which appeared to be unrelated[15, 57, 62, 66, 73, 74].

Ten cross-sectional studies reported that increased availability/accessibility was associated with higher intakes of fruit[34, 55, 62, 66, 72-74, 81, 82, 103], as did eight with vegetables[34, 55, 62, 72, 76, 81, 82, 103] and two with milk[48, 62]. Three studies reported that higher availability of high-energy drinks was associated with increased intake of these beverages[62, 71, 104]. Likewise, one study showed that higher availability of sweet and savoury snacks resulted in higher intakes of these foods [57].

The three intervention studies produced mixed results. The study by Baranowski et al[85] − which was largely school-based, with family involvement through newsletters, home assignments and family nights − reported that increased availability resulted in an increase in fruit, vegetable and juice intake combined, fruit intake, but not vegetable intake *per se* in the intervention group. A second intervention also involved both school and family components in an attempt to increase fruit and vegetable consumption by increasing the availability and accessibility of fruit and vegetables within the home[105]. During the intervention students received 12 lessons on nutrition, and developed a media campaign for their parents. Although the intervention was successful at improving fruit and vegetable availability, this did not translate into increased intakes of these foods. The third intervention study assessed exposure rather than food availability *per se*[77]. One hundred and fifty-six participants were randomised to either an exposure, information or control group. In the intervention group parents were asked to offer a previously disliked vegetable every day for 14 days. The information group were given nutritional advice and a leaflet, whereas the control group received no intervention. Only the exposure group

reported significant increased intakes, willingness to eat and preference for the target vegetable. This suggests that increasing exposure, through increased availability and accessibility, may increase vegetable intake.

Overall, participation by families in one of these interventions was modest[85]. Future intervention studies should look at ways to increase family involvement, which may promote greater dietary change and result in more pronounced findings.

Accessibility *per se* was measured in four of the cross-sectional studies and two intervention studies. Three of the four cross-sectional studies and one intervention study reported a positive association between diet quality and accessibility. This indicates that both availability and accessibility are important influences on dietary intake among children.

The analyses included samples from a variety of countries, including 11 from the USA[34, 48, 62, 71, 72, 74, 81, 82, 85, 103, 105], four from Europe[55, 66, 73, 76], two from Australia[15, 57], and one from England[77]. Seven analyses involved large (over 1000 participants) samples of children[48, 55, 66, 76, 82, 85, 103].

There are limitations with some of these studies. Whereas most studies used comprehensive food frequency questionnaires (FFQs) (up to 149-items) or multiple-day food records to assess dietary intake, some used FFQs with only two to four items[55, 71-73, 76].

In summary, all of the cross-sectional studies support an association between availability and/or accessibility and food intake among families. Increased availability of both healthy and unhealthy foods influenced children's intake. However, the intervention studies produced mixed results, with two studies showing higher intakes of fruit and/or vegetable intake with higher availability, and one study showing that increasing fruit and vegetable fruit availability did not increase intake. The lack of agreement among the intervention studies makes definitive conclusions difficult.

Table 9a. Summary of studies investigating the relationship between availability and accessibility and healthful eating among children

Study	Increased intake with increased availability/ accessibility of *healthy* food	No association with increased intake of *healthy* food	Decreased intake with increased availability/ accessibility of *healthy* food	Increased intake with increased availability/ accessibility of *unhealthy* food	No association with increased intake of *unhealthy* food	Decreased intake with increased availability/ accessibility of *unhealthy* food
Reynolds et al 1999[81]	Fruit and vegetables					
Kratt et al 2000[82]	Fruit and vegetables					
Cullen et al 2003[34]	Fruit and vegetables, 100% fruit juice					
Bere & Klepp 2004[55]	Fruit and vegetables					
Grimm et al 2004[71]				Soft drinks		
Young et al 2004[72]	Fruit and vegetables					
Hanson et al 2005[62]	Fruit and vegetables (girls) milk (boys)	Fruit and vegetables (boys) milk (girls)		Soft drink		
Vereecken et al 2005[73]	Fruit	Vegetables				
Campbell et al 2006[15]		Vegetables			Energy, savoury and sweet snacks, high-energy drinks	
Larson et al 2006[48]	Milk					
Matheson et al 2006[74]	Fruit	Vegetables			Sweet snacks	
Wind et al 2006[76]	Vegetables	Fruit				
Campbell et al 2007[57]				Unhealthy food, high-energy drinks, savoury snacks		

Nanney et al 2007[103]	Fruit and vegetables					
Reinaerts et al 2007[66]	Fruit	Vegetables				
Total studies = 15	**12**	**4**	**0**	**4**	**2**	**0**
Intervention Studies						
Baranowski et al 2000[85]	Juice, vegetables and juice/fruit/vegetables combined	Fruit				
Evans et al 2006[105]		Fruit and vegetables				
Wardle et al 2003[77]	Vegetables					
Total studies = 3	**2**	**2**	**0**	**0**	**0**	**0**

Table 9b. Summary of studies investigating the relationship between availability and accessibility and dietary outcomes among children

Dietary outcome	Number of studies showing higher intakes with increased availability/ accessibility of *healthy* food	Number of studies showing no association with increased availability of *healthy* food	Number of studies showing lower intakes with increased availability/ accessibility of *healthy* food	Number of studies showing higher intakes with increased availability/ accessibility of *unhealthy* food	Number of studies showing no association with increased availability of *unhealthy* food	Number of studies showing lower intakes with increased availability/ accessibility of *unhealthy* food
Cross-sectional studies						
↑ Fruit	10	2	0			
↑ Vegetables	8	5	0			
↑ Calcium/milk/dairy	2	1	0			
↑ High-energy drinks				3	1	0
↑ Savoury snacks				1	1	0
↑ Sweet snacks				1	2	0
Total number of studies = 15	**12**	**6**	**0**	**3**	**2**	**0**
Intervention studies						
↑ Fruit	0	0	0			
↑ Vegetables	2	2	0			
↑ Fruit juice	1	0	0			
↑ Fruit /juice / vegetables combined	1	0	0			
Total number of studies = 3	**2**	**2**	**0**	**0**	**0**	**0**

4. Is the family activity environment associated with physical activity by children?

4.1 Introduction

The studies reported in this section were identified from the initial literature search, and from references listed in individual research papers which provided access to previous studies with results related to the question. Research on the effect of family environment on physical activity by children goes back at least to the early 1970s[106]. A review by Sallis and colleagues of all correlates of physical activity in children, covering papers published from 1970 to 1998, concluded that a number of family characteristics (parental support, sibling physical activity and direct help from parents) were associated with physical activity in adolescents[107]. However, it is apparent that parents are the primary influence of behaviour within the family environment. The parental correlates of physical activity in children and adolescents have been reviewed recently, for papers published between 1985 and 2003, which concluded that there were significant correlations between parental support and child physical activity level[108].

The current review covers papers published from 1996 to 2007. Fifty-one studies were found that reported on the effect of family correlates (mostly parental) on physical activity by children. The study designs used in these papers were cross-sectional (see Appendix J, n = 40), cohort (Appendix K, n = 10) and intervention (Appendix L, n = 1).

4.2 Study design

Twenty-four of the cross-sectional studies were carried out in the US[19, 63, 87, 94, 109-128]. Ten cross-sectional studies were carried out in Europe (two in Finland[129, 130], three in Estonia[131-133], and one each in England[134], Iceland[135], Portugal [136], France[137] and Italy[138]) and the remaining six were carried out in Australia[139-143] and New Zealand [144]. Eight of the cohort studies were carried out in the US[145-152], and the remaining two in Finland[153] and France[154]. The single intervention study was carried out in the US[155].

Four studies have reported physical activity results more than once: a study of 31 schools in Minneapolis [114, 127], a small study in a US Midwestern city[111, 113], a study of nine-year old girls in Pennsylvania[149, 156], and a study of children from 19 primary schools in Melbourne[140, 141].

The studies have varied in the representativeness of their samples. Some have recruited small samples of children from schools, while others have recruited large representative community samples of more than 1000 children, such as a US national survey of children recruited by random-digit telephone dialling[123], another national US study of more than 13,000 students sampled from 80 randomly selected schools[152], a population-based twin register of 16-year-olds in Finland[129], a national sample of children aged 9−15 years in

Finland[153], a nationally representative sample of 15−16-year-olds in Iceland[135], a random sample from 88 schools in France[137], a random sample of children in five Italian regions[138], and national surveys of children in Australia[139].

Objective measures of physical activity by children were used in only eight studies: accelerometers in six studies[110, 115, 119, 126, 140, 147] and pedometers in two studies[122, 151]. The remainder used questionnaires to assess child physical activity, which were mostly completed by the children themselves, except for three studies with young children which used parental reports of their children's activity levels[94, 141, 142].

Parental physical activity was mainly measured by parental self-reports, except for a small number which used child reports[109, 112, 134, 135, 139, 145]. Parental support of child physical activity was also mostly based on parental self-reports, although a number of studies used child reports[109, 111, 112, 117, 121, 125, 127, 128, 143, 144, 150, 152].

4.3 Is parental physical activity associated with child physical activity?

The studies that reported results on the association between parent and child physical activity levels are shown in Table 10. Fifteen out of 23 cross-sectional studies, and three out of six cohort studies, along with the single intervention study, reported significant positive associations between parent and child physical activity levels. Overall, 19 out of 30 studies (63%) reported significant positive associations. The remaining 11 studies reported no association. Importantly, no study reported an overall inverse association between parental and child physical activity. Only one study reported an inverse association in a sub-sample – between mothers and girls[132]. There was no evidence that one parent had a stronger effect on child physical activity than the other, with some studies reporting an association only with mothers[129, 145, 154] and others an association only with fathers[112, 134, 135, 156].

4.4 Is parental support associated with child physical activity?

Parental support for child physical activity can occur in a number of ways. These include encouragement, watching their child being physically active, having supportive beliefs about the benefits of physical activity, playing with their child, providing home activity equipment, transporting their child to sports or physical activity events, and paying for fees for their child to participate in physical activity.

The studies that reported results on the association between parent and child physical activity levels are shown in Table 11. Twenty-two out of 29 cross-sectional studies and five out of six cohort studies reported significant positive associations between parental support and child physical activity levels. Overall, 27 out of 35 studies (77%) reported significant positive associations. The remaining eight studies reported no association. Importantly, no study reported an inverse association between parental support and child physical activity. There was no clear pattern between the type of parental support and the finding of a significant positive association between parental support and child physical activity levels.

4.5 Summary

Overall, the findings indicate that both parental physical activity and parental support of physical activity are associated with physical activity levels in their children, although the results are more consistent for parental support. Importantly, no study reported a negative association, aside from Viira and Raudsepp[132], although the possibility of publication bias causing this overall pattern cannot be discounted. Observations of more inverse associations should have been observed by chance if there was truly no association between parental activity and support with child physical activity (on the assumption there is no publication bias). Thus, there is considerable evidence that the family environment, through the influence of parental physical activity and parental support of physical activity, can increase physical activity in children.

Table 10: Summary of studies of parental physical activity and child physical activity

Type of study	Direction of association			Total
	Positive	**None**	**Inverse**	
Cross-sectional (Appendix J)	Hovell et al 1996[110] Aarnio et al 1997[129] Shropshire & Carroll 1997[134] Vilhjalmsson & Thorlindsson 1998[135] Fogelholm et al 1999[130] Mota & Silva 1999[136] Raudsepp & Viira 2000[131] Kalakanis et al 2001[126] Davison et al 2003[156] Welk et al 2003[19] Adkins et al 2004[119] Wagner et al 2004[137] Martin et al 2005*[139] Salmon et al 2005[140] Raudsepp 2006[131]	Kimiecik & Horn 1998[111] McGuire et al 2002a[114] Sallis et al 2002[116] Trost et al 2000[118] Viira & Raudsepp 2003[132] Martin et al 2005*[139] Ammouri et al 2007[124] Wilson & Dollman 2007[143]		23
Cohort (Appendix K)	Yang et al 1996[153] Trost et al 1997[145] Bois et al 2005[154]	DiLorenzo et al 1998[146] Iannotti et al 2005[148] Duncan et al 2007[151]		6
Intervention (Appendix L)	McGarvey et al 2004[155]			1
Total	19	11	0	30

* Reported different results from two separate surveys.

Table 11: Summary of studies of parental support and child physical activity

Type of study	Direction of association			Total
	Positive	**None**	**Inverse**	
Cross-sectional (Appendix J)	Brustad 1996[109] Hovell et al 1996[110] Bungum & Vincent 1997[112] Kimiecik & Horn 1998*[113] Hoefer et al 2001[157] McGuire et al 2002a†[114] McGuire et al 2002b†[127] Davison et al 2003#[156] Dunton et al 2003[117] Trost et al 2003[118] Welk et al 2003[19] Davison 2004[120] Saunders et al 2004[121] Ziviani et al 2004[142] Duncan et al 2005[122] Arredondo et al 2006[94] Beets et al 2006[125] Springer et al 2006[128] Heitzler et al 2006[123] Ammouri et al 2007[124] Hohepa et al 2007[144] Wilson & Dollman 2007[143]	Kimiecik et al 1996*[111] Prochaska et al 2002[115] Sallis et al 2002[116] Viira & Raudsepp 2003[132] Adkins et al 2004[119] Timperio et al 2006[141] Zambon et al 2006[138]		29
Cohort (Appendix K)	Sallis et al 1999[147] Bois 2005[154] Davison et al 2006#[149] Dowda et al 2007[150] Ornelas et al 2007[152]	Duncan et al 2007[151]		6
Intervention (Appendix L)				0
Total	27	8	0	35

* Same sample.
† Same sample
# Same sample.

5. Recommendations

Family food and activity environments are important for children's food and activity outcomes. Information about establishing healthy family environments should be widely disseminated to the health, education and social sectors, and to parents and their advocates.

The Ministries of Health, Education and Social Development, the Families Commission and other related agencies should support parents in their efforts to create positive family food and activity environments. New Zealand intervention studies are required to gain insight into the suitability of an "authoritative feeding style" among a variety of cultures and ethnic groups. Public health programmes need to include the development of parenting skills to facilitate healthy behaviours.

5.1 Family mealtimes

Recommendation for parents: Family mealtimes should be maintained as positive occasions as much as possible.

Strategies:

- Eat as a family as much as possible (try for most nights and for most breakfasts).
- Describe mealtimes as a family tradition.
- Help all family members to learn to prepare quick, healthful meals.
- Look for realistic ways to increase the number of family meals, taking into account work, school, and extracurricular activities.
- Adopt age-appropriate ways to involve children and adolescents in meal planning and preparation. For example, young children can open tinned ingredients, stir meals, set the table, get the water jug for the table, decide what to have tomorrow night.
- Prepare vegetables in imaginative ways – mixed into meals or cut into different shapes.
- Encourage children to sit down with you to share a meal (at a table, or in a designated eating space facing each other – not in front of the TV).
- Set a time when you'll be eating together and let the family know in advance.

Television viewing and interruptions during mealtimes

Recommendation for parents: Turn the TV off during mealtimes.

Strategies:

- Permanently move the TV set out of view of the dining table.

- Place clear maximum limits of one hour of television per day.[8]
- Designate times and days to be TV free.[g]
- Negotiate and plan the number of TV programmes the family wants to watch at the beginning of the week and don't watch any others.[g]

Parental modelling

Recommendation for parents: Eat a healthy diet and undertake 30 minutes of moderate intensity physical activity per day yourself.

Strategies:

- Eat meals together as a family.
- Walk, play, dance and be active together as a family. Make activity fun to do.
- Use active transport (walk or cycle) for trips less than 2 kilometres.
- Make a healthy lunch and take it to work.
- Follow the *Food and Nutrition Guidelines for Healthy Adults*, Available under the heading "Nutrition and physical activity" at http://www.healthed.govt.nzBoth parents should act as role models.
- Back up "what you say" with "what you do".
- Put a healthy diet and activity at the top of your "to do" list, not at the bottom.

Parental support

Recommendation for parents: Support and encourage all attempts by the child to follow healthy eating patterns and being active.

Strategies:

- Create a supportive food environment by having healthy foods easily available, and keeping unhealthy foods to small portions or out of the house altogether.
- Pack a healthy lunch rather than giving children "lunch-money".
- Create a supportive activity environment by providing safe play spaces, and by helping children get to other play spaces and activities/sports.
- When affordable for the family, pay for any activity fees, buy uniforms and equipment, etc.

Family interaction

Recommendation for parents: Maintain a positive emotional atmosphere during family meals.

Strategies:

- Avoid arguments during family mealtimes.
- Think about conversation topics before the meal.

[8] These recommendations have been added based on a previous ANA report by Scragg et al 2006 "Does TV watching contribute to increased body weight and obesity in children". The authors believe these recommendations compliment those highlighted in the current literature review.

- Encourage all family members to talk during mealtimes, perhaps by:
    - taking turns in the family to talk about a good thing that happened to you that day
    - taking turns in the family to talk about a good thing that you did for someone that day.

Self-efficacy

Recommendation for parents: Ensure children have the confidence to make healthy dietary choices, especially in what might be difficult situations (e.g. eating with friends).

Strategies:

- When children talk about eating well, tell them that you believe in them and that you know they can eat more healthy foods (or less of foods considered unhealthy).
- When you see other children eating well, point out to your child how well the other child is doing.
- Provide specific feedback to your child about his or her healthy eating efforts in a positive manner. Congratulate successful behaviour – small victories are critical for success and boosting confidence.
- Encourage other parents to do the same for your child, but sensitively − children don't want everyone to know they're trying to eat better or be more physically active.
- Have healthy foods available when friends share snacks and meals with your child.
- Make the healthy choice the easy choice by having plenty of healthy food available and accessible.
- Buy in treat foods as needed so that children are not faced with difficult choices on a day-to-day basis.

Work−family spillover

Recommendation for parents: Acknowledge that work commitments in family time may limit the availability of time to spend with family and can be damaging to family food and activity patterns.

Strategies:

- Share meal planning, shopping and preparation among the family.
- Cook and plan meals ahead. Where possible, cook multiple meals for later use.
- Talk to the boss about greater work flexibility.
- Have confidence in your food preparation and cooking skills (or increase your confidence by learning healthy cooking from friends and family, taking a community course, using a slow-cooker, or getting cookbooks or magazines out of the library).

Parenting style

Recommendation for parents: Regulate the quality and patterns of food intake, and allow children to choose how much they should eat (known as authoritative parenting).

Strategies:

- Avoid parenting styles with high levels of pressure, restriction, and control.
- Provide a variety of healthful foods, and give children the freedom to choose how much of this food they will eat.
- Once dinner is finished, offer dessert.

Availability and accessibility

Recommendations for parents: Have lots of healthy foods easily accessible in the home, and have small portions of, or no, "treat" food in the home.

Strategies:

- Pre-prepare healthy foods (e.g. slice vegetables such as carrots, celery, peppers and fresh beans, and store them in the refrigerator for easy access).
- Make the healthy choice the easy choice.
- Make tap water the first choice − chilled in the fridge is good. Low-fat milk is a good second choice. Don't offer sweet drinks.
- Put a jug of water on the table at meal times.
- Buy "treat" foods as needed for special occasions − don't stock up.
- Have a full fruit bowl readily available for snacks.
- If treat foods are in the house, keep them out of sight and in a place where you need to go to some effort to eat them.

References

1. Kalil A, *Family Resilience and Good Child Outcomes: A review of the literature*. Wellington: Ministry of Social Development. 2003.
2. Families Commission, *Focus on Families: Reinforcing the importance of family. Report on literature review and focus groups.* Wellington: Families Commission. 2005.
3. Families Commission, *What Makes Your Family Tick? Families with dependent children – successful outcomes project. Report on public consultation*. Wellington: Families Commission. 2006.
4. Health Sponsorship Council, *Healthy Eating: Programme Plan 200−-2009.* Wellington: Health Sponsorship Council. 2006.
5. Golan M, Parents as agents of change in childhood obesity: from research to practice. *International Journal of Pediatric Obesity* 2006;1(2):66-76.
6. Young KM, Northern JJ, Lister KM, et al, A meta-analysis of family-behavioral weight-loss treatments for children. *Clinical Psychology Review* 2007;27(2):240-249.
7. O'Byrne K, Haddock L, Poston W, Parenting style and adolescent smoking. *Journal of Adolescent Health* 2002;30(6):418-25.
8. Ministry of Health, *NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey*. Wellington: Ministry of Health. 2003.
9. SPARC, *SPARC Facts 97-01*. Wellington: SPARC. 2003.
10. Davison KK, Birch LL. Childhood overweight: a contextual model and recommendations for future research. *Obesity Reviews* 2001;2:159-171.
11. Birch L,. Family and social environment measures. In: Johnson-Taylor W and Everhart J: modifiable environmental and behavioural determinants of overweight among children and adolescents: Report of a workshop. *Obesity Research* 2006;14(6):929-966.
12. Devine CM, A life course perspective: understanding food choices in time, social location, and history. *Journal of Nutrition Education & Behavior* 2005;37(3):121-128.
13. TNS New Zealand Ltd, *The Value of Sport: Attitudes, barriers and motivations for participation in sport by 11-14 year olds*. Wellington: SPARC. 2005.
14. Caspersen CJ, Powell KE, Christenson GM, Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports* 1985;100(2):126-131.
15. Campbell K, Crawford D, Ball K, Family food environment and dietary behaviors likely to promote fatness in 5−6-year-old children. *International Journal of Obesity* 2006;30(8):1272-1280.
16. Crawford D, Timperio A, Telford A, et al, Parental concerns about childhood obesity and the strategies employed to prevent unhealthy weight gain in children. *Public Health Nutrition* 2006;9(7):889-895.
17. Devine CM, Jastran M, Jabs J, et al, "A lot of sacrifices": work−family spillover and the food choice coping strategies of low-wage employed parents. *Social Science & Medicine* 2006;63(10):2591-2603.
18. Epstein LH, Valoski A, Wing RR, et al, Ten-year follow-up of behavioral, family-based treatment for obese children. *Journal of the American Medical Association* 1990;21(264):2159-2535.

19. Welk G, Wood K, Morss G, Parental influences on physical activity in children: an exploration of potential mechanisms. *Pediatric Exercise Science* 2003;15:19-33.
20. Crossman A, Sullivan DA, Benin M, The family environment and American adolescents' risk of obesity as young adults. *Social Science & Medicine* 2006;63(9):2255-2267.
21. Statistics New Zealand, *QuickStats National Highlights: Families 2007*. Available from: http://www.stats.govt.nz/census/.
22. McHale S, The role of family environments in children's overweight. In: Johnson-Taylor W and Everhart J. Modifiable environmental and behavioural determinants of overweight among children and adolescents: report of a workshop. *Obesity* 2006;14(6):929-966.
23. Kolt G, Schofield G, Schofield L, et al, *Best Practice Review of Sport and Physical Activity Interventions for Young People Aged 13-18 Years: Report to Sport and Recreation New Zealand* (Vol. 1 & 2). Auckland: Auckland University of Technology. 2006.
24. Utter J, Denny S, Robinson E, Perceived access to community facilities, social motivation, and physical activity among New Zealand youth. *Journal of Adolescent Health* 2006;39:770-773.
25. Utter J, Scragg R, Schaaf D, et al, Nutrition and physical activity behaviours among Maori, Pacific and NZ European children: identifying opportunities for population-based interventions. *Australian & New Zealand Journal of Public Health* 2006;30(1):50-56.
26. Hohepa M, Schofield G, Kolt G, Physical activity: what do high school students think? *Journal of Adolescent Health* 2006;39:328-336.
27. New Zealand Television Broadcasters' Council. *Research.* 2007. Available from: http://www.nztbc.co.nz/research/index.html
28. University of Auckland, *Census at school 2007: Table maker 2007*. 2007. Available from: https://www.censusatschool.org.nz/2007/table-maker/
29. Utter J, Denny S, Prevalence of physical activity among New Zealand youth and its association with community environments. *Journal of Adolescent Health* 2005;34(2):116-117.
30. TNS New Zealand Ltd, *Healthy Eating in New Zealand Families and Whanau: Social marketing audience research.* Wellington: Health Sponsorship Council. 2007.
31. Auckland University of Technology, *Our Pacific Families: Our Children in New Zealand Pacific Islands Family Study*. Auckland: Auckland University of Technology. 2007.
32. Borra ST, Kelly L, Shirreffs MB, et al, Developing health messages: qualitative studies with children, parents, and teachers help identify communications opportunities for healthful lifestyles and the prevention of obesity. *Journal of the American Dietetic Association* 2003;103(6):721-728.
33. Nielsen SJ, Popkin BM, Patterns and trends in food portion sizes, 1977−1998. *Journal of the American Medical Association* 2003;289(4):450-453.
34. Cullen KW, Baranowski T, Owens E, et al, Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Education & Behavior* 2003;30(5):615-626.

35. Chen J-L, Kennedy C, Factors associated with obesity in Chinese-American children. *Pediatric Nursing* 2005;31(2):110-115.
36. Puhl RM, Schwartz MB, If you are good you can have a cookie: how memories of childhood food rules link to adult eating behaviors. *Eating Behaviors* 2003;4(3):283-293.
37. Boutelle K, Lytle L, Murray D, Perceptions of the family mealtime environment and adolescent mealtime behaviour: do adults and adolescents agree? *Journal of Nutrition Education* 2001;33(3):128-133.
38. Holm-Denoma JM, Lewinsohn PM, Gau JM, et al, Parents' reports of the body shape and feeding habits of 36-month-old children: an investigation of gender differences. *International Journal of Eating Disorders* 2005;38(3):228-235.
39. Laroche HH, Hofer TP, Davis MM, Adult fat intake associated with the presence of children in households: findings from NHANES III. *Journal of the American Board of Family Medicine* 2007;20(1):9-15.
40. Fitzpatrick E, Edmunds LS, Dennison BA, Positive effects of family dinner are undone by television viewing. *Journal of the American Dietetic Association* 2007;107(4):666-671.
41. Gillman MW, Rifas-Shiman SL, Frazier AL, et al, Family dinner and diet quality among older children and adolescents. *Archives of Family Medicine* 2000;9(3):235-240.
42. Roos EB, Hirvonen T, Mikkilä V, et al, Household educational level as a determinant of consumption of raw vegetables among male and female adolescents. *Preventive Medicine* 2001;33:282-291.
43. Videon TM, Manning CK, Influences on adolescent eating patterns: the importance of family meals. *Journal of Adolescent Health* 2003;32(5):365-373.
44. Cooke L, Wardle J, Gibson E, Relationship between parental report of food neophobia and everyday food consumption in 2-6-year-old children. *Appetite* 2003;41(2):205-206.
45. Haapalahti M, Mykkanen H, Tikkanen S, et al, Meal patterns and food use in 10- to 11-year-old Finnish children. *Public Health Nutrition* 2003;6(4):365-370.
46. Hannon PA, Bowen DJ, Moinpour CM, et al, Correlations in perceived food use between the family food preparer and their spouses and children. *Appetite* 2003;40(1):77-83.
47. Neumark-Sztainer D, Hannan PJ, Story M, et al, Family meal patterns: associations with sociodemographic characteristics and improved dietary intake among adolescents [see comment]. *Journal of the American Dietetic Association* 2003;103(3):317-322.
48. Larson NI, Story M, Wall M, et al, Calcium and dairy intakes of adolescents are associated with their home environment, taste preferences, personal health beliefs, and meal patterns. *Journal of the American Dietetic Association* 2006;106(11):1816-24.
49. DeBourdeaudhuij I, Van Oost P, Personal and family determinants of dietary behaviour in adolescents and their parents. *Psychology & Health* 2000;15(6):751-770.
50. Sweeting H, West P, Dietary habits and children's family lives. *Journal of Human Nutrition and Dietetics* 2005;18(2):93-97.
51. Fulkerson JA, Neumark-Sztainer D, Story M, Adolescent and parent views of family meals. *Journal of the American Dietetic Association* 2006;106(4):526-532.

52. Boutelle KN, Birnbaum AS, Lytle LA, et al, Associations between perceived family meal environment and parent intake of fruit, vegetables, and fat. *Journal of Nutrition Education and Behavior* 2003;35(1):24-29.
53. Coon KA, Goldberg J, Rogers BL, et al, Relationships between use of television during meals and children's food consumption patterns. *Pediatrics* 2001;107(1):E7.
54. Kremers SP, van der Horst K, Brug J, Adolescent screen-viewing behaviour is associated with consumption of sugar-sweetened beverages: the role of habit strength and perceived parental norms. *Appetite* 2007;48(3):345-350.
55. Bere E, Klepp KI, Correlates of fruit and vegetable intake among Norwegian schoolchildren: parental and self-reports. *Public Health Nutrition* 2004;7(8):991-998.
56. Brown R, Ogden J, Children's eating attitudes and behaviour: a study of the modelling and control theories of parental influence. *Health Education Research* 2004;19(3):261-271.
57. Campbell KJ, Crawford DA, Salmon J, et al, Associations between the home food environment and obesity-promoting eating behaviors in adolescence. *Obesity* 2007;15(3):719-730.
58. Fisher JO, Mitchell DC, Smiciklas-Wright H, et al, Maternal milk consumption predicts the tradeoff between milk and soft drinks in young girls' diets. *Journal of Nutrition* 2000;131:246-250.
59. Fisher JO, Mitchell DC, Smiciklas-Wright H, et al, Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *Journal of the American Dietetic Association* 2002;102:58-64.
60. Galloway AT, Lee Y, Birch LL, Predictors and consequences of food neophobia and pickiness in young girls. *Journal of the American Dietetic Association* 2003;103(6):692-698.
61. Gibson EL, Wardle J, Watts J, Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. *Appetite* 1998;31:205-228.
62. Hanson NI, Neumark-Sztainer D, Eisenberg ME, et al, Associations between parental report of the home food environment and adolescent intakes of fruits, vegetables and dairy foods. *Public Health Nutrition* 2005;8(1):77-85.
63. Johnson RK, Panely CV, Wang MQ, Associations between the milk mothers drink and the milk consumed by their school-aged children. *Family Economics and Nutrition Review* 2001;13(1):27-36.
64. Keski-Rahkonen A, Kaprio J, Rissanen A, et al, Breakfast skipping and health-compromising behaviors in adolescents and adults. *European Journal of Clinical Nutrition* 2003;57(7):842-853.
65. Keski-Rahkonen A, Viken RJ, Kaprio J, et al, Genetic and environmental factors in breakfast eating patterns. *Behavior Genetics* 2004;34(5):503-514.
66. Reinaerts E, de Nooijer J, Candel M, et al, Explaining school children's fruit and vegetable consumption: the contributions of availability, accessibility, exposure, parental consumption and habit in addition to psychosocial factors. *Appetite* 2007;48(2):248-258.
67. Vereecken CA, Keukelier E, Maes L, Influence of mother's educational level on food parenting practices and food habits of young children. *Appetite* 2004;43(1):93-103.
68. Wardle J, Carnell S, Cooke L, Parental control over feeding and children's fruit and vegetable intake: how are they related? [see comment]. *Journal of the American Dietetic Association* 2005;105(2):227-232.

69. Tibbs T, Haire-Joshu D, Schechtman KB, et al, The relationship between parental modeling, eating patterns, and dietary intake among African-American parents. *Journal of the American Dietetic Association* 2001;101:535-541.
70. Haire-Joshu D, Brownson RC, Nanney MS, et al, Improving dietary behavior in African Americans: the Parents As Teachers High 5, Low Fat Program. *Preventive Medicine* 2003;36(6):684-691.
71. Grimm GC, Harnack L, Story M, Factors associated with soft drink consumption in school-aged children. [see comment]. *Journal of the American Dietetic Association* 2004;104(8):1244-1249.
72. Young EM, Fors SW, Hayes DM, Associations between perceived parent behaviors and middle school student fruit and vegetable consumption. *Journal of Nutrition Education & Behavior* 2004;36(1):2-8.
73. Vereecken CA, Van Damme W, Maes L, Measuring attitudes, self-efficacy, and social and environmental influences on fruit and vegetable consumption of 11- and 12-year-old children: reliability and validity. [see comment]. *Journal of the American Dietetic Association* 2005;105(2):257-261.
74. Matheson DM, Robinson TN, Varady A, et al, Do Mexican-American mothers' food-related parenting practices influence their children's weight and dietary intake? *Journal of the American Dietetic Association* 2006;106(11):1861-1865.
75. Talvia S, Rasanen L, Lagstrom H, et al, Longitudinal trends in consumption of vegetables and fruit in Finnish children in an atherosclerosis prevention study (STRIP). *European Journal of Clinical Nutrition* 2006;60(2):172-180.
76. Wind M, de Bourdeaudhuij I, te Velde SJ, et al, Correlates of fruit and vegetable consumption among 11-year-old Belgian-Flemish and Dutch schoolchildren. *Journal of Nutrition Education & Behavior* 2006;38(4):211-221.
77. Wardle J, Cooke LJ, Gibson EL, et al, Increasing children's acceptance of vegetables: a randomized trial of parent-led exposure. *Appetite* 2003;40(2):155-162.
78. Zabinski MF, Daly T, Norman GJ, et al, Psychosocial correlates of fruit, vegetable, and dietary fat intake among adolescent boys and girls. *Journal of the American Dietetic Association* 2006;106(6):814-821.
79. Neumark-Sztainer D, Story M, Resnick MD, et al, Correlates of inadequate fruit and vegetable consumption among adolescents. *Preventive Medicine* 1996;25(5):497-505.
80. Bandura A, Self-efficacy: toward a unifying theory of behavioral change. [see comment]. *Psychological Review* 1977;84(2):191-215.
81. Reynolds KM, Hinton AW, Shewchuk RM, et al, Social cognitive model of fruit and vegetable consumption in elementary school children. *Journal of Nutrition Education* 1999;31(1):23-30.
82. Kratt P, Reynolds K, Shewchuk R, The role of availability as a moderator of family fruit and vegetable consumption. *Health Education & Behavior* 2000;27(4):471-482.
83. Kremers SPJ, Brug J, de Vries H, et al, Parenting style and adolescent fruit consumption. *Appetite* 2003;41(1):43-50.
84. van der Horst K, Kremers S, Ferreira I, et al, Perceived parenting style and practices and the consumption of sugar-sweetened beverages by adolescents. *Health Education Research* 2007;22(2):295-304.

85. Baranowski T, Davis M, Resnicow K, et al, Gimme 5 fruit and vegetables for fun and health: outcome evaluation. *Health Education & Behavior* 2000;27:96-110.
86. Saksvig BI, Gittelsohn J, Harris SB, et al, A pilot school-based healthy eating and physical activity intervention improves diet, food knowledge, and self-efficacy for native Canadian children. *Journal of Nutrition* 2005;135(10):2392-2398.
87. Devine CM, Connors MM, Sobal J, et al, Sandwiching it in: spillover of work onto food choices and family roles in low- and moderate-income urban households. *Social Science & Medicine* 2003;56(3):617-630.
88. Jabs J, Devine CM, Bisogni CA, et al, Trying to find the quickest way: employed mothers' constructions of time for food. *Journal of Nutrition Education Behaviour* 2007;39:18-25.
89. Roos EB, Sarlio-Lähteenkorva S, Lallukka T, et al, Associations of work−family conflicts with food habits and physical activity. *Public Health Nutrition* 2006;10(3):222-229.
90. Lake AA, Rugg-Gunn AJ, Hyland RM, et al, Longitudinal dietary change from adolescence to adulthood: perceptions, attributions and evidence. *Appetite* 2004;42(3):255-263.
91. Hughes SO, Power TG, Orlet Fisher J, et al, Revisiting a neglected construct: parenting styles in a child-feeding context. *Appetite* 2005;44(1):83-92.
92. Lytle LA, Varnell S, Murray DM, et al, Predicting adolescents' intake of fruits and vegetables. *Journal of Nutrition Education Behaviour* 2003;35:170-178.
93. Patrick H, Nicklas TA, A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition* 2005;24(2):83-92.
94. Arredondo EM, Elder JP, Ayala GX, et al, Is parenting style related to children's healthy eating and physical activity in Latino families? *Health Education Research* 2006;21(6):862-871.
95. Galloway AT, Fiorito LM, Francis LA, et al, "Finish your soup": counterproductive effects of pressuring children to eat on intake and affect. *Appetite* 2006;46(3):318-323.
96. de Bruijn G-J, Kremers SPJ, de Vries H, et al, Associations of social-environmental and individual-level factors with adolescent soft drink consumption: results from the SMILE study. *Health Education Research* 2007;22(2):227-237.
97. Ogden J, Reynolds R, Smith A, Expanding the concept of parental control: a role for overt and covert control in children's snacking behaviour? *Appetite* 2006;47(1):100-106.
98. Robinson S, Children's perceptions of who controls their food. *Journal of Human Nutrition and Dietetics* 2000;13(3):163-171.
99. Fisher JO, Birch LL, Restricting access to foods and children's eating. *Appetite* 1999;32:405-419.
100. Birch LL, Fisher JO, Davison KK, Learning to overeat: maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. *American Journal of Clinical Nutrition* 2003;78:215-220.
101. Fisher JO, Birch LL, Restricting access to palatable foods affects children's behavioural response, food selection, and intake. *American Journal of Clinical Nutrition* 1999b;69:1264-1272.

102. Harvey-Berino J, Rourke J, Obesity prevention in preschool Native-American children: a pilot study using home visiting. *Obesity Research* 2003;11(5):606-611.
103. Nanney MS, Johnson S, Elliott M, et al, Frequency of eating homegrown produce is associated with higher intake among parents and their preschool-aged children in rural Missouri. *Journal of the American Dietetic Association* 2007;107(4):577-584.
104. Campbell KJ, Crawford DA, Hesketh KD, Australian parents' views on their 5-6-year-old children's food choices. *Health Promotion International* 2007;22(1):11-18.
105. Evans AE, Dave J, Tanner A, et al, Changing the home nutrition environment: effects of a nutrition and media literacy pilot intervention. *Family & Community Health* 2006;29(1):43-54.
106. Snyder EE, Sprietzer E, Family influence and involvement in sports. *Research Quarterly* 1973;44(3):249-255.
107. Sallis JF, Prochaska JJ, Taylor WC, A review of correlates of physical activity of children and adolescents. *Medicine & Science in Sports & Exercise* 2000;32(5):963-975.
108. Gustafson SL, Rhodes RE, Parental correlates of physical activity in children and early adolescents. *Sports Medicine* 2006;36(1):79-97.
109. Brustad RJ, Attraction to physical activity in urban schoolchildren: parental socialization and gender influences. *Research Quarterly for Exercise & Sport* 1996;67(3):316-323.
110. Hovell MF, Kolody B, Sallis JF, et al, Parent support, physical activity, and correlates of adiposity in nine year olds. *Journal of Health Education* 1996;27:126-129.
111. Kimiecik JC, Horn TS, Shurin CS, Relationships among children's beliefs, perceptions of their parents' beliefs, and their moderate-to-vigorous physical activity. *Research Quarterly for Exercise & Sport* 1996;67(3):324-336.
112. Bungum TJ, Vincent ML, Determinants of physical activity among female adolescents. *American Journal of Preventive Medicine* 1997;13(2):115-122.
113. Kimiecik JC, Horn TS, Parental beliefs and children's moderate-to-vigorous physical activity. *Research Quarterly for Exercise & Sport* 1998;69:163-175.
114. McGuire MT, Hannan PJ, Neumark-Sztainer D, et al, Parental correlates of physical activity in a racially/ethnically diverse adolescent sample. *Journal of Adolescent Health* 2002a;30(4):253-261.
115. Prochaska JJ, Rodgers MW, Sallis JF, Association of parent and peer support with adolescent physical activity. *Research Quarterly for Exercise & Sport* 2002;73:206-210.
116. Sallis JF, Taylor WC, Dowda M, et al, Correlates of vigorous physical activity for children in grades 1 through 12: comparing parent-reported and objectively measured physical activity. *Pediatric Exercise Science* 2002;14:30-44.
117. Dunton GF, Jamner MS, Cooper DM, Assessing the perceived environment among minimally active adolescent girls: validity and relations to physical activity outcomes. *American Journal of Health Promotion* 2003;18(1):70-73.
118. Trost SG, Sallis JF, Pate RR, et al, Evaluating a model of parental influence on youth physical activity. *American Journal of Preventive Medicine* 2003;25(4):277-282.
119. Adkins S, Sherwood NE, Story M, et al, Physical activity among African-American girls: the role of parents and the home environment. *Obesity Research* 2004;12(Suppl):38S-45S.

120. Davison KK, Activity-related support from parents, peers and siblings and adolescents' physical activity: are there gender differences. *Journal of Physical Activity and Health* 2004;1:363-376.
121. Saunders RP, Motl RW, Dowda M, et al, Comparison of social variables for understanding physical activity in adolescent girls. *American Journal of Health Behavior* 2004;28(5):426-436.
122. Duncan SC, Duncan TE, Strycker LA, Sources and types of social support in youth physical activity. *Health Psychology* 2005;24(1):3-10.
123. Heitzler CD, Martin SL, Duke J, et al, Correlates of physical activity in a national sample of children aged 9-13 years. *Preventive Medicine* 2006;42(4):254-260.
124. Ammouri AA, Kaur H, Neuberger GB, et al, Correlates of exercise participation in adolescents. *Public Health Nursing* 2007;24(2):111-120.
125. Beets MW, Vogel R, Forlaw L, et al, Social support and youth physical activity: the role of provider and type. *American Journal of Health Behavior* 2006;30(3):278-289.
126. Kalakanis LE, Goldfield GS, Paluch RA, et al, Parental activity as a determinant of activity level and patterns of activity in obese children. *Research Quarterly for Exercise & Sport* 2001;72(3):202-209.
127. McGuire MT, Neumark-Stzainer DR, Story M, Correlates of time spent in physical activity and television viewing in a multi-racial sample of adolescents. *Pediatric Exercise Science* 2002b;14:75-86.
128. Springer AE, Kelder SH, Hoelscher DM, Social support, physical activity and sedentary behavior among 6th-grade girls: a cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity* 2006;3:8.
129. Aarnio M, Winter T, Kujala UM, et al, Familial aggregation of leisure-time physical activity: a three generation study. *International Journal of Sports Medicine* 1997;18(7):549-556.
130. Fogelholm M, Nuutinen O, Pasanen M, et al, Parent-child relationship of physical activity patterns and obesity. *International Journal of Obesity and Related Metabolic Disorders* 1999;23(12):1262-1268.
131. Raudsepp L, The relationship between socio-economic status, parental support and adolescent physical activity. *Acta Paediatrica* 2006;95(1):93-98.
132. Viira R, Raudsepp L, Psychosocial correlates of physical activity among seven through eight grades. *Journal of Human Movement Studies* 2003;44:501-517.
133. Raudsepp L, Viira R, Influence of parents' and siblings' physical activity on activity levels of adolescents. *European Journal of Physical Education* 2000;5:169-178.
134. Shropshire J, Carroll B, Family variables and children's physical activity: influence of parental exercise and socio-economic status. *Sport Education & Society* 1997;2:95-116.
135. Vilhjalmsson R, Thorlindsson T, Factors related to physical activity: a study of adolescents. *Social Science & Medicine* 1998;47(5):665-675.
136. Mota J, Silva G, Adolescents' physical activity: association with socio-economic status and parental participation among a Portuguese sample. *Sport, Education & Society* 1999;4:193-199.
137. Wagner A, Klein-Platat C, Arveiler D, et al, Parent-child physical activity relationships in 12-year-old French students do not depend on family socioeconomic status. *Diabetes & Metabolism* 2004;30(4):359-366.

138. Zambon A, Lemma P, Borraccino A, et al, Socio-economic position and adolescents' health in Italy: the role of the quality of social relations. *European Journal of Public Health* 2006;16(6):627-632.
139. Martin M, Dollman J, Norton K, et al, A decrease in the association between the physical activity patterns of Australian parents and their children; 1985-1997. *Journal of Science & Medicine in Sport* 2005;8(1):71-76.
140. Salmon J, Timperio A, Telford A, et al, Association of family environment with children's television viewing and with low level of physical activity. *Obesity Research* 2005;13(11):1939-1951.
141. Timperio A, Ball K, Salmon J, et al, Personal, family, social, and environmental correlates of active commuting to school. *American Journal of Preventive Medicine* 2006;30(1):45-51.
142. Ziviani J, Scott J, Wadley D, Walking to school: incidental physical activity in the daily occupations of Australian children. *Occupational Therapy International* 2004;11(1):1-11.
143. Wilson AN, Dollman J, Social influences on physical activity in Anglo- and Vietnamese-Australian adolescent males in a single sex school. *Journal of Science & Medicine in Sport* 2007;10(3):147-155.
144. Hohepa M, Scragg R, Schofield G, et al, Social support for youth physical activity: importance of siblings, parents, friends and school support across a segmented school day. *International Journal of Behavioral Nutrition and Physical Activity* 2007;4:54.
145. Trost SG, Pate RR, Saunders R, et al, A prospective study of the determinants of physical activity in rural fifth-grade children. *Preventive Medicine* 1997;26(2):257-263.
146. DiLorenzo TM, Stucky-Ropp RC, Vander Wal JS, et al, Determinants of exercise among children. II: a longitudinal analysis. *Preventive Medicine* 1998;27(3):470-477.
147. Sallis JF, Alcaraz JE, McKenzie TL, et al, Predictors of change in children's physical activity over 20 months: variations by gender and level of adiposity. *American Journal of Preventive Medicine* 1999;16(3):222-229.
148. Iannotti RJ, Sallis JF, Chen R, et al, Prospective analyses of relationships between mothers' and children's physical activity. *Journal of Physical Activity & Health* 2005;2(1):16-34.
149. Davison KK, Downs DS, Birch LL, Pathways linking perceived athletic competence and parental support at age 9 years to girls' physical activity at age 11 years. *Research Quarterly for Exercise & Sport* 2006;77(1):23-31.
150. Dowda M, Dishman RK, Pfeiffer KA, et al, Family support for physical activity in girls from 8th to 12th grade in South Carolina. *Preventive Medicine* 2007;44(2):153-159.
151. Duncan SC, Duncan TE, Strycker LA, et al, A cohort-sequential latent growth model of physical activity from ages 12 to 17 years. *Annals of Behavioral Medicine* 2007;33(1):80-89.
152. Ornelas IJ, Perreira KM, Ayala GX, Parental influences on adolescent physical activity: a longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity* 2007;4:3.

153. Yang X, Telama R, Laasko L, Parents' physical activity, socioeconomic status and education as predictors of physical activity and sport among children and youths: a 12 year follow-up study. *International Review for Sociology of Sport* 1996;31:273-291.
154. Bois JE, Sarrazin PG, Brustad RJ, et al, Elementary schoolchildren's perceived competence and physical activity involvement: the influence of parents' role modelling behaviours and perceptions of their child's competence. *Psychology of Sport & Exercise* 2005;6(4):381-397.
155. McGarvey E, Keller A, Forrester M, et al, Feasibility and benefits of a parent-focused preschool child obesity intervention. *American Journal of Public Health* 2004;94(9):1490-1495.
156. Davison KK, Cutting TM, Birch LL, Parents' activity-related parenting practices predict girls' physical activity. *Medicine & Science in Sports & Exercise* 2003;35(9):1589-1595.
157. Hoefer WR, McKenzie TL, Sallis JF, et al, Parental provision of transportation for adolescent physical activity. *American Journal of Preventive Medicine* 2001;21(1):48-51.
1. Kalil A, *Family Resilience and Good Child Outcomes: A review of the literature*. Wellington: Ministry of Social Development. 2003.
2. Families Commission, *Focus on Families: Reinforcing the importance of family. Report on literature review and focus groups.* Wellington: Families Commission. 2005.
3. Families Commission, *What Makes Your Family Tick? Families with dependent children – successful outcomes project. Report on public consultation*. Wellington: Families Commission. 2006.
4. Health Sponsorship Council, *Healthy Eating: Programme Plan 200−-2009.* Wellington: Health Sponsorship Council. 2006.
5. Golan M, Parents as agents of change in childhood obesity: from research to practice. *International Journal of Pediatric Obesity* 2006;1(2):66-76.
6. Young KM, Northern JJ, Lister KM, et al, A meta-analysis of family-behavioral weight-loss treatments for children. *Clinical Psychology Review* 2007;27(2):240-249.
7. O'Byrne K, Haddock L, Poston W, Parenting style and adolescent smoking. *Journal of Adolescent Health* 2002;30(6):418-25.
8. Ministry of Health, *NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey*. Wellington: Ministry of Health. 2003.
9. SPARC, *SPARC Facts 97-01*. Wellington: SPARC. 2003.
10. Davison KK, Birch LL. Childhood overweight: a contextual model and recommendations for future research. *Obesity Reviews* 2001;2:159-171.
11. Birch L,. Family and social environment measures. In: Johnson-Taylor W and Everhart J: modifiable environmental and behavioural determinants of overweight among children and adolescents: Report of a workshop. *Obesity Research* 2006;14(6):929-966.
12. Devine CM, A life course perspective: understanding food choices in time, social location, and history. *Journal of Nutrition Education & Behavior* 2005;37(3):121-128.
13. TNS New Zealand Ltd, *The Value of Sport: Attitudes, barriers and motivations for participation in sport by 11-14 year olds*. Wellington: SPARC. 2005.
14. Caspersen CJ, Powell KE, Christenson GM, Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Reports* 1985;100(2):126-131.

15. Campbell K, Crawford D, Ball K, Family food environment and dietary behaviors likely to promote fatness in 5−6-year-old children. *International Journal of Obesity* 2006;30(8):1272-1280.
16. Crawford D, Timperio A, Telford A, et al, Parental concerns about childhood obesity and the strategies employed to prevent unhealthy weight gain in children. *Public Health Nutrition* 2006;9(7):889-895.
17. Devine CM, Jastran M, Jabs J, et al, "A lot of sacrifices": work−family spillover and the food choice coping strategies of low-wage employed parents. *Social Science & Medicine* 2006;63(10):2591-2603.
18. Epstein LH, Valoski A, Wing RR, et al, Ten-year follow-up of behavioral, family-based treatment for obese children. *Journal of the American Medical Association* 1990;21(264):2159-2535.
19. Welk G, Wood K, Morss G, Parental influences on physical activity in children: an exploration of potential mechanisms. *Pediatric Exercise Science* 2003;15:19-33.
20. Crossman A, Sullivan DA, Benin M, The family environment and American adolescents' risk of obesity as young adults. *Social Science & Medicine* 2006;63(9):2255-2267.
21. Statistics New Zealand, *QuickStats National Highlights: Families 2007*. Available from: http://www.stats.govt.nz/census/.
22. McHale S, The role of family environments in children's overweight. In: Johnson-Taylor W and Everhart J. Modifiable environmental and behavioural determinants of overweight among children and adolescents: report of a workshop. *Obesity* 2006;14(6):929-966.
23. Kolt G, Schofield G, Schofield L, et al, *Best Practice Review of Sport and Physical Activity Interventions for Young People Aged 13-18 Years: Report to Sport and Recreation New Zealand* (Vol. 1 & 2). Auckland: Auckland University of Technology. 2006.
24. Utter J, Denny S, Robinson E, Perceived access to community facilities, social motivation, and physical activity among New Zealand youth. *Journal of Adolescent Health* 2006;39:770-773.
25. Utter J, Scragg R, Schaaf D, et al, Nutrition and physical activity behaviours among Maori, Pacific and NZ European children: identifying opportunities for population-based interventions. *Australian & New Zealand Journal of Public Health* 2006;30(1):50-56.
26. Hohepa M, Schofield G, Kolt G, Physical activity: what do high school students think? *Journal of Adolescent Health* 2006;39:328-336.
27. New Zealand Television Broadcasters' Council. *Research.* 2007. Available from: http://www.nztbc.co.nz/research/index.html
28. University of Auckland, *Census at school 2007: Table maker 2007*. 2007. Available from: https://www.censusatschool.org.nz/2007/table-maker/
29. Utter J, Denny S, Prevalence of physical activity among New Zealand youth and its association with community environments. *Journal of Adolescent Health* 2005;34(2):116-117.
30. TNS New Zealand Ltd, *Healthy Eating in New Zealand Families and Whanau: Social marketing audience research.* Wellington: Health Sponsorship Council. 2007.

31. Auckland University of Technology, *Our Pacific Families: Our Children in New Zealand Pacific Islands Family Study*. Auckland: Auckland University of Technology. 2007.
32. Borra ST, Kelly L, Shirreffs MB, et al, Developing health messages: qualitative studies with children, parents, and teachers help identify communications opportunities for healthful lifestyles and the prevention of obesity. *Journal of the American Dietetic Association* 2003;103(6):721-728.
33. Nielsen SJ, Popkin BM, Patterns and trends in food portion sizes, 1977−1998. *Journal of the American Medical Association* 2003;289(4):450-453.
34. Cullen KW, Baranowski T, Owens E, et al, Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Education & Behavior* 2003;30(5):615-626.
35. Chen J-L, Kennedy C, Factors associated with obesity in Chinese-American children. *Pediatric Nursing* 2005;31(2):110-115.
36. Puhl RM, Schwartz MB, If you are good you can have a cookie: how memories of childhood food rules link to adult eating behaviors. *Eating Behaviors* 2003;4(3):283-293.
37. Boutelle K, Lytle L, Murray D, Perceptions of the family mealtime environment and adolescent mealtime behaviour: do adults and adolescents agree? *Journal of Nutrition Education* 2001;33(3):128-133.
38. Holm-Denoma JM, Lewinsohn PM, Gau JM, et al, Parents' reports of the body shape and feeding habits of 36-month-old children: an investigation of gender differences. *International Journal of Eating Disorders* 2005;38(3):228-235.
39. Laroche HH, Hofer TP, Davis MM, Adult fat intake associated with the presence of children in households: findings from NHANES III. *Journal of the American Board of Family Medicine* 2007;20(1):9-15.
40. Fitzpatrick E, Edmunds LS, Dennison BA, Positive effects of family dinner are undone by television viewing. *Journal of the American Dietetic Association* 2007;107(4):666-671.
41. Gillman MW, Rifas-Shiman SL, Frazier AL, et al, Family dinner and diet quality among older children and adolescents. *Archives of Family Medicine* 2000;9(3):235-240.
42. Roos EB, Hirvonen T, Mikkilä V, et al, Household educational level as a determinant of consumption of raw vegetables among male and female adolescents. *Preventive Medicine* 2001;33:282-291.
43. Videon TM, Manning CK, Influences on adolescent eating patterns: the importance of family meals. *Journal of Adolescent Health* 2003;32(5):365-373.
44. Cooke L, Wardle J, Gibson E, Relationship between parental report of food neophobia and everyday food consumption in 2-6-year-old children. *Appetite* 2003;41(2):205-206.
45. Haapalahti M, Mykkanen H, Tikkanen S, et al, Meal patterns and food use in 10- to 11-year-old Finnish children. *Public Health Nutrition* 2003;6(4):365-370.
46. Hannon PA, Bowen DJ, Moinpour CM, et al, Correlations in perceived food use between the family food preparer and their spouses and children. *Appetite* 2003;40(1):77-83.
47. Neumark-Sztainer D, Hannan PJ, Story M, et al, Family meal patterns: associations with sociodemographic characteristics and improved dietary intake among

adolescents [see comment]. *Journal of the American Dietetic Association* 2003;103(3):317-322.
48. Larson NI, Story M, Wall M, et al, Calcium and dairy intakes of adolescents are associated with their home environment, taste preferences, personal health beliefs, and meal patterns. *Journal of the American Dietetic Association* 2006;106(11):1816-24.
49. DeBourdeaudhuij I, Van Oost P, Personal and family determinants of dietary behaviour in adolescents and their parents. *Psychology & Health* 2000;15(6):751-770.
50. Sweeting H, West P, Dietary habits and children's family lives. *Journal of Human Nutrition and Dietetics* 2005;18(2):93-97.
51. Fulkerson JA, Neumark-Sztainer D, Story M, Adolescent and parent views of family meals. *Journal of the American Dietetic Association* 2006;106(4):526-532.
52. Boutelle KN, Birnbaum AS, Lytle LA, et al, Associations between perceived family meal environment and parent intake of fruit, vegetables, and fat. *Journal of Nutrition Education and Behavior* 2003;35(1):24-29.
53. Coon KA, Goldberg J, Rogers BL, et al, Relationships between use of television during meals and children's food consumption patterns. *Pediatrics* 2001;107(1):E7.
54. Kremers SP, van der Horst K, Brug J, Adolescent screen-viewing behaviour is associated with consumption of sugar-sweetened beverages: the role of habit strength and perceived parental norms. *Appetite* 2007;48(3):345-350.
55. Bere E, Klepp KI, Correlates of fruit and vegetable intake among Norwegian schoolchildren: parental and self-reports. *Public Health Nutrition* 2004;7(8):991-998.
56. Brown R, Ogden J, Children's eating attitudes and behaviour: a study of the modelling and control theories of parental influence. *Health Education Research* 2004;19(3):261-271.
57. Campbell KJ, Crawford DA, Salmon J, et al, Associations between the home food environment and obesity-promoting eating behaviors in adolescence. *Obesity* 2007;15(3):719-730.
58. Fisher JO, Mitchell DC, Smiciklas-Wright H, et al, Maternal milk consumption predicts the tradeoff between milk and soft drinks in young girls' diets. *Journal of Nutrition* 2000;131:246-250.
59. Fisher JO, Mitchell DC, Smiciklas-Wright H, et al, Parental influences on young girls' fruit and vegetable, micronutrient, and fat intakes. *Journal of the American Dietetic Association* 2002;102:58-64.
60. Galloway AT, Lee Y, Birch LL, Predictors and consequences of food neophobia and pickiness in young girls. *Journal of the American Dietetic Association* 2003;103(6):692-698.
61. Gibson EL, Wardle J, Watts J, Fruit and vegetable consumption, nutritional knowledge and beliefs in mothers and children. *Appetite* 1998;31:205-228.
62. Hanson NI, Neumark-Sztainer D, Eisenberg ME, et al, Associations between parental report of the home food environment and adolescent intakes of fruits, vegetables and dairy foods. *Public Health Nutrition* 2005;8(1):77-85.
63. Johnson RK, Panely CV, Wang MQ, Associations between the milk mothers drink and the milk consumed by their school-aged children. *Family Economics and Nutrition Review* 2001;13(1):27-36.

64. Keski-Rahkonen A, Kaprio J, Rissanen A, et al, Breakfast skipping and health-compromising behaviors in adolescents and adults. *European Journal of Clinical Nutrition* 2003;57(7):842-853.
65. Keski-Rahkonen A, Viken RJ, Kaprio J, et al, Genetic and environmental factors in breakfast eating patterns. *Behavior Genetics* 2004;34(5):503-514.
66. Reinaerts E, de Nooijer J, Candel M, et al, Explaining school children's fruit and vegetable consumption: the contributions of availability, accessibility, exposure, parental consumption and habit in addition to psychosocial factors. *Appetite* 2007;48(2):248-258.
67. Vereecken CA, Keukelier E, Maes L, Influence of mother's educational level on food parenting practices and food habits of young children. *Appetite* 2004;43(1):93-103.
68. Wardle J, Carnell S, Cooke L, Parental control over feeding and children's fruit and vegetable intake: how are they related? [see comment]. *Journal of the American Dietetic Association* 2005;105(2):227-232.
69. Tibbs T, Haire-Joshu D, Schechtman KB, et al, The relationship between parental modeling, eating patterns, and dietary intake among African-American parents. *Journal of the American Dietetic Association* 2001;101:535-541.
70. Haire-Joshu D, Brownson RC, Nanney MS, et al, Improving dietary behavior in African Americans: the Parents As Teachers High 5, Low Fat Program. *Preventive Medicine* 2003;36(6):684-691.
71. Grimm GC, Harnack L, Story M, Factors associated with soft drink consumption in school-aged children. [see comment]. *Journal of the American Dietetic Association* 2004;104(8):1244-1249.
72. Young EM, Fors SW, Hayes DM, Associations between perceived parent behaviors and middle school student fruit and vegetable consumption. *Journal of Nutrition Education & Behavior* 2004;36(1):2-8.
73. Vereecken CA, Van Damme W, Maes L, Measuring attitudes, self-efficacy, and social and environmental influences on fruit and vegetable consumption of 11- and 12-year-old children: reliability and validity. [see comment]. *Journal of the American Dietetic Association* 2005;105(2):257-261.
74. Matheson DM, Robinson TN, Varady A, et al, Do Mexican-American mothers' food-related parenting practices influence their children's weight and dietary intake? *Journal of the American Dietetic Association* 2006;106(11):1861-1865.
75. Talvia S, Rasanen L, Lagstrom H, et al, Longitudinal trends in consumption of vegetables and fruit in Finnish children in an atherosclerosis prevention study (STRIP). *European Journal of Clinical Nutrition* 2006;60(2):172-180.
76. Wind M, de Bourdeaudhuij I, te Velde SJ, et al, Correlates of fruit and vegetable consumption among 11-year-old Belgian-Flemish and Dutch schoolchildren. *Journal of Nutrition Education & Behavior* 2006;38(4):211-221.
77. Wardle J, Cooke LJ, Gibson EL, et al, Increasing children's acceptance of vegetables: a randomized trial of parent-led exposure. *Appetite* 2003;40(2):155-162.
78. Zabinski MF, Daly T, Norman GJ, et al, Psychosocial correlates of fruit, vegetable, and dietary fat intake among adolescent boys and girls. *Journal of the American Dietetic Association* 2006;106(6):814-821.
79. Neumark-Sztainer D, Story M, Resnick MD, et al, Correlates of inadequate fruit and vegetable consumption among adolescents. *Preventive Medicine* 1996;25(5):497-505.

80. Bandura A, Self-efficacy: toward a unifying theory of behavioral change. [see comment]. *Psychological Review* 1977;84(2):191-215.
81. Reynolds KM, Hinton AW, Shewchuk RM, et al, Social cognitive model of fruit and vegetable consumption in elementary school children. *Journal of Nutrition Education* 1999;31(1):23-30.
82. Kratt P, Reynolds K, Shewchuk R, The role of availability as a moderator of family fruit and vegetable consumption. *Health Education & Behavior* 2000;27(4):471-482.
83. Kremers SPJ, Brug J, de Vries H, et al, Parenting style and adolescent fruit consumption. *Appetite* 2003;41(1):43-50.
84. van der Horst K, Kremers S, Ferreira I, et al, Perceived parenting style and practices and the consumption of sugar-sweetened beverages by adolescents. *Health Education Research* 2007;22(2):295-304.
85. Baranowski T, Davis M, Resnicow K, et al, Gimme 5 fruit and vegetables for fun and health: outcome evaluation. *Health Education & Behavior* 2000;27:96-110.
86. Saksvig BI, Gittelsohn J, Harris SB, et al, A pilot school-based healthy eating and physical activity intervention improves diet, food knowledge, and self-efficacy for native Canadian children. *Journal of Nutrition* 2005;135(10):2392-2398.
87. Devine CM, Connors MM, Sobal J, et al, Sandwiching it in: spillover of work onto food choices and family roles in low- and moderate-income urban households. *Social Science & Medicine* 2003;56(3):617-630.
88. Jabs J, Devine CM, Bisogni CA, et al, Trying to find the quickest way: employed mothers' constructions of time for food. *Journal of Nutrition Education Behaviour* 2007;39:18-25.
89. Roos EB, Sarlio-Lähteenkorva S, Lallukka T, et al, Associations of work−family conflicts with food habits and physical activity. *Public Health Nutrition* 2006;10(3):222-229.
90. Lake AA, Rugg-Gunn AJ, Hyland RM, et al, Longitudinal dietary change from adolescence to adulthood: perceptions, attributions and evidence. *Appetite* 2004;42(3):255-263.
91. Hughes SO, Power TG, Orlet Fisher J, et al, Revisiting a neglected construct: parenting styles in a child-feeding context. *Appetite* 2005;44(1):83-92.
92. Lytle LA, Varnell S, Murray DM, et al, Predicting adolescents' intake of fruits and vegetables. *Journal of Nutrition Education Behaviour* 2003;35:170-178.
93. Patrick H, Nicklas TA, A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition* 2005;24(2):83-92.
94. Arredondo EM, Elder JP, Ayala GX, et al, Is parenting style related to children's healthy eating and physical activity in Latino families? *Health Education Research* 2006;21(6):862-871.
95. Galloway AT, Fiorito LM, Francis LA, et al, "Finish your soup": counterproductive effects of pressuring children to eat on intake and affect. *Appetite* 2006;46(3):318-323.
96. de Bruijn G-J, Kremers SPJ, de Vries H, et al, Associations of social-environmental and individual-level factors with adolescent soft drink consumption: results from the SMILE study. *Health Education Research* 2007;22(2):227-237.

97. Ogden J, Reynolds R, Smith A, Expanding the concept of parental control: a role for overt and covert control in children's snacking behaviour? *Appetite* 2006;47(1):100-106.
98. Robinson S, Children's perceptions of who controls their food. *Journal of Human Nutrition and Dietetics* 2000;13(3):163-171.
99. Fisher JO, Birch LL, Restricting access to foods and children's eating. *Appetite* 1999;32:405-419.
100. Birch LL, Fisher JO, Davison KK, Learning to overeat: maternal use of restrictive feeding practices promotes girls' eating in the absence of hunger. *American Journal of Clinical Nutrition* 2003;78:215-220.
101. Fisher JO, Birch LL, Restricting access to palatable foods affects children's behavioural response, food selection, and intake. *American Journal of Clinical Nutrition* 1999b;69:1264-1272.
102. Harvey-Berino J, Rourke J, Obesity prevention in preschool Native-American children: a pilot study using home visiting. *Obesity Research* 2003;11(5):606-611.
103. Nanney MS, Johnson S, Elliott M, et al, Frequency of eating homegrown produce is associated with higher intake among parents and their preschool-aged children in rural Missouri. *Journal of the American Dietetic Association* 2007;107(4):577-584.
104. Campbell KJ, Crawford DA, Hesketh KD, Australian parents' views on their 5-6-year-old children's food choices. *Health Promotion International* 2007;22(1):11-18.
105. Evans AE, Dave J, Tanner A, et al, Changing the home nutrition environment: effects of a nutrition and media literacy pilot intervention. *Family & Community Health* 2006;29(1):43-54.
106. Snyder EE, Sprietzer E, Family influence and involvement in sports. *Research Quarterly* 1973;44(3):249-255.
107. Sallis JF, Prochaska JJ, Taylor WC, A review of correlates of physical activity of children and adolescents. *Medicine & Science in Sports & Exercise* 2000;32(5):963-975.
108. Gustafson SL, Rhodes RE, Parental correlates of physical activity in children and early adolescents. *Sports Medicine* 2006;36(1):79-97.
109. Brustad RJ, Attraction to physical activity in urban schoolchildren: parental socialization and gender influences. *Research Quarterly for Exercise & Sport* 1996;67(3):316-323.
110. Hovell MF, Kolody B, Sallis JF, et al, Parent support, physical activity, and correlates of adiposity in nine year olds. *Journal of Health Education* 1996;27:126-129.
111. Kimiecik JC, Horn TS, Shurin CS, Relationships among children's beliefs, perceptions of their parents' beliefs, and their moderate-to-vigorous physical activity. *Research Quarterly for Exercise & Sport* 1996;67(3):324-336.
112. Bungum TJ, Vincent ML, Determinants of physical activity among female adolescents. *American Journal of Preventive Medicine* 1997;13(2):115-122.
113. Kimiecik JC, Horn TS, Parental beliefs and children's moderate-to-vigorous physical activity. *Research Quarterly for Exercise & Sport* 1998;69:163-175.
114. McGuire MT, Hannan PJ, Neumark-Sztainer D, et al, Parental correlates of physical activity in a racially/ethnically diverse adolescent sample. *Journal of Adolescent Health* 2002a;30(4):253-261.
115. Prochaska JJ, Rodgers MW, Sallis JF, Association of parent and peer support with adolescent physical activity. *Research Quarterly for Exercise & Sport* 2002;73:206-210.

116. Sallis JF, Taylor WC, Dowda M, et al, Correlates of vigorous physical activity for children in grades 1 through 12: comparing parent-reported and objectively measured physical activity. *Pediatric Exercise Science* 2002;14:30-44.
117. Dunton GF, Jamner MS, Cooper DM, Assessing the perceived environment among minimally active adolescent girls: validity and relations to physical activity outcomes. *American Journal of Health Promotion* 2003;18(1):70-73.
118. Trost SG, Sallis JF, Pate RR, et al, Evaluating a model of parental influence on youth physical activity. *American Journal of Preventive Medicine* 2003;25(4):277-282.
119. Adkins S, Sherwood NE, Story M, et al, Physical activity among African-American girls: the role of parents and the home environment. *Obesity Research* 2004;12(Suppl):38S-45S.
120. Davison KK, Activity-related support from parents, peers and siblings and adolescents' physical activity: are there gender differences. *Journal of Physical Activity and Health* 2004;1:363-376.
121. Saunders RP, Motl RW, Dowda M, et al, Comparison of social variables for understanding physical activity in adolescent girls. *American Journal of Health Behavior* 2004;28(5):426-436.
122. Duncan SC, Duncan TE, Strycker LA, Sources and types of social support in youth physical activity. *Health Psychology* 2005;24(1):3-10.
123. Heitzler CD, Martin SL, Duke J, et al, Correlates of physical activity in a national sample of children aged 9-13 years. *Preventive Medicine* 2006;42(4):254-260.
124. Ammouri AA, Kaur H, Neuberger GB, et al, Correlates of exercise participation in adolescents. *Public Health Nursing* 2007;24(2):111-120.
125. Beets MW, Vogel R, Forlaw L, et al, Social support and youth physical activity: the role of provider and type. *American Journal of Health Behavior* 2006;30(3):278-289.
126. Kalakanis LE, Goldfield GS, Paluch RA, et al, Parental activity as a determinant of activity level and patterns of activity in obese children. *Research Quarterly for Exercise & Sport* 2001;72(3):202-209.
127. McGuire MT, Neumark-Stzainer DR, Story M, Correlates of time spent in physical activity and television viewing in a multi-racial sample of adolescents. *Pediatric Exercise Science* 2002b;14:75-86.
128. Springer AE, Kelder SH, Hoelscher DM, Social support, physical activity and sedentary behavior among 6th-grade girls: a cross-sectional study. *International Journal of Behavioral Nutrition and Physical Activity Act* 2006;3:8.
129. Aarnio M, Winter T, Kujala UM, et al, Familial aggregation of leisure-time physical activity: a three generation study. *International Journal of Sports Medicine* 1997;18(7):549-556.
130. Fogelholm M, Nuutinen O, Pasanen M, et al, Parent-child relationship of physical activity patterns and obesity. *International Journal of Obesity and Related Metabolic Disorders* 1999;23(12):1262-1268.
131. Raudsepp L, The relationship between socio-economic status, parental support and adolescent physical activity. *Acta Paediatrica* 2006;95(1):93-98.
132. Viira R, Raudsepp L, Psychosocial correlates of physical activity among seven through eight grades. *Journal of Human Movement Studies* 2003;44:501-517.
133. Raudsepp L, Viira R, Influence of parents' and siblings' physical activity on activity levels of adolescents. *European Journal of Physical Education* 2000;5:169-178.

134. Shropshire J, Carroll B, Family variables and children's physical activity: influence of parental exercise and socio-economic status. *Sport Education & Society* 1997;2:95-116.
135. Vilhjalmsson R, Thorlindsson T, Factors related to physical activity: a study of adolescents. *Social Science & Medicine* 1998;47(5):665-675.
136. Mota J, Silva G, Adolescents' physical activity: association with socio-economic status and parental participation among a Portuguese sample. *Sport, Education & Society* 1999;4:193-199.
137. Wagner A, Klein-Platat C, Arveiler D, et al, Parent-child physical activity relationships in 12-year-old French students do not depend on family socioeconomic status. *Diabetes & Metabolism* 2004;30(4):359-366.
138. Zambon A, Lemma P, Borraccino A, et al, Socio-economic position and adolescents' health in Italy: the role of the quality of social relations. *European Journal of Public Health* 2006;16(6):627-632.
139. Martin M, Dollman J, Norton K, et al, A decrease in the association between the physical activity patterns of Australian parents and their children; 1985-1997. *Journal of Science & Medicine in Sport* 2005;8(1):71-76.
140. Salmon J, Timperio A, Telford A, et al, Association of family environment with children's television viewing and with low level of physical activity. *Obesity Research* 2005;13(11):1939-1951.
141. Timperio A, Ball K, Salmon J, et al, Personal, family, social, and environmental correlates of active commuting to school. *American Journal of Preventive Medicine* 2006;30(1):45-51.
142. Ziviani J, Scott J, Wadley D, Walking to school: incidental physical activity in the daily occupations of Australian children. *Occupational Therapy International* 2004;11(1):1-11.
143. Wilson AN, Dollman J, Social influences on physical activity in Anglo- and Vietnamese-Australian adolescent males in a single sex school. *Journal of Science & Medicine in Sport* 2007;10(3):147-155.
144. Hohepa M, Scragg R, Schofield G, et al, Social support for youth physical activity: importance of siblings, parents, friends and school support across a segmented school day. *International Journal of Behavioral Nutrition and Physical Activity* 2007;4:54.
145. Trost SG, Pate RR, Saunders R, et al, A prospective study of the determinants of physical activity in rural fifth-grade children. *Preventive Medicine* 1997;26(2):257-263.
146. DiLorenzo TM, Stucky-Ropp RC, Vander Wal JS, et al, Determinants of exercise among children. II: a longitudinal analysis. *Preventive Medicine* 1998;27(3):470-477.
147. Sallis JF, Alcaraz JE, McKenzie TL, et al, Predictors of change in children's physical activity over 20 months: variations by gender and level of adiposity. *American Journal of Preventive Medicine* 1999;16(3):222-229.
148. Iannotti RJ, Sallis JF, Chen R, et al, Prospective analyses of relationships between mothers' and children's physical activity. *Journal of Physical Activity & Health* 2005;2(1):16-34.
149. Davison KK, Downs DS, Birch LL, Pathways linking perceived athletic competence and parental support at age 9 years to girls' physical activity at age 11 years. *Research Quarterly for Exercise & Sport* 2006;77(1):23-31.

150. Dowda M, Dishman RK, Pfeiffer KA, et al, Family support for physical activity in girls from 8th to 12th grade in South Carolina. *Preventive Medicine* 2007;44(2):153-159.
151. Duncan SC, Duncan TE, Strycker LA, et al, A cohort-sequential latent growth model of physical activity from ages 12 to 17 years. *Annals of Behavioral Medicine* 2007;33(1):80-89.
152. Ornelas IJ, Perreira KM, Ayala GX, Parental influences on adolescent physical activity: a longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity* 2007;4:3.
153. Yang X, Telama R, Laasko L, Parents' physical activity, socioeconomic status and education as predictors of physical activity and sport among children and youths: a 12 year follow-up study. *International Review for Sociology of Sport* 1996;31:273-291.
154. Bois JE, Sarrazin PG, Brustad RJ, et al, Elementary schoolchildren's perceived competence and physical activity involvement: the influence of parents' role modelling behaviours and perceptions of their child's competence. *Psychology of Sport & Exercise* 2005;6(4):381-397.
155. McGarvey E, Keller A, Forrester M, et al, Feasibility and benefits of a parent-focused preschool child obesity intervention. *American Journal of Public Health* 2004;94(9):1490-1495.
156. Davison KK, Cutting TM, Birch LL, Parents' activity-related parenting practices predict girls' physical activity. *Medicine & Science in Sports & Exercise* 2003;35(9):1589-1595.
157. Hoefer WR, McKenzie TL, Sallis JF, et al, Parental provision of transportation for adolescent physical activity. *American Journal of Preventive Medicine* 2001;21(1):48-51.
158. Quigley R, Taylor R, Scragg R. Is consuming breakfast important for academic performance, maintaining a healthy body weight, and improving nutrient intake and lifestyle habits in children? *Report for Agencies for Nutrition Action* 2007 Available from: http://www.ana.org.nz/

Appendices

Appendix A. Studies investigating the association between shared family meals and food habits and behaviours

Author, year (reference)	Study sample	Assessment of dietary intake	Assessment of family mealtimes	Confounders adjusted for / limitations	Main outcomes
Cross-sectional studies					
DeBourdeaudhuij & Van Oost 2000[49]	A random sample of 104 parent−children dyads (total = 208) was recruited from Ghent, Belgium. The sample consisted of 2-parent families with at least 2 adolescents aged 12−18 years.	Each participant completed a modified 56-item food frequency questionnaire validated in the Netherlands for the Flemish population. Dietary outcomes included intake of fat, fruit, vegetables, soft drinks, snacks and diet quality.	Children and parents completed a computerised questionnaire, including the extent to which breakfast and/or hot meals were shared within families.	*Confounders adjusted for* Personal determinants, interactions around food in family, general family characteristics. *Limitations* A low response rate of 47.8%. The majority of respondents were middle-class, which may limit the generalisability of the results.	With increased shared breakfast, parents consumed less soft drink ($p < 0.05$) and snacks (0.05), and in general ate slightly more healthily ($0.05 > p < 0.10$). Eating meals together was not a significant predictor of dietary outcome in adolescents.
Gillman et al 2000[41]	8677 girls and 7525 boys aged 9−14 years were recruited for this study. Participants were sons and daughters of the ongoing Nurses' Health Study II, a cohort of 160,000 registered female nurses.	Children completed a validated, self-administered, semi-quantitative food frequency questionnaire. Dietary outcomes included fruit, vegetables, soda, fried foods eaten at and away from home, glycaemic load, trans- and saturated fat, and micronutrient intake.	Children completed a mailed self-administered questionnaire, including questions on eating dinner with other members of the family (e.g. how often they sit down with other members of the family to eat dinner or supper).	*Confounders adjusted for* Age, sex, energy intake, BMI, physical activity, hours of TV viewing, smoking, household income, 2-parent home vs other arrangement, frequency child made dinner, ready-made dinner intake. *Limitations* Generalisability of results may be limited as all mothers were nurses and 90% were white.	Children who ate a family dinner every day consumed 0.8 more servings of fruit and vegetables and consumed less fried food and soda than those who ate a family dinner never or sometimes. Children eating a family dinner more frequently reported slightly higher energy intakes and substantially higher intakes of fibre, calcium, folate, vitamins B_6, B_{12}, C and E, and iron. They consumed less trans- and saturated fat and their glycaemic load was lower. The odds ratios (OR) associated with frequency of family dinner most days vs never

					or some days for eating at least 5 serves of fruits and vegetables was 1.45 (95% CI: 1.37−1.53); for eating fried foods away from home it was 0.67 (95% CI: 0.64−0.70); for eating fried food at home it was 0.90 (95% CI: 0.86−0.94); and for drinking soda it was 0.73 (95% CI: 0.66−0.80).
Roos et al 2001[42]	76,201 children were recruited as part of the School Health Promotion Survey, involving secondary schools in eastern and western Finland.	Each adolescent completed a 15-item food frequency questionnaire, one question of which was related to raw vegetables.	Each adolescent completed a self-administered questionnaire, including the evening meal pattern at home.	*Confounders adjusted for* Sex-specific analysis; adjustment for education level, family factors, school achievement and eating patterns. *Limitations* Only raw vegetable consumption was assessed.	Adolescents who did not share family meals consumed significantly less raw vegetables than those who shared family meals; OR 0.68 (95% CI: 0.64−0.73) for girls and OR 0.57 (95% CI: 0.51−0.63) for boys.
Cooke et al 2003[44]	564 parents or principal caregivers of children aged 2−6 years were recruited from 22 North London nursery schools.	The frequency of fruit and vegetable consumption by both parent and child was assessed by asking parents how often they or their child ate 6 different food items, including fruit (fresh and tinned), vegetables (including salad but not potatoes).	Parents completed questionnaires, including 3 items on family meals (e.g. do children often eat the meals at the same time as grown-ups, the same food and the same place).	*Confounders adjusted for* Sex, age, ethnicity, parents' education level, food environment, child neophobia and enjoyment of food. *Limitations* A modest response rate of 64%. The respondents were predominantly white, middle-class and higher educated, which may limit extrapolation to other groups.	Family mealtimes were positively related to vegetable intake ($p = 0.02$) and insignificantly to fruit intake ($p = 0.06$).
Haapalahti et al 2003[45]	404 children aged 10−11 years, from the rural town of	Each child completed a food frequency questionnaire consisting of 39 items on the	Children completed a questionnaire, including 3 items on	*Confounders adjusted for* Gender, father's occupation, behavioural and emotional	Children with regular family mealtimes ate sweets ($p = 0.034$) and fast food ($p = 0.033$) less

	Ylivieska, in mid-western Finland.	consumption of a variety of foods and 16 items on food patterns. Dietary outcomes included healthy and unhealthy food habits, and food intakes, including fruit, vegetables, spread on bread, milk, soft drink / sugar juices, juice, fast food, sausages, sweet pastries and biscuits, and sweets.	family meal patterns (e.g. we tend to eat at the same time, the whole family tends to eat together).	scale scores.	often, but consumed juice more often ($p = 0.024$) than children without regular family mealtimes. Children sharing a regular family dinner had fewer unhealthy habits than those with no regular family meal ($p = 0.002$).
Hannon et al 2003[46]	282 family food preparers (FFP) with children aged 5−17 years were recruited from religious organisations in Seattle. Baseline information was collected from an intervention study.	The FFP completed a self-administered food frequency questionnaire on the consumption of high-fat foods, fruit and vegetables for themselves, their spouses and children. The FFP also completed a food fat-and-fibre diet behaviour questionnaire (FFB). This included 36 items assessing fat and fibre intake over the previous 3 months.	The FFP completed a self-administered questionnaire, including an item on the number of meals per week over the past month they shared with their child(ren).	*Confounders adjusted for* Demographic variables, race, gender, education, employment status and income. *Limitations* Family members did not report their own eating habits. Global ratings of intakes may not be accurate. The adolescent sample was small ($n = 50$).	For children aged 5−12 years the association of FFP fruit and vegetable intake with child fruit and vegetable intake increased as the number of shared meals increased ($p < 0.05$). The association of FFP fruit and vegetable intake with adolescent (aged 13−17 years) intake was strongest when up to 2 meals per day were shared.
Neumark-Sztainer et al 2003[47]	4746 adolescents aged 11−18 years, from 31 public middle and high schools from urban and suburban school districts in the St Paul / Minneapolis area of Minnesota.	Dietary intake was assessed with the 149-item Youth and Adolescent Food Frequency Questionnaire. Dietary outcomes included servings of fruits, vegetables, grains, calcium-rich foods, snack foods and soft drinks. Nutrients assessed included energy, total fat, saturated fat, carbohydrate, protein, calcium, iron, vitamin A, vitamin C, vitamin E, vitamin	Frequency of family meals was assessed with the following question: "During the last 7 days, how many times did all, or most, of your family living in your house eat a meal together?"	*Confounders adjusted for* Sex, school level, race, mother's employment status, socio-economic status, and energy intake. *Limitations* Under-reporting was evident.	There were positive associations between frequency of family meals and fruit ($p < 0.001$), vegetable ($p < 0.001$), grain ($p = 0.002$) and calcium-rich food consumption ($p < 0.001$), and a negative association with soft-drink ($p < 0.001$) consumption. After controlling for energy intake, the association between family meals and grains was no longer significant, whereas there was a significant negative

		B_6, folate and fibre.			association between snack food intake and family meal frequency. Positive associations were also seen between frequency of family meals and energy, protein, calcium, iron, folate and vitamins A, C, E and B_6. Intake.
Videon & Manning 2003[43]	18,177 adolescents in grades 7 through 12 were recruited from schools in the US as part of the National Longitudinal Study of Adolescent Health. Baseline data were presented in this paper.	Adolescent food consumption was assessed by a questionnaire, including questions on usual breakfast intake, and fruit, vegetable and dairy intake on the previous day.	Adolescents completed a questionnaire, including the number of times at least 1 parent was present when they ate their evening meal in the past 7 days.	*Confounders adjusted for* Body weight perception and socio-demographic characteristics. *Limitations* Outcomes included at least the presence of 1 parent during the evening meal, not necessarily all family members.	Compared to children who consumed 3 or fewer family meals per week, children who consumed 6 or 7 family meals per week, skipped meals less often (OR 0.48; 95% CI: 0.42−0.55) and were less likely not to eat 2 plus vegetable (OR 0.62; 95% CI: 0.55−0.69), fruit (OR 0.69; 95% CI: 0.61−0.77) or dairy (OR 0.73; 95% CI: 0.66−0.81) ($p < 0.001$).
Sweeting & West 2005[50]	2146 children aged 11 years, and their parents, from schools in the west of Scotland. Participants were recruits of a longitudinal study: The West of Scotland 11−16 Study: Teenage Health.	A healthy eating index was completed by children, including items on usual type of milk consumed, and frequency of cheese, chips and processed meats consumption. A fat score was obtained from this. A fibre score was obtained from usual type of bread consumed, and consumption of cereals, fruit and vegetables. Respondents with a fat score greater or equal to their fibre score were categorised as "less healthy eaters". Children were also asked if they had eaten a variety of snack foods (sweets or chocolate, biscuits or cake,	Parents completed a self-administered questionnaire, including questions on frequency of family meals.	*Confounders adjusted for* Maternal employment, family structure, area deprivation category, maternal qualifications and gender. *Limitations* Data analysed were 10 years old. The healthy index omitted many current foods and was not validated against actual intake.	Daily family meals was not associated with "less healthy eating", OR 0.98 (95% CI: 0.81−1.20) or "unhealthy snacking", OR 0.94 (95% CI: 0.75−1.17).

		crisps and fizzy drinks) the day before they completed the survey.			
Larson et al 2006[48]	4079 adolescents aged 11−18 years were recruited from 31 junior and senior high schools in the St Paul / Minneapolis area of Minnesota.	A 149-item validated Youth Adolescent Food Frequency Questionnaire was used to assess energy and calcium intakes, servings of dairy, milk and soft drinks.	Each adolescent completed a self-administered questionnaire, including questions on parental presence at meals.	*Confounders adjusted for* Race, grade level, weight status, caloric intake, and socio-environmental, personal and behavioural factors. *Limitations* An FFQ may not be appropriate for all ethnic groups	Parental presence at meals was significantly positively correlated with calcium, milk and dairy intake. However, parental presence at meals did not significantly predict calcium intakes.
Fitzpatrick et al 2007[40]	1336 child−parent pairs were recruited from families participating in the Nutrition Program for Women, Infants, and Children in New York state. Children age ranged from 1.0−4.9 years.	The child's parent/guardian reported the frequencies with which they served milk, fruits and vegetables with specific meals and snacks in a self-administered questionnaire.	The child's parent/ guardian completed a questionnaire reporting the number of times during the previous week the family ate dinner together.	*Confounders adjusted for* Race/ethnicity and parental education.	Servings of fruit ($p = 0.002$), vegetables ($p = 0.001$) and milk ($p = 0.03$) were positively associated with number of nights family ate together.

Appendix B. Studies investigating the relationship between TV watching during mealtimes and food habits and behaviours

Author, year (reference)	Study sample	Assessment of dietary intake	Assessment of TV watching during mealtimes	Confounders adjusted for / limitations	Main outcomes
Cross-sectional studies					
Coon et al 2001[53]	91 child−parent pairs from suburbs adjacent to Washington, DC. Mean age of children was 10 years.	Three 24-hour recalls assessed children's intake. One interview was performed in the child's home and the remaining 2 were conducted by telephone. Dietary outcomes included energy intake, % energy from carbohydrate, total fat and saturated fat, dietary fibre, cholesterol, sodium, caffeine, calcium, vitamin A, vitamin C, folate and 15 food groups.	In a face-to-face interview in the family home, parents were asked whether the TV was on or off in the presence of children while they ate meals.	*Confounders adjusted for* Child's age, sex, race, number of years the mother was in school, the number of hours per week the mother worked for pay, 2-parent households, family income, parents' score on nutrition knowledge, attitudes and norms scale, and number of nights per week the parents prepared quick suppers. *Limitations* The sample was not randomly selected, and recruitment was based on self-selection.	Multiple regression analysis revealed a positive association between presence of TV during meals and children's consumption of red meat ($p < 0.05$), pizza, salty snacks, and sodas ($p < 0.01$). There was a negative association between presence of TV during meals and children's consumption of fruit and vegetables ($p < 0.01$). There was also a positive association between TV viewing during meals and caffeine intake ($p < 0.01$). A higher presence of TV during meals was associated with a lower % of energy from carbohydrate.
Boutelle et al 2003[52]	A convenience sample of 277 parents, with at least 1 adolescent, was recruited through 4 schools in the Minneapolis / St	Adult fruit and vegetable consumption was assessed using the Block Fruit Screener. Fat intake was assessed using the Block Fat Screener. These screeners rank participants along a continuum of fruit, vegetable and fat consumption.	Adults completed a telephone survey, including 3 questions on TV mealtime behaviour. A TV score was calculated based on how often TV is on during dinner, adults	*Confounders adjusted for* Socio-economic variables. *Limitations* Low participation rate of 20%. Not a random sample. Only adult dietary intake was assessed.	A higher TV score was negatively associated with adult fruit and vegetable consumption ($p = 0.02$). There was an insignificant trend suggesting more TV watching is associated with fat intake ($p = 0.07$).

	Paul, Minnesota, metropolitan area.		wanting the TV on during mealtimes, and children wanting the TV on during mealtimes. Higher scores on the TV scale indicate that the family frequently watches TV during mealtimes.		
Campbell et al 2006[15]	560 families with children aged 5−6 years, from 3 distinct socio-economic districts in Melbourne, Australia.	A 56-item food frequency questionnaire was completed by parents on their child's behalf. Dietary outcomes included energy intake; and vegetable, savoury snack, sweet snack, and high-energy drink consumption.	Parents completed a 59-item self-administered food environment questionnaire, including questions on meal interruptions (e.g. how often the TV is on during the evening meal).	*Confounders adjusted for* Maternal education, clustering by school, perception of adequacy of diet, parenting styles, food availability, confidence in cooking, cost and preference for fruit and vegetables, and maternal education. *Limitations* Response rate varied according to socio-economic status (49% high, 26% middle and 29% low).	TV viewing during meals was negatively associated with energy intake ($p = 0.014$) only.
Fitzpatrick et al 2007[40]	1336 child−parent pairs were recruited from families participating in the Nutrition Program for Women, Infants, and Children in	The child's parent/guardian reported the frequencies with which they served milk, fruits and vegetables with specific meals and snacks in a self-administered questionnaire.	The child's parent/guardian completed a questionnaire reporting the number of times during the previous week the family ate dinner together and the number of days the	*Confounders adjusted for* Race/ethnicity and parental education.	Serves of fruit ($p = 0.05$) and vegetables ($p = 0.006$), but not milk, were negatively associated with the number of nights per week that TV was on during dinner.

	New York state. Children's ages ranged from 1.0 to 4.9 years (mean: 2.8 years).		TV was on during dinner.		
Kremers et al 2007[54]	383 adolescents aged 12−16 years, from 5 Dutch secondary schools in Nijemgen.	Each adolescent completed a self-administered questionnaire, including 2 questions on sugar-sweetened drinks (number of days consumed per week and amount consumed).	Each adolescent completed a self-administered questionnaire, including 6 items on screen viewing and 2 items on perceived parental norms regarding screen-viewing. A questionnaire including 12 items was also completed, assessing strength of habit of screen-viewing behaviour and sugar-sweetened beverage consumption.	*Confounders adjusted for* Gender and age.	Habit strength of screen-viewing was the strongest correlate of habitual sugar-sweetened beverage consumption ($p < 0.001$). Perceived parental norms regarding screen viewing were associated with adolescent consumption of sugar-sweetened beverages ($p < 0.05$). Screen-viewing behaviour was the strongest correlate of sugar-sweetened beverage consumption ($p < 0.001$).

Appendix C. Studies investigating the association between parental modelling and food habits and behaviours among children

Author, year (reference)	Study sample	Assessment of dietary intake	Assessment of parental modelling	Confounders adjusted for / limitations	Main outcomes
Cross-sectional studies					
Gibson et al 1998[61]	92 children aged 9−11 years, and their mothers, from 5 primary care registers within south London.	Children completed a 3-day food diary. Mothers completed a 130-item food frequency questionnaire based on average consumption in the last year. Dietary outcomes included fruit, vegetable, and confectionery intake.	Comparison of child and mother intake.	*Confounders adjusted for* Mother's nutritional knowledge, mother's attitude to fruit, vegetables and cancer risk, child liking for common vegetables, mother's liking of confectionery, child concern for health. *Limitations* Not a random sample. Two differing methods of dietary assessment were used to assess the dietary intake of children and parents.	Mothers reporting eating fruit most frequently tended to have children with high fruit consumption ($p < 0.001$). However, there was no relationship for vegetable or confectionery intake.
De Bourdeaudhuij & Van Oost 2000[49]	A random sample of 104 parent−children dyads (total = 208) was recruited from Ghent, Belgium. The sample consisted of 2-parent families with at least 2 adolescents aged 12−18 years.	Each participant completed a modified 56-item food frequency questionnaire validated in the Netherlands for the Flemish population. Dietary outcomes included intake of fat, fruit, vegetables, soft drinks and snacks, and diet quality.	Each participant completed a questionnaire, including questions assessing the dietary behaviour of family members.	*Confounders adjusted for* Personal determinants, interactions around food in the family, general family characteristics. *Limitations* A moderate response rate of 47.8%. The majority of respondents were middle-class, which may limit generalisability of the results. Only the breakfast meal was investigated.	Higher levels of family food modelling were associated with lower perceived intakes of fat ($p < 0.001$), and higher intakes of fruit and snacks ($p < 0.05$) among adolescents.
Fisher et al	197 girls aged 5	Mothers' typical energy	Comparison of	*Confounders adjusted for*	Daughters' intake of milk and soft

2000[58]	years, and their mothers, were recruited from several counties in Pennsylvania.	intake, calcium, milk and sweetened beverages were measured using a quantitative food frequency questionnaire on intake over the last 3 months. Children's energy, calcium, milk and soft-drink intakes were measured using 3 x 24-hour recalls, with mothers acting as the primary source of information in the presence of their daughters.	mothers' intake with that of their daughters.	Mother−daughter similarities in energy intake; influences of energy intake on calcium, milk and soft-drink intakes. *Limitations* Two different forms of dietary assessment were used to measure intake of daughters and mothers. The results may not be able to be extrapolated to boys.	drink was directly influenced by their mothers' intake of those beverages ($p < 0.01$). Mothers with more frequent intakes of soft drink had daughters with more frequent intakes of soft-drink beverages ($p < 0.01$). Mothers' milk intake had a positive influence on their daughters' milk intake ($p < 0.01$). Mothers who consumed milk more frequently tended to have daughters who consumed soft drinks less frequently ($p < 0.01$). Mothers and daughters who drank more milk and fewer soft drinks tended to have higher calcium intakes ($p < 0.01$).
Johnson et al 2001[63]	1303 children aged 5−17 years, and their mothers, from the 1994/95 USDA Continuing Survey of Food Intakes by Individuals (CSFII).	Each child completed 2 x 24-hour recalls administered by trained interviewers. Dietary outcomes included the amount and type of milk consumed.	Mothers' milk consumption patterns were compared to the intake of children.	*Confounders adjusted for* Covariates including race, gender, school lunch, school breakfast, mothers' education, age, type of milk consumed and region.	Maternal milk intake was significantly and positively related to the amount of milk consumed by children ($p < 0.001$).
Tibbs et al 2001[69]	456 African-American parents were recruited as part of the High 5, Low Fat intervention study. These were baseline data from the intervention study.	Parents completed a modified Block short form, telephone-administered food frequency questionnaire. Parents also completed an 18-item questionnaire assessing low-fat eating behaviours. Dietary outcomes included low-fat eating patterns, % energy from fat and fruit and vegetable intake.	Parents completed a 6-item parental dietary modelling scale which assessed the frequency with which parents model dietary behaviours to their children.	*Confounders adjusted for* Covariates including age and income. *Limitations* Results not likely to be generalisable beyond African-American populations.	Multiple regression analysis indicated that parental dietary modelling was independently associated with a reduction in fat intake ($p < 0.0001$), low fat eating patterns ($p < 0.05$) and increased fruit and vegetable consumption ($p = 0.003$).

Fisher et al 2002[59]	191 non-Hispanic white families with girls aged 5 years, from central Pennsylvania. Cross-sectional data from a longitudinal study.	Children's fruit and vegetable, micronutrient, and energy intakes were assessed using 3 x 24-hour recalls conducted with mothers in the presence of their daughters. Parents' typical fruit and vegetable intake was assessed by a food frequency questionnaire on intake over the previous 3 months.	Comparison of parental and child intake.	*Confounders adjusted for* Girls' energy intakes. *Limitations* The sample was exclusively non-Hispanic, white, 2-parent families and so generalisability of results may be limited. Two differing methods of dietary assessment were used to assess the dietary intake of children and parents.	Parents who consumed more fruit and vegetables had daughters who consumed more fruit and vegetables ($p < 0.05$).
Cooke et al 2003[44]	564 parents or principal caregivers of children aged 2−6 years, from 22 North London nursery schools.	The frequency of fruit and vegetable consumption by both parent and child was assessed by asking parents how often they and their child ate 6 different food items, including fruit (fresh and tinned) and vegetables (including salad but not potatoes).	Comparison of parent and child intake.	*Confounders adjusted for* Sex, age, ethnicity, parents' education level, food environment, child neophobia and enjoyment of food. *Limitations* A modest response rate of 64%. The respondents were predominantly white, middle-class and highly educated, which may limit extrapolation to other groups.	Children's fruit and vegetable intake was most strongly predicted by parental intake ($p < 0.0001$).
Galloway et al 2003[60]	192 girls aged 7 years, and their parents, from 5 counties in central Pennsylvania.	Mothers completed 3 x 24-hour recalls on their daughters' intake in the presence of the child. A food frequency questionnaire to measure parental vegetable intake was completed by parents. Dietary outcomes included food neophobia, pickiness and vegetable intake.	Comparison of parental vegetable intake and neophobia and that of their child.	*Confounders adjusted for* None *Limitations* Two differing methods of dietary assessment were used to assess the dietary intake of children and parents.	Mothers' food neophobia scores were positively associated with daughters' neophobia scores ($p < 0.01$). Mothers reporting low vegetable variety were more likely to have girls who were picky eaters ($p < 0.05$). Picky girls were less likely to eat vegetables ($p < 0.05$). Mothers' vegetable variety was associated with daughters' vegetable intake

					($p < 0.05$).
Hannon et al 2003[46]	282 family food preparers (FFPs) with children aged 5−17 years were recruited from religious organisations in Seattle. Baseline cross-sectional data from an intervention study.	The FFP completed a self-administered food frequency questionnaire on consumption of high-fat foods, fruit and vegetables for themselves, their spouses and children. The FFP also completed a food fat-and-fibre diet behaviour questionnaire (FFB). This included 36 items assessing fat and fibre intake over the previous 3 months.	FFP intake was compared with family intake.	*Confounders adjusted for* Demographic variables, race, gender, education, employment status and income. *Limitations* Family members did not report their own eating habits. Global ratings of intakes may not be accurate. Adolescent sample was small (n = 50).	FFP fruit and vegetable intake predicted family members' fruit and vegetable intake ($p < 0.01$). FFP consumption of high-fat foods predicted family members' fat intake ($p < 0.01$). This relationship was stronger for younger children than for adolescents.
Bere & Klepp 2004[55]	1950 children, mean age 11.8 years, and 1647 of their parents, from 38 schools in Hedmark and Telemark counties in Norway. Cross-sectional data from an intervention study.	Fruit and vegetable intake was measured by 4 frequency items in a self-administered questionnaire completed by children and parents.	Children completed a self-administered questionnaire, including a modelling scale assessing perceived behaviour of important others (e.g. "my mother eats lots of fruit and vegetables"). Parental and child dietary intakes were compared.	*Confounders adjusted for* Parent and children scales of intent, availability, preferences, self-efficacy, and awareness. *Limitations* Children whose parents did not participate differed from children with participating parents with regard to demographic variables, health-related behaviours and fruit and vegetable intake measures. Perceived modelling, as opposed to actual modelling, was assessed.	Perceived modelling was positively associated with children's fruit and vegetable intake ($p = 0.03$). Parental intake was positively associated with children's fruit and vegetable intake ($p < 0.01$).
Brown & Ogden 2004[56]	112 children aged 9−13, and 1 of their parents, were recruited from 3	Children and parents completed a food frequency questionnaire assessing snack food	Parents and children's reported snack food intake and motivations for eating	*Confounders adjusted for* Not stated. *Limitations*	There were significant associations between general healthy food intake ($p = 0.01$), general unhealthy food intake

	schools in southern England.	intake “yesterday” and “in general”. Scores of healthy and unhealthy snack foods were calculated.	were compared.	Both children and adults in the study had BMIs within the healthy range, so results may not be applicable to overweight populations.	(p = 0.001), and unhealthy food intake yesterday (p = 0.01) between parent and child.
Grimm et al 2004[71]	560 children aged 8−13 years completed a survey in an educational publication for children, produced by Miami University. The magazine was distributed to elementary and middle schools across the US.	Children were asked how often they drank soft drinks and what type they consumed (e.g. diet vs regular).	Children were asked whether their parents consumed soft drinks on a regular basis (3 or more times per week).	*Confounders adjusted for* Age, sex, taste preference for soda, soda availability in home, television viewing, friends’ soda intake, soda availability in school, taste preference for milk and taste preference for water. *Limitations* There was limited demographic information about the children (e.g. no information on socio-economic status or ethnicity).	Children with parents who regularly drank soft drinks were 2.88 (95% CI: 1.76−4.72) times more likely to drink the beverage 5 or more times per week compared to children whose parents did not regularly consume soft drinks.
Keski-Rahkonen et al 2004[65]	5250 twins aged 16 years, and their parents (n = 4663), from 5 consecutive birth cohorts of Finnish twins born between 1975 and 1979. Cross-sectional data from a cohort study.	Self-administered questionnaires were completed by children and parents when the twins were aged 16 years. Dietary outcome was breakfast eating.	Comparison of child and parental breakfast eating habits.	*Confounders adjusted for* Sex of adolescents and sex and age of adults. *Limitations* Results may not be applicable to non-twin populations.	Parental breakfast eating was strongly correlated to twin breakfast eating. The overall mother−daughter breakfast eating correlation was 0.30 (95% CI: 0.25−0.36); mother−son correlation was 0.35 (95% CI: 0.29−0.41), father−daughter correlation was 0.27 (95% CI: 0.21−0.33); and father−son correlation was 0.29 (95% CI: 0.23−0.35).
Vereecken et al 2004[67]	316 mothers of children aged 2.5−7 years, from 8 kindergartens in Ieper, Belgium.	Mothers were asked to assess their children’s usual consumption of fruit, vegetables, candy and soft drink using a short 4-item	Comparing intake of children with their mother. Parents completed a questionnaire	*Confounders adjusted for* Mothers’ education, modelling and various parenting styles. *Limitations*	Parents’ restraint from negative modelling correlated positively with the consumption of fruit (p < 0.01) and negatively with soft-drink intake (p < 0.001).

		food frequency questionnaire (FFQ). Mothers' intake was assessed using the same FFQ.	assessing negative modelling.	A moderate response rate of 64%. Crude measure of mothers' intake as no serving size was collected.	Mothers' consumption of fruit, vegetable, sweet and soft-drink ($p < 0.001$) intake correlated with children's intake of these foods.
Young et al 2004[72]	366 children aged 12−16 years, 3 middle schools in 2 northeast Georgia counties.	Children completed a questionnaire containing 2 items for fruit consumption and 4 items for vegetable consumption.	Perceived parental modelling was assessed by 12 items in a self-administered questionnaire.	*Confounders adjusted for* Gender, grade, socio-economic status, school, and ethnicity. *Limitations* Modest response rate of 59%. Perceived modelling rather than actual modelling was assessed.	Parental modelling was a significant predictor of fruit and vegetable intake among children ($p = 0.005$).
Hanson et al 2005[62]	902 adolescents and a parent/guardian, from public middle and high schools in the Minneapolis / St Paul and Osseo districts in Minnesota.	Adolescents completed a 149-item semi-quantitative Youth Adolescent Food Frequency Questionnaire administered by trained staff. Parents completed a semi-quantitative food questionnaire on fruits, vegetables and dairy foods consumed over the previous week, administered by telephone interviews. Dietary outcomes included fruit, vegetable, milk and soft-drink intake.	Adolescent consumption of fruit, vegetable and dairy foods was compared to parental intake.	*Confounders adjusted for* School level, parent socio-economic status, parent gender and race/ethnicity. *Limitations* Low response rate from lower socio-economic groups.	For girls, fruit, vegetable ($p < 0.01$) and dairy foods ($p = 0.01$) intake was associated with parental intake. For boys, only dairy foods intake was associated with parental intake ($p = 0.04$).
Vereecken et al 2005[73]	207 children aged 11−12 years, from 3 primary schools in Flanders.	Fruit and vegetable consumption was measured by 2 items in a self-administered questionnaire completed by each child.	A self-administered questionnaire completed by each child, including 2 items on perceived parental eating	*Confounders adjusted for* Not stated. *Limitations* No direct measure of parental intake.	Perceived parental intake of fruit and vegetables was positively associated with fruit and vegetable consumption of children ($p < 0.001$).

			behaviour with regard to fruit and vegetables.		
Wardle et al 2005[68]	564 parents of children aged 2−6 years, from 22 London nursery schools.	The frequency of fruit and vegetable intake of both child and parent was measured using validated questionnaires completed by parents.	Comparison of child and parent consumption.	*Confounders adjusted for* Sex, age of child, and socio-economic deprivation score. *Limitations* A modest response rate of 64%.	Children's fruit and vegetable consumption was positively associated with parental consumption ($p < 0.001$).
Campbell et al 2006[15]	560 families with children aged 5−6 years, from 3 distinct socio-economic districts in Melbourne, Australia.	A 56-item food frequency questionnaire was completed by parents on their child's behalf. Dietary outcomes included energy intake, high-energy (non-dairy) fluids, sweet snacks, savoury snacks, and vegetable consumption.	Parents completed a 59-item self-administered food environment questionnaire, including questions on modelling of eating.	*Confounders adjusted for* Maternal education, clustering by school, perception of adequacy of diet, parenting styles, food availability, confidence in cooking, cost and preference for fruit and vegetables, mealtime interruptions, TV viewing. *Limitations* Response rate varied by socio-economic area: 49%, 26% and 29% in high, middle and low, respectively.	Parental modelling was significantly and positively associated with daily vegetable intake only ($p = 0.003$).
Matheson et al 2006[74]	108 Mexican-American children aged 9−13 years, and their mothers, from 8 schools participating in an obesity prevention trial.	Three 24-hour recalls were conducted with children as the primary respondents. One was collected in a face-to-face interview and 2 were conducted over the telephone. Dietary outcomes included fruit, vegetable, sweets and snack consumption, and % energy from fat and energy density.	Mothers' attitudes to modelling healthful foods was measured by 4 items in a questionnaire completed via face-to-face interviews.	*Confounders adjusted for* None. *Limitations* Attitudes to modelling, rather than actual modelling, were measured. Results may only be applicable to Mexican-American families.	Mothers' attitudes to modelling healthful food behaviours were negatively associated with the energy density of foods consumed by children ($p < 0.05$).

Wind et al 2006[76]	2468 children, mean age 11.6 years, were recruited from 98 schools in Belgium and the Netherlands.	Fruit and vegetable intake was assessed by 1 and 3 food frequency questions, respectively.	A self-administered questionnaire was completed by children, which included questions on the modelling behaviour of their parents.	*Confounders adjusted for* Sex, physical environment and social environment, personal factors.	Children reporting eating fruit more frequently perceived their parents eating fruit every day, and those eating more vegetables perceived more modelling behaviour of their parents. Modelling was positively related to fruit and vegetable consumption in children ($p < 0.001$).
Campbell et al 2007[57]	347 adolescents aged 12−13 years, and their parents, were recruited from participants of the longitudinal Nepean Study (a birth cohort born between August 1989 and April 1990 at Nepean Hospital), Penrith, in Western Sydney, Australia.	Each adolescent completed a 56-item food frequency questionnaire. Both parents completed their own separate food frequency questionnaire. Dietary outcomes included high-energy drinks, sweet snacks, savoury snacks, and take-out food.	Comparison of parent and child intake.	*Confounders adjusted for* All other independent variables, maternal education, and sex. *Limitations* One-half of mothers in the group had a low education level and so results may be less applicable to families with mothers with higher education levels.	Mothers' consumption of sweet and savoury snacks was positively associated with boys' sweet snack ($p = 0.01$) and savoury snack ($p = 0.008$) consumption. Mothers' consumption of take-out food was positively associated with boys' consumption of take-out food ($p = 0.0007$). Mothers' consumption of high-energy foods was associated with high-energy drink consumption in boys ($p = 0.003$) and girls ($p = 0.025$).
Reinaerts et al 2007[66]	A convenience sample of 1739 parents of children aged 4−12 years was recruited from a larger longitudinal study. The sample was recruited from 49 primary schools in the southern part of the Netherlands.	Fruit and vegetable intake of children was determined by a food frequency questionnaire completed by parents. Parental fruit and vegetable intake was assessed by a validated 10-item food frequency questionnaire.	A self-administered questionnaire was completed by parents, including questions on modelling behaviour. Fruit and vegetable intake of parents was compared to fruit and vegetable intake of children.	*Confounders adjusted for* Demographic variables: child's sex, age, ethnicity, BMI, siblings (yes/no), and parents' age, marital status, and education level.	Modelling by mothers and fathers was positively associated with children's fruit intake ($p < 0.001$), and modelling by mothers only was positively associated with vegetable intake ($p < 0.01$). Fruit and vegetable intake of children was positively associated with parental consumption ($p < 0.01$).
Longitudinal studies					
Keski-Rahkonen et al 2003[64]	A cohort of 5448 boys and girls from 5	Self-administered questionnaires were	Comparison of child and parental breakfast	*Confounders adjusted for* Sex of children and adults and	Parental breakfast eating was positively significantly associated

	consecutive birth cohorts of Finnish twins born between 1975 and 1979, aged 16 years, and their parents (n = 4660).	completed by children and parents when the twins were aged 16, 17 and 18.5 years, including questions on breakfast eating (e.g. how often breakfast is eaten).	eating habits.	age of parents. *Limitations* Results may not be applicable to non-twin populations.	with adolescent breakfast eating ($p < 0.001$).
Intervention studies					
Author, date (reference)	**Study sample**	**Intervention**	**Measurement of food intake and modelling**	**Confounders adjusted for / limitations**	**Main outcomes**
Talvia et al 2006[75]	1062 infants were recruited by nurses at well-baby clinics in Turku, Finland. Children were followed from 7 months until 11 years of age.	The intervention families received nutritional counselling aimed at reducing cardiovascular risk factors, especially saturated fat, at 1- to 3-month intervals until the child was 2 years old and biannually thereafter. Counselling was mainly given to parents until the child reached 7 years of age, after which separate sessions were organised for the child and the parents.	Food records on 4 consecutive days were collected from children at 6-month intervals up to 7 years, after which records were collected at yearly intervals. Parents' food consumption was obtained from food records on 1 day close to the child's birthday. For correlation analysis, each child's consumption was calculated based on 2 x 4-day food records collected at 9 and 11 years, and parents' consumption was based on 2 x 1-day food records.	*Confounders adjusted for* Gender, age. *Limitations* Only having 1-day food records for adult intake may not reflect usual intake.	The percentage of energy from fruit and vegetables was higher in the intervention girls ($p < 0.04$) and boys ($p < 0.001$) than in control girls and boys. The intervention children consumed more vegetables than the control children ($p < 0.001$). Fruit consumption was higher in intervention boys ($p < 0.001$), but not girls. Mothers' fruit and vegetable consumption correlated with the consumption of their daughters and sons, whereas fathers' consumption correlated only with their sons.

Appendix D. Studies investigating the relationship between parental support and food habits and behaviours among children

Paper	Participants	Assessment of dietary intake	Assessment of parental support	Confounders adjusted for / limitations	Main outcomes
Cross-sectional studies					
Young et al 2004[72]	366 children aged 12−16 years, from 3 middle schools in 2 northeast Georgia counties.	Children completed a questionnaire containing 2 items on fruit consumption and 4 items on vegetable consumption.	Perceived parental support was assessed using a 7-item encouragement scale.	*Confounders adjusted for* Gender, grade, socio-economic status, school, and ethnicity. *Limitations* A modest response rate of 59%.	Perceived parental support was not a significant predictor of fruit and vegetable intake.
Larson et al 2006[48]	4079 adolescents aged 11−18 years from 31 junior and senior high schools in the St Paul / Minneapolis area of Minnesota.	A 149-item validated Youth Adolescent Food Frequency Questionnaire was used to assess energy and calcium intakes, servings of dairy and milk.	Each adolescent completed self-administered questionnaires, including 4 items on parental support (e.g. my mother/father encourages me to eat healthy food).	*Confounders adjusted for* Race, grade level, weight status and caloric intake, and covariates including socio-economic, personal and behavioural factors. *Limitations* An FFQ may not be appropriate for all ethnic groups	Parental support was positively associated with calcium intakes in boys ($p = 0.033$), but not girls.
Wind et al 2006[76]	2468 children, mean age 11.6 years, from 98 schools in Belgium and the Netherlands.	Fruit and vegetable intake was assessed by 1 and 3 food frequency questions respectively.	Perceived parental encouragement and facilitation were measured by a self-administered questionnaire.	*Confounders adjusted for* Sex, physical environment and social environment, personal factors.	Parental facilitation was positively associated with fruit ($p = 0.03$) and vegetable intake ($p < 0.001$). Parental encouragement was not associated with fruit and vegetable intake.
Zabinski 2006[78]	878 adolescents aged 11−15 years, and 1 parent each, from 6 clinics in San Diego County.	Each adolescent completed 3 x 24-hour recalls: 1 by interview and 2 by telephone.	Parents completed a self-administered questionnaire with 13 items assessing healthy parental	*Confounders adjusted for* Sex- and age-specific analyses; other covariates including child strategies, rules and perception of pros.	Family support was positively associated with fruit and vegetable intake ($p < 0.01$) but not dietary fat intake.

		Dietary outcomes included servings of fruit and vegetables and percent energy from fat.	lifestyle strategies (e.g. what parents have done to help their children lead a healthful lifestyle).	*Limitations* Generalisability of the results may be limited as the samples were recruited from healthcare provider offices.	

Appendix E. Studies investigating the relationship between family interaction and food habits and behaviours among families

Author, date (reference)	Study sample	Assessment of dietary intake	Assessment of family interaction	Confounders adjusted for / limitations	Main outcomes
Cross-sectional studies					
Neumark-Sztainer et al 1996[79]	36,284 adolescents attending grades 7−12, in Minnesota public secondary schools, were recruited as part of the Minnesota Adolescent Health Survey.	Each participant completed a 10-item food frequency questionnaire, including 2 items assessing fruit and vegetable intake.	Each participant completed a self-administered questionnaire, including 6 items assessing family connectiveness. This included questions on assessing perceptions of family and parent care, understanding, and attention adolescents receive from their family.	*Confounders adjusted for* Socio-economic status, race, gender, age and BMI.	Children from families with low connectiveness were more than twice as likely to have an inadequate fruit and vegetable intake compared to those from families with high connectiveness ($p < 0.0001$); 19.4% of adolescents from families with high connectiveness reported an inadequate intake of fruit compared to 39% of adolescents from families with very low connectiveness ($p < 0.00001$); and 27.6% of adolescents from families with high connectiveness reported an inadequate intake of fruit compared to 49% of adolescents from families with very low connectiveness ($p < 0.00001$).
De Bourdeaudhuij & Van Oost 2000[49]	A random sample of 104 parent−children dyads (total = 208) from Ghent, a medium-sized town in Belgium. The sample consisted of 2-parent families with at least 2 adolescents aged	Each participant completed a modified 56-item food frequency questionnaire validated in the Netherlands for the Flemish population. Dietary outcomes included intake of fat, fruit, vegetables, soft drinks and snacks, and diet quality.	Participants completed a questionnaire measuring interactions around food in families, including 3 items on communication.	*Confounders adjusted for* Personal determinants, interactions around food in family, general family characteristics. *Limitations* A low-to-moderate response rate of 47.8%. Results may be more applicable to middle-class families.	Family cohesion and positive parent−child interactions were positively related with food score ($p < 0.05$). More family cohesion was associated with a general healthy food score in parents ($p < 0.05$). More positive family interactions were related to a higher perceived vegetable consumption in adolescents ($p < 0.01$).

	12−18 years.				
Boutelle et al 2003[52]	A convenience sample of 277 parents with at least 1 child were recruited through 4 schools in the Minneapolis / St Paul, Minnesota, metropolitan area.	Adult fruit and vegetable consumption was assessed using the Block Fruit and Vegetable Screener, and fat intake was assessed using the Block Fat Screener. These screeners rank participants along a continuum of fruit, vegetable and fat consumption.	Adults completed a self-administered questionnaire, including a question on arguments during family dinner.	*Confounders adjusted for* Socio-economic variables. *Limitations* Low participation rate of 20%. Not a random sample. Dietary data for adults only.	Arguments about eating during mealtimes were positively associated with fat intake ($p < 0.01$), but were unrelated to fruit and vegetable consumption.
Campbell et al 2007[57]	347 adolescents aged 12−13 years, and their parents, were recruited from participants of the longitudinal Nepean Study (a birth cohort born between August 1989 and April 1990 at Nepean Hospital), Penrith, in Western Sydney, Australia.	Adolescents completed a 56-item food frequency questionnaire. Both parents completed a food frequency questionnaire. Dietary outcomes included sweet and savoury snacks, high-energy fluids and take-out foods.	Adolescents completed a self-administered questionnaire, including items on family functioning (e.g. family satisfaction, conflict, criticism).	*Confounders adjusted for* Maternal education and all independent variables, including parenting style, availability, parents' consumption of high-energy drinks, sweet and savoury snacks, take-out food, parents' difficulty spending time with child, pressure, kitchen set-up, parental praise, high cost of fruit and vegetables. *Limitations* Results are likely to be less applicable to families with mothers with a high educational level.	Lack of family conflict was negatively associated with sweet snack ($p < 0.001$) and take-out food consumption in girls only ($p = 0.002$). No relationship between family conflict and other dietary outcomes.

Appendix F. Studies investigating the relationship between self-efficacy and food habits and behaviours among children

Author, date (reference)	Study sample	Assessment of dietary intake	Assessment of self-efficacy	Confounders adjusted for / limitations	Main outcomes
Cross-sectional studies					
Reynolds et al 1999[81]	414 3rd-grade children and their parents recruited from participants providing baseline data for the High 5 intervention project.	Each participant completed a 24-hour recall. Dietary outcomes included fruit and vegetable consumption.	Children completed a self-administered questionnaire, including 21 items assessing self-efficacy.	*Confounders adjusted for* Gender-specific analyses. *Limitations* Only one 24-hour recall was used to assess dietary intake.	Self-efficacy (as part of overall motivation) was positively related with fruit and vegetable intake ($p < 0.05$).
De Bourdeaudhuij & Van Oost 2000[49]	A random sample of 104 parent−children dyads (total = 208) from Ghent, a medium-sized town in Belgium. The sample consisted of 2-parent families with at least 2 adolescents aged 12−18 years.	Each participant completed a modified 56-item food frequency questionnaire validated in the Netherlands for the Flemish population. Dietary outcomes included intake of fat, fruit, vegetables, soft drinks, snacks and diet quality.	Participants completed a questionnaire, including items on how easy/difficult they thought it was, and how confident they were to eat less fat, fewer snacks, fewer soft drinks, 2 pieces of fruit and 3 of vegetables per day in certain difficult situations.	*Confounders adjusted for* Personal determinants, interactions around food in family, general family characteristics. *Limitations* A low response rate of 47.8%. Results may be more applicable to middle-class families.	Self-efficacy was positively associated with healthy eating score ($p < 0.001$), fruit ($p < 0,01$), and vegetable intake ($p < 0.01$), and negatively associated with fat ($0.05 < p < 0.1$) and soft-drink intake ($p < 0.01$).
Kratt et al 2000[82]	1196 4th-grade children and their parents, from Alabama, USA. These were baseline data for the High 5 Alabama intervention project.	Children completed a 24-hour recall in a face-to-face interview to assess fruit and vegetable intake.	Parents and children completed a questionnaire, including questions on self-efficacy (e.g. how confident they are about eating fruit, juices, or vegetables at specific meals and snack times). Children were asked about their self-efficacy to ask parents for fruit	*Confounders adjusted for* Parent and child expectations, knowledge and availability. *Limitations* Only 1 x 24-hour recall was used to assess dietary intake.	Where there was low availability of fruit and vegetables, self-efficacy was positively associated with fruit and vegetable intake.

			and vegetables and to participate in fruit and vegetable preparation at home. Parents were also asked about their self-efficacy to serve their child fruit and vegetables.		
Kremers et al 2003[83]	643 adolescents aged 16−17 years, from Dutch schools.	Fruit intake was estimated using a validated 14-item food frequency questionnaire (FFQ). This FFQ was cross-checked with an item in a questionnaire assessing perceived fruit intake.	Adolescents completed a questionnaire including 1 item on self-efficacy: "Do you think you can eat at least 2 pieces of fruit per day when you want or would want to?"	*Confounders adjusted for* Gender, age and religion. *Limitations* 45.5% of participants were found to realistically estimate their own fruit intake, and only these 643 adolescents were used in the analysis. The FFQ may overestimate fruit intake.	Adolescents raised in authoritative homes had higher self-efficacy scores than those raised in indulgent, neglectful or authoritarian homes ($p < 0.01$). Adolescents raised in authoritative homes ate significantly more fruit than adolescents raised with parents with the other 3 parenting styles ($p < 0.01$).
Bere & Klepp 2004[55]	1950 children, mean age 11.8 years, and 1647 of their parents, were recruited from 38 schools in Hedmark and Telemark counties in Norway. Cross-sectional data from an intervention study.	Fruit and vegetable intake was measured by 4 frequency items in a self-administered questionnaire completed by children and parents.	Children completed a self-administered questionnaire, including 4 items assessing self-efficacy with respect to eating 5 servings of fruit and vegetables per day.	*Confounders adjusted for* Parent and children scales of intent, availability, preferences, and awareness. *Limitations* Children whose parents did not participate differed from children with participating parents with regard to demographic variables, health-related behaviours, and fruit and vegetable intake measures.	Self-efficacy was positively associated with fruit and vegetable intake ($p < 0.01$).
Young et al 2004[72]	366 children aged 12−16 years, from 3 middle schools in 2	Children completed a questionnaire containing 2 items for	Children completed a self-administered questionnaire, including	*Confounders adjusted for* Gender, grade, socio-economic status, school,	Self-efficacy was positively associated with fruit and vegetable consumption ($p < 0.0001$).

	northeast Georgia counties.	fruit consumption and 4 items for vegetable consumption.	a 21-item self-efficacy scale.	and ethnicity. *Limitations* Modest response rate of 59%.	
Vereecken et al 2005[73]	207 children aged 11−12 years, from 3 primary schools in Flanders.	Fruit and vegetable consumption was measured by 2 items in a self-administered questionnaire completed by each child.	A self-administered questionnaire was completed by each child, including 11 items on self-efficacy regarding fruit and vegetable intake.	*Confounders adjusted for* Not stated.	Self-efficacy was positively associated with fruit intake ($p < 0.01$).
Larson et al 2006[48]	4079 adolescents aged 11−18 years, from 31 junior and senior high schools in the St Paul / Minneapolis area of Minnesota.	A 149-item validated Youth Adolescent Food Frequency Questionnaire was used to assess energy and calcium intakes, servings of dairy and milk.	Each adolescent completed self-administered questionnaires, including 9 items on self-efficacy to make healthful food choices.	*Confounders adjusted for* Race, grade level, weight status and caloric intake, and covariates including socio-economic, personal and behavioural factors. *Limitations* The FFQ may not be appropriate for all ethnic groups	Self-efficacy was positively associated with calcium intake in girls ($p = 0.004$) but not boys.
Wind et al 2006[76]	2468 children, mean age 11.6 years, from 98 schools in Belgium and the Netherlands.	Fruit and vegetable intake was assessed by 1 and 3 food frequency questions, respectively.	A self-administered questionnaire was completed by children, which included items on self-efficacy to eat fruit and vegetables.	*Confounders adjusted for* Sex, physical environment and social environment, personal factors.	Self-efficacy was positively associated with fruit ($p < 0.001$) and vegetable ($p = 0.01$) intake.
Zabinski et al 2006[78]	878 adolescents aged 11−15 years and 1 parent each, from 6 clinics in San Diego County.	Three 24-hour recalls, 1 by interview and 2 by telephone. Dietary outcomes included servings of fruit and vegetables and percent energy from fat.	Each adolescent completed a self-administered questionnaire assessing self-efficacy, including 7 items on fruit and vegetables and 8 items for dietary fat.	*Confounders adjusted for* Sex- and age-specific analyses; other covariates included child strategies, rules and perception of pros. *Limitations*	Self-efficacy was positively associated with fruit and vegetable intake in older children only ($p < 0.05$). Fat intake was not associated with self-efficacy.

				Generalisability of the results may be limited as the samples were recruited from healthcare provider offices.	
van der Horst et al 2007[84]	383 adolescents, mean age 13.5 years, from Dutch secondary schools. This study was part of the Dutch Obesity Intervention in teenagers.	Adolescents completed a self-administered questionnaire, including 2 items assessing the frequency and quantity of sugar-sweetened beverage intake.	Adolescents completed a self-administered questionnaire, including 2 items assessing self-efficacy.	*Confounders adjusted for* Age, sex, ethnicity, habit strength, attitude and modelling from parents. *Limitations* Schools were not randomly selected. Few children were recruited from ethnic minorities.	Self-efficacy was negatively associated with soft-drink intake ($p < 0.001$).
Reinaerts et al 2007[66]	A convenience sample of 1739 parents of children aged 4−12 years were recruited from a larger longitudinal study. The sample was recruited from 49 primary schools in the southern part of the Netherlands.	Fruit and vegetable intake of children was determined by a food frequency questionnaire completed by parents. Parental fruit and vegetable intake was assessed by a validated 10-item food frequency questionnaire.	Parents completed self-administered questionnaires, including 2 items on self-efficacy (e.g. do you think your child is able to increase his/her vegetable consumption?).	*Confounders adjusted for* Demographic variables: child's sex, age, ethnicity, BMI, siblings (yes/no); and parents' age, marital status, education level; and other covariates, including parental consumption, habit, attitude, preferences, modelling, social influence and intention.	Self-efficacy was positively associated with fruit ($p < 0.001$) and vegetable consumption ($p < 0.01$).
Intervention studies					
Baranowski et al 2000[85]	1253 children were recruited from 16 elementary schools (4 from a major south-eastern metropolitan area and 12 from a south-eastern suburban school	The intervention was based on social cognitive theory and was school-based, with 12 sessions per year. Weekly newsletters taken home to parents, home assignments and family nights were	Children completed a questionnaire including 12 items on their self-efficacy for eating fruit and vegetables.	*Confounders adjusted for* None *Limitations* Self-efficacy was only 1 aspect of the intervention.	At year 3 of the intervention, self-efficacy to consume fruit and vegetables was higher (but not significantly) in the intervention group ($p < 0.1$). At 3 years the intervention group consumed significantly more fruit and vegetables than the control group ($p < 0.05$).

	system). Schools were assigned to treatment and control groups. An annual random sample of 13−16 parents from each school was selected for telephone interviews.	included to involve the family. Dietary outcomes included fruit, juice and vegetable intakes of children, measured by 7-day food records.			
Saksvig et al 2005[86]	122 Native North American children aged 7−14 years were recruited from a school in Ontario.	The study was a single sample design. It combined an ecological model and social cognitive theory approaches. Food high in fat, sugar and energy was targeted. The intervention focused on knowledge and skills development, with cultural adaptations such as story telling. Family components included messages on community radio shows, information booths, at parent−teacher nights, and newsletters. Dietary outcomes included fat, sugar, fibre and energy intake, measured by 24-hour recalls.	Children completed a questionnaire at baseline and at the end of the intervention to assess self-efficacy.	*Confounders adjusted for* Baseline scores *Limitations* Self-efficacy was only 1 aspect of the intervention. Results may not be applicable to other ethnic groups	The percentage of energy from fat at follow-up was reduced compared to baseline. The reduction was only significant in boys ($p < 0.05$). Dietary self-efficacy increased for both boys and girls ($p < 0.05$).

Appendix G. Studies investigating the relationship between work−family spillover and food habits and behaviours among families

Author, date (reference)	Study sample	Assessment of dietary intake	Assessment of work−family conflicts	Confounders adjusted for / limitations	Main outcomes
Cross-sectional studies					
Devine et al 2003[87]	51 low- to moderate-income adults, aged 18−80 years, living in a metropolitan area in upstate New York.	Semi-structured interviews, including questions on food choices in general, with an emphasis on fruit and vegetables.	A grounded theory approach was used, with semi-structured interviews to gain an understanding of the relationships between work and food choices.	*Confounders adjusted for* None *Limitations* There was no direct collection of dietary intake data.	Participants expressed how employment limited the time and energy available for food preparation or shopping, and also time at home and with their families. Participants felt that work spilled over into their ability to make healthful food choices. Most described work as demanding and limiting to their food choices, while some described work as demanding but manageable, and a few described it as unproblematic. Those finding it demanding and limiting used strategies such as skipping meals, eating out, take-out and eating junk food. Those finding it manageable used strategies such as planning and cooking ahead, multiple meals and taking fruit from home.
Neumark-Sztainer et al 2003[47]	4746 adolescents aged 11−18 years, from 31 public middle and high schools from urban and suburban school districts in the St Paul / Minneapolis area of Minnesota.	Dietary intake was assessed with the 149-item Youth and Adolescent Food Frequency Questionnaire. Dietary outcomes included servings of fruit, vegetables, grains, calcium-rich foods, snack foods and soft drinks.	Adolescents completed questionnaires, including 4 items on mothers' employment status.	*Confounders adjusted for* Sex, school level, race, mothers' employment status, socio-economic status, and energy intake. *Limitations* Under-reporting was evident.	The mean weekly frequency of family meals for families with mothers who were not employed (4.9) was greater than those with mothers who worked part time (4.5) or full time (4.2) ($p < 0.001$). There were positive associations between frequency of family meals and fruit ($p < 0.001$), vegetable ($p < 0.001$), grain ($p = 0.002$), and calcium-rich

					food consumption ($p < 0.001$), and a negative association with soft-drink ($p < 0.001$) consumption.
Videon & Manning 2003[43]	18,177 adolescents in grades 7 through 12 were recruited from schools in the US as part of the National Longitudinal Study of Adolescent Health. Baseline data were presented in this paper.	Child food consumption was assessed by a questionnaire, including items on usual breakfast intake, and fruit, vegetable and dairy intake on the previous day.	Adolescents completed a questionnaire, including an item assessing how often a parent was present when they left for, and returned from, school.	*Confounders adjusted for* Body weight perception and socio-demographic characteristics.	The presence of a parent when children left for, or returned from, home was not associated with the adolescent's consumption of vegetables, fruit or dairy.
Sweeting & West 2005[50]	2146 children aged 11 years, and their parents, from schools in the west of Scotland. Participants were recruits from a longitudinal study: The West of Scotland 11−16 Study: Teenage Health.	A healthy eating index was completed by children, including items on the usual type of milk consumed, and the frequency of cheese, chips and processed meats consumption. A fat score was obtained from this. A fibre score was obtained from the usual type of bread consumed, and consumption of cereals, fruit and vegetables. Respondents with a fat score greater or equal to their fibre score were categorised as "less healthy eaters". Children were also asked if they had eaten a variety of snack foods (sweets or chocolate, biscuits or cake, crisps and	Parents completed a self-administered questionnaire, including maternal employment status.	*Confounders adjusted for* Maternal employment, family structure, area deprivation category, maternal qualifications and gender. *Limitations* Data analysed were 10 years old. The healthy index omitted many current foods and was not validated against actual intake.	Less healthy eating was less likely when mothers worked part-time (OR 0.77; 95% CI: 0.62−0.97) compared with full-time homemakers and full-time workers.

		fizzy drinks) the day before they completed the survey.			
Devine et al 2006[17]	Low-waged mothers (35) and fathers (34) aged 25−51 years, working at least 20 hours per week, from a multi-ethnic metropolitan area in upstate New York.	Two women interviewers conducted 1-hour in-depth interviews. The interviews included questions on eating and food preparation routines.	The interviews included questions on how working parents managed food and eating.	*Confounders adjusted for* None *Limitations* There was no direct collection of dietary intake data.	Work−family spillover was viewed primarily as negative. Negative feelings of "used up" and "too tired to eat" were common. Many mothers and fathers who negatively viewed work−family conflict explained that they did not have the time or energy to be good parents and feed their families "right", to enjoy food and/or cooking with their families, or to make healthful personal food choices. A few individuals described positive feelings of pride in food management skills or being energised by work.
Roos et al 2006[89]	5346 females (n = 4289) and males (1057) employed by the City of Helsinki, including general local administration, healthcare, social welfare, education and culture, public transport, and technical and construction services.	Participants completed a food frequency questionnaire estimating how often they consumed selected food items during the past 4 weeks. Participants were also asked the type of fat they use on bread and in cooking. A summary index of recommended food habits was calculated based on fruit, vegetables, dark bread, fish consumption, and use of oils and margarines.	Each participant completed a self-administered questionnaire, including 4 items on the extent to which job responsibilities interfere with family life (e.g. your job reduces the amount of time you can spend with the family).	*Confounders adjusted for* Age, family structure and work-related factors. *Limitations* A modest response rate of 66%.	Women with strong work−family conflict were more likely to report recommended food habits compared with women with no or weak conflicts. However, after adjustment this association was weakened and only those with weak conflicts were more likely to report recommended food habits than those with no conflicts (OR 1.24; 95% CI: 1.02−1.51). Work−family conflicts were not associated with recommended food habits in males. Interestingly, both females and males reporting strong family−work conflicts (the extent to which family life interferes with work) were less likely to report recommended food habits: females (OR 0.75; 95% CI: 0.61−0.92); males OR 0.57; 95% CI:

					0.34−0.96).
Jabs et al 2007[88]	35 women aged 25−51 years, with at least 1 child under the age of 16 years currently living with them, were recruited from a metropolitan area in the north-eastern US.	Each of the women participated in an interview where they were asked to describe food choices and eating activities on hectic days and on days when everything ran smoothly. They were also asked questions on their overall satisfaction with their management of food and eating for themselves and their family.	A grounded theory approach was used. Each of the women participated in an interview lasting 45−90 minutes, in which they were asked to describe their last work day in detail, from when they woke to when they went to bed, including their responsibilities and whom they ate with.	*Confounders adjusted for* None *Limitations* No food intake data collected directly.	Feelings of time scarcity and strain were common. Most mothers said there was not enough time to do everything they wanted and so needed to prioritise. A priority for all mothers was feeding their children. Mothers with cooking skills and confidence in cooking a variety of meals reported greater time and priority for cooking. Mothers often used fast food or convenience foods because they were tired or running late.
Cohort studies					
Lake et al 2004[90]	198 children aged 11−12 years, from 7 schools in Northumberland, England, were followed from 1980 to 2000.	Two 3-day food diaries were collected in 1980 and 2000. During each time period the diaries were collected 6 months apart.	A self-administered question was completed by participants in 2000, including 21 items on whether they believed their diet had changed since 1980 and attributions for any changes.	*Confounders adjusted for* Not stated.	Employment was often cited as reducing the time available to cook and prepare foods, which influenced dietary intake. Those experiencing a "time famine" due to work and family commitments reported smaller increases in fruit and vegetable intake over the 20-year assessment period compared to those who did not lack time.

Appendix H. Studies investigating the relationship between parental feeding styles and food habits and behaviours among children

Paper	Study sample	Assessment of dietary intake	Assessment of parenting style	Confounders adjusted for / limitations	Main outcomes
Cross-sectional studies					
Fisher & Birch 1999[99]	70 children aged 3−6 years, from day-care programs at the Pennsylvania State University Child Development Laboratory.	Children were seen individually, immediately after eating their usual lunch (where they indicated that they were full). They were provided with free access to toys and a generous amount of 10 snack foods. Children were left alone in the room for 10 minutes, where they were observed using a 1-way mirror in an adjacent room. Snack food intake was measured by comparing the weight of snack foods before and after the session.	Children were asked the extent to which their parents restricted access to the 10 snack foods. Maternal restriction of children's access to the snack foods was assessed by 9 items on each food.	*Confounders adjusted for* Age- and sex-specific analysis, adjusted for children's weight for height. *Limitations* A small convenience sample was used.	Maternal restriction of children's access to snack foods was positively correlated to girls' consumption of those foods ($p < 0.01$), but not boys'. Greater levels of maternal restriction were associated with higher intake in an unrestricted setting in girls. Girls' perceptions of restriction were positively related to the amount of snack foods they consumed in the unrestricted setting.
Fisher et al 2002[59]	191 non-Hispanic white families with girls aged 5 years, from central Pennsylvania. Cross-sectional data from a longitudinal study.	Children's fruit, vegetable, micronutrient, and energy intakes were assessed using 3 x 24-hour recalls conducted with mothers in the presence of their	Parents completed the Child Feeding Questionnaire, including 4 items measuring the extent to which parents pressure children to consume foods (e.g. always eating all food	*Confounders adjusted for* Girls' energy intakes. *Limitations* The sample was exclusively non-Hispanic white, 2-parent families and so the generalisability of results	Pressure in child feeding was negatively related to dietary quality, fruit and vegetable intake and micronutrient intake. Parents in the highest quintile for use of pressure had children who consumed 1.6 fewer serves of fruit and vegetables ($p < 0.0001$), 155 ug less vitamin A

		daughters. Parents' typical fruit and vegetable intake was assessed by a food frequency questionnaire regarding intake over the previous 3 months.	from the plate).	may be limited.	($p < 0.05$), and 50 ug less folate ($p < 0.001$) than did those girls whose parents were in the lowest quintile for using pressure.
Kremers et al 2003[83]	643 adolescents aged 16−17 years, from Dutch schools.	Fruit intake was estimated using a validated 14-item food frequency questionnaire (FFQ). This FFQ was cross-checked with an item in a questionnaire assessing perceived fruit intake.	Adolescents completed a 17-item questionnaire to assess parenting style. Ten items measured involvement (e.g. encouraging to do better), and 7 items measured strictness (e.g. parents knowing exactly where children are after school). Four parenting categories were defined: authoritarian (scored in lower half involvement, upper half strictness), authoritative (scored in upper have on both involvement and strictness), neglectful (scored lower half of both involvement and strictness), and indulgent (scored in upper half on involvement and lower half on strictness.	*Confounders adjusted for* Gender, age and religion. *Limitations* 45.5% of participants were found to realistically estimate their own fruit intake, and only these 643 adolescents were used in the analysis. FFQ may overestimate fruit intake.	Adolescents raised in an authoritative home ate significantly more fruit than adolescents raised with parents with the other 3 parenting styles ($p < 0.01$). Adolescents from indulgent homes consumed more fruit than those from authoritarian and neglectful homes ($p < 0.01$). There was no difference in fruit intake between those from authoritarian and those from neglectful homes.
Lytle et al 2003[92]	3878 children, mean age 12.8 years, from 16 middle schools in the Minneapolis / St	Children completed a 6-item food frequency questionnaire assessing fruit and vegetable	Children completed a self-administered questionnaire, including 18 items assessing	*Confounders adjusted for* Race, gender, age, family structure, receipt of free lunch / reduced-price lunch,	Maternal authoritative parenting style was related to fruit and vegetable intake. Children who scored at the 75^{th} and 90^{th} percentiles consumed

	Paul, Minnesota, metropolitan area. These were baseline data from the Teens Eating for Energy and Nutrition at School intervention study.	intake.	parenting style.	parent employment status, parental education level.	1.06 and 1.17 times as many serves of fruit and vegetables as those at the median, respectively. Those at the 10^{th} and 25^{th} percentiles did not consume fewer fruit and vegetables than those at the median. However, there was a significant trend for increasing intake with increasing maternal authoritative style ($p < 0.05$). There was also a trend for increased fruit and vegetable consumption with increasing paternal non-authoritative style ($p < 0.05$).
Brown & Ogden 2004[56]	112 children aged 9−13 years, and 1 parent each, from 3 schools in southern England.	Both children and parents completed a food frequency questionnaire assessing snack food intake "yesterday" and "in general". Scores for healthy and unhealthy snack foods were calculated.	Parents completed a questionnaire on control over their child's diet (e.g. firmness on what a child eats), and control over their child's behaviour using food (e.g. treating child with food for food behaviour).	*Confounders adjusted for* Not reported *Limitations* Both children and adults in the study had BMIs within the healthy range, so results may not be applicable to overweight populations.	There was no effect of parental control over diet on snack food intake in general. Children whose parents reported a higher level of control reported eating more of both healthy and unhealthy snack foods yesterday. There were no differences in snack food intake in children whose parents reported a high level of control of their child's behaviour using food compared to parents who exercised lower control.
Vereecken et al 2004[67]	316 mothers of children aged 2.5−7 years, from 8 kindergartens in Ieper, Belgium.	Mothers were asked to assess their children's usual consumption of fruit, vegetables, candy and soft drink using a short 4-item food frequency questionnaire.	Mothers completed self-administered questionnaires assessing parenting practices. These addressed permissiveness, pressure, material reward, verbal praise, negotiation, encouragement through rationale (fruit and vegetable consumption), discouragement through	*Confounders adjusted for* Mothers' education, modelling and various parenting styles. *Limitations* Modest response rate of 64%	Permissiveness was a significant predictor of increased soft-drink ($p < 0.001$) and sweet consumption ($p < 0.006$). Using food as a reward predicted a higher intake of sweets ($p < 0.02$). Praising children for their fruit and vegetable consumption predicted a higher intake of vegetables ($p < 0.03$).

			rationale (sweet and soft-drink consumption) and catering to children's demand.		
Young et al 2004[72]	366 children aged 12−16 years, from 3 middle schools in 2 northeast Georgia counties.	Children completed a questionnaire containing 2 items for fruit consumption and 4 items for vegetable consumption.	Perceived authoritative parenting was assessed using a 20-item modified Authoritative Parenting Index. Perceived parental control over the child's eating situation was assessed using an 11-item parent control subscale.	*Confounders adjusted for* Gender, grade, socio-economic status, school, and ethnicity. *Limitations* Modest response rate of 59%	Perceived authoritative parenting and parenting control were not related to fruit and vegetable consumption.
Chen & Kennedy 2005[35]	68 Chinese-American children aged 8−10 years, and their mothers, were recruited through 2 Chinese-language schools in urban and suburban areas of Northern California.	Children completed a 50-item food frequency questionnaire. Dietary outcomes included high-sugar, high-fat and energy-dense foods.	Parents completed a self-administered questionnaire including 2 subscales: authoritarian (26 items) and democratic (14 items).	*Confounders adjusted for* Children's age and gender and mothers' level of education. *Limitations* The sample is reasonably small and the results may not be applicable to other ethnic groups. An authoritarian parenting style in Chinese families may not reflect the strict parenting measured in Western society.	A significant association was found between a democratic parenting style and higher sugar intake in children ($p = 0.006$). No association was found between an authoritarian parenting style and dietary intake.
Patrick & Nicklas 2005[93]	231 African-American and Hispanic caregivers who had 1 child enrolled at Head Start centres located throughout the	Caregivers completed a questionnaire assessing the child's dairy, fruit and vegetable consumption during the week.	The Caregiver's Feeding Style Questionnaire (CFSQ) was used to assess feeding styles. Items in the questionnaire measured authoritarian (e.g. show	*Confounders adjusted for* Child's sex and BMI, and caregiver's ethnicity, BMI and education. *Limitations* The results may not be	Authoritative feeding was positively associated with dairy ($p < 0.001$) and vegetable ($p < 0.05$) intake by children, whereas authoritarian feeding was negatively associated with vegetable intake.

	Houston metropolitan area.		disapproval of the child for not eating) and authoritative (e.g. reason with the child to get them to eat) feeding styles.	generalisable to European-Americans.	
Vereecken et al 2005[73]	207 children aged 11−12 years, from 3 primary schools in Flanders.	Fruit and vegetable consumption was measured by 2 items in a self-administered questionnaire completed by each child.	A self-administered questionnaire completed by each child assessed parental encouragement (e.g. telling children to eat fruit and vegetables), permissive eating practices (e.g. parents allowing child to eat whatever they like) and obligation rules (e.g. tasting food).	*Confounders adjusted for* Not stated.	Permissive eating practice was positively associated with vegetable ($p < 0.05$) but not fruit intake. Obligation rules were positively associated with vegetable ($p < 0.001$) but not fruit intake.
Wardle et al 2005[68]	564 parents of children aged 2−6 years, from 22 London nursery schools.	The frequency of fruit and vegetable intake of both child and parent was measured using questionnaires completed by parents.	Control was measured using the Parental Control Index, a 6-item questionnaire assessing the extent to which parents use restriction and pressure to control their child's eating.	*Confounders adjusted for* Sex, age of child, socio-economic deprivation score and other predictor variables, including adult fruit and vegetable consumption and child neophobia. *Limitations* A modest response rate of 64%.	Increased parental control was negatively associated with fruit and vegetable consumption ($p < 0.01$). Multiple regression models showed parental control predicted fruit and vegetable intake ($p = 0.016$), but this ceased to be a significant predictor when neophobia was controlled for.
Arredondo et al 2006[94]	812 Latino children, mean age 6 years, and 1 parent for each, from 13 schools in San Diego county.	Child intake was assessed by a food frequency questionnaire completed by parents. Dietary outcomes included healthy eating (fruit, vegetables, low-	A self-administered questionnaire with 14 items relating to parenting style and eating, including monitoring (e.g. keeping track of the intake of sweet snacks), limit	*Confounders adjusted for* Age, marital status, education and employment. *Limitations* Results may not be generalisable to other ethnic groups.	Monitoring ($p < 0.001$), reinforcement ($p < 0.001$) and discipline ($p < 0.05$) were positively associated with healthy eating (fruit and vegetables, low-fat dairy foods, low-sugar cereals, wheat bread and crackers) ($p < 0.001$). Monitoring and reinforcement were negatively

		fat dairy foods, low-sugar cereals, wheat bread and crackers), and unhealthy foods (regular soda, flavoured drinks, fats and sugar cereals).	setting (e.g. limiting the amount of soda or snack food), reinforcement (e.g. praising the child for eating a healthy snack), discipline (e.g. disciplining the child for snacking without permission), and control (e.g. rewarding good behaviour with food).		associated with unhealthy eating (regular soda, flavoured drinks, fats, sweets and sugar cereals) ($p < 0.01$). Control was positively associated with unhealthy eating ($p < 0.01$). Limit-setting was unrelated to healthy and unhealthy eating by the child.
Campbell et al 2006[15]	560 families with children aged 5−6 years, from 3 distinct socio-economic districts in Melbourne, Australia.	Parents, on their child's behalf, completed a 56-item food frequency questionnaire. Dietary outcomes included energy intake, vegetable savoury snack, sweet snack, and high-energy drink consumption.	Parents completed a 59-item self-administered food environment questionnaire, including questions on restriction of eating (e.g. making sure child does not eat too many high-fat foods) and monitoring of eating (e.g. keeping track of snack food intake of the child).	*Confounders adjusted for* Maternal education and all predictor variables, including clustering by school, perception of adequacy of diet, parental modelling, food availability, confidence in cooking, cost and preference for fruit and vegetables, mealtime interruptions, TV viewing. *Limitations* Response rate varied according to socio-economic status (49% high, 26% middle and 29% low).	Pressure to eat was positively associated with energy intake ($p < 0.001$). Each unit of increase in the factor "pressure to eat" was associated with an increase in predicted energy intake per day of 457 KJ. Pressure to eat was also positively associated with savoury snack consumption ($p = 0.005$), sweet snack consumption ($p = 0.006$), and high-energy (non-dairy) drink consumption ($p = 0.015$).
Ogden et al 2006[97]	297 parents of children aged 4−11 years, from 3 primary schools in southern England.	Parents completed a self-administered questionnaire to measure their child's snack intake of 7 unhealthy snacks (chocolate, crisps, pastries, ice-cream, sweets, cakes, biscuits)	Parents completed a self-administered questionnaire with 5 items assessing overt control over their child's eating behaviour (control detected by the child; e.g. firmness on what a child should eat) and 5	*Confounders adjusted for* Not stated. *Limitations* Moderate response rate of 59%. List of snack foods was not comprehensive.	Child's unhealthy snack intake was negatively associated with covert control ($p = 0.0001$) but not overt control. Child's healthy snack consumption was positively associated with overt control ($p = 0.001$) but not covert control.

		and 5 healthy snacks (grapes, oranges, peaches, yoghurt, toast).	items assessing covert control over their child's eating behaviour (not detected by the child; e.g. avoid buying sweets).		
Wind et al 2006[76]	2468 children, mean age 11 .6 years, were recruited from 98 schools in Belgium and the Netherlands.	Fruit and vegetable intake was assessed by 1 and 3 food frequency questions, respectively	A self-administered questionnaire was completed by children, including questions on parental demand (e.g. whether parents demand that their children eat fruit and vegetables) and parental allowance (parents allow their child to eat as much fruit and vegetables as they like).	*Confounders adjusted for* Sex-specific analysis and adjustment for the physical and social environment, personal and demographic factors.	Parental demand was positively associated with children's intake of fruit ($p < 0.001$) and vegetables ($p < 0.001$). Parental allowance was not associated with children's fruit and vegetable intake.
Zabinski et al 2006[78]	878 adolescents aged 11−15 years, and 1 parent each, from 6 clinics in San Diego County.	Each adolescent completed 3 x 24-hour recalls, 1 by interview and 2 by telephone. Dietary outcomes included servings of fruit and vegetables and percent energy from fat.	Parents completed a self-administered questionnaire, with 6 items assessing household eating rules regarding healthful foods, and foods to limit.	*Confounders adjusted for* Sex- and age-specific analyses and adjustment for psychosocial covariates. *Limitations* Generalisability of the results may be limited as the samples were recruited from healthcare provider offices.	Healthful eating rules were positively associated with fruit and vegetable intake ($p < 0.01$) and negatively associated with dietary fat intake ($p < 0.01$)
Campbell et al 2007[57]	347 adolescents aged 12−13 years, and their parents, were recruited from participants in the longitudinal Nepean Study (a birth cohort born between August 1989 and April 1990	Adolescents completed a 56-item food frequency questionnaire. Both parents completed their own separate food frequency questionnaire. Dietary outcomes	Adolescents completed a self-administered questionnaire on environmental factors hypothesised to be associated with food consumption. This included 6 items on monitoring (how much	*Confounders adjusted for* Maternal education and all independent variables, including availability, parents' consumption of high-energy drinks, sweet and savoury snacks, take-out foods, parents' difficulty spending time with child,	Boys were more likely to consume soft drinks if their parents reported an authoritarian parenting style ($p = 0.002$). Boys' intake of sweet snacks was positively associated with parental pressure to eat more food ($p = 0.011$).

	at Nepean Hospital) Penrith, in Western Sydney, Australia.	included sweet and savoury snacks, high-energy fluids and take-out foods.	parents supervised adolescent intake), 2 items on using food as a reward, and 4 items on pressure (assessing parents' pressure to eat more). Parents completed a 26-item questionnaire describing demandingness (d) and responsiveness (r). Four factors describing parenting style were generated (authoritarian (high d, low r), authoritative (high d, high r), indulgent (low d, high r), uninvolved (low d, low r).	pressure, kitchen set-up, parental praise, high cost of fruit and vegetables, family conflict. *Limitations* Results are likely to be less applicable to families with mothers with a high educational level.	
de Bruijn et al 2007[96]	208 children, mean age 15.2 years, were recruited from a longitudinal Dutch adolescent cohort. Cross-sectional data were from a cohort study.	Children completed a validated questionnaire assessing soft-drink consumption (frequency and serving size).	Children completed a self-administered questionnaire, with 8 items assessing parenting practices (e.g. parental control over the amount and frequency of soft-drink consumption).	*Confounders adjusted for* Personality dimensions, age and sex *Limitations* Did not control for SES; a very low response rate (< 20%); females were more likely to respond.	Children who perceived less behavioural control and parental practices regarding soft-drink consumption consumed more soft drink ($p < 0.002$).
van der Horst et al 2007[84]	383 adolescents, mean age 13.5 years, from Dutch secondary schools. This study was part of the Dutch Obesity Intervention in teenagers.	Adolescents completed a self-administered questionnaire, including 2 items assessing the frequency and quantity of sugar-sweetened beverage intake.	Adolescents completed a self-administered questionnaire, including 9 items assessing perceived parenting practices and style. Five items measured restrictive practices (e.g. parent determining how	*Confounders adjusted for* Age, sex, ethnicity, habit strength, attitude, modelling from parents and self-efficacy. *Limitations* Schools were not randomly selected. Few children were	More perceived restrictive parenting practices were associated with less consumption of sugar-sweetened beverages ($p < 0.001$). The association between sugar-sweetened beverages and parenting style varied by different quartiles of strictness and involvement. Significantly less sugar-sweetened beverages was consumed

			much a child should drink). Strictness was assessed by 7 items (e.g. parents knowing exactly where children are after school). Involvement was assessed by 10 items (e.g. parents make time to talk to children).	recruited from ethnic minorities.	in the 2nd ($p < 0.05$) and 3rd quartiles ($p < 0.01$) of strictness and the highest quartile of involvement ($p < 0.01$).
Cohort studies					
Birch et al 2003[100]	140 girls aged 5 years, and their parents, from central Pennsylvania.	Eating in the absence of hunger was assessed when girls were aged 5, 7 and 9 years. Girls reported to the laboratory where they received lunch. Following lunch they were asked to rate their preferences for 10 sweet and savoury snack foods by taking 2-bite samples of each. The girls were then shown a variety of toys and containers with generous portions of the snack food. They were instructed that they could play with any of the toys or eat any of the snack foods while the instructor left the room for 10 minutes. Food items were weighed before and after the 10-minute	The experimenter interviewed each child after the 10-minute session, asking whether her parents would let her have the foods provided. Mothers' feeding practices were assessed by the Child Feeding Questionnaire. The primary feeding style evaluated was restriction. Other styles evaluated included monitoring and pressure to eat.	*Confounders adjusted for* Family income, mother's years of education, mother's BMI. *Limitations* The assessment of the eating pattern (eating in the absence of hunger) was performed in a laboratory setting, which may be somewhat artificial.	At age 5 years there were no significant effects of restriction on eating in the absence of hunger. At ages 7 and 9 years, those exposed to higher levels of restriction had higher eating in the absence of hunger scores than those exposed to low levels of restriction. The mothers who reported high levels of restriction also reported high levels of monitoring. The mothers of non-overweight daughters pressured their children to eat more than the mothers with overweight daughters.

		session to assess food and energy intake.			
Intervention studies					
Author, year	**Study sample**	**Intervention**		**Confounders adjusted for / limitations**	**Main outcomes**
Fisher & Birch 1999[101]	*Experiment 1:* 31 children aged 4−6 years and their parents were recruited from day-care programmes at the Pennsylvania State University Child Development Laboratory. *Experiment 2:* 40 children aged 3−6 years and their parents were recruited from day-care programmes at the Pennsylvania State University Child Development Laboratory.	*Experiment 1:* Each child's access to a target food was restricted while they were given free access to a control food for 5 weeks. The experimental foods were an apple and peach fruit bar cookie. Assignment to the restricted food was random. Children were seen twice per week during a 5-week restricted access intervention. Children received a generous portion of the control food in an open container and had free access to this during the 20-minute procedure. The target food was kept in a large transparent jar in the centre of the table. After 10 minutes a bell signalled the beginning of a 2-minute period when the children had access to the target food. At the end of the 2-minute period access was restricted for the remainder of the trial. Children's food selection and intake were measured 3 weeks before and 3 weeks after a period of restriction. Also, children's behavioural response was measured both before and during 5 weeks of restricted access to the snack food. *Experiment 2:* Children participated in 4 unrestricted snack sessions where the restricted food was freely available, followed by 4 restricted snack sessions where access to the restricted food was limited. Each child was randomly assigned to receive 1 of 2 restricted foods. Children's food selection, intake and behavioural response regarding the restricted food were measured in 3 consecutive 5-minute periods during each 15-minute snack session. During the 4 unrestricted sessions children were provided with the restricted		*Confounders adjusted for* Age- and sex-specific analysis. *Limitations* Laboratory settings can be artificial.	*Experiment 1:* The restricted food elicited more positive comment about it, more requests for it and more attempts to obtain it ($p < 0.01$). However, there were no effects of restriction on children's intake or selection. No significant differences between pre- and post-restriction were observed in those children selecting the target food as a snack. *Experiment 2:* Children's behavioural response (comments and behaviour) to a palatable snack food was greater during the restricted sessions ($p < 0.001$). Intake ($p < 0.01$) and selection ($p < 0.001$) of the restricted food were higher during restricted snack sessions than during unrestricted sessions. Greater increases in children's selection of the restricted food were associated with higher levels of maternal restriction of access to the restricted food at home ($p < 0.05$).

		food over a 15-minute period. During the 4 restricted snack sessions, wheat crackers were served in an open container in the middle of the table while the restricted food was kept in a closed, clear container. Children were allowed to self-select crackers throughout the 15-minute session, but they had free access to the restricted food only during the 2nd 5-minute period. Parents completed a questionnaire, including 6 items assessing the extent to which they typically restricted their child's access to the experimental foods at home.		
Harvey-Berino & Rourke 2003[102]	43 child−mother pairs were recruited from the St Regis Mohawk community of Akwesasne, located in northern New State, Ontario, and Quebec, Canada. All participants were Native-Americans.	Participants were randomly recruited to either a parenting support group (PS) or obesity prevention plus parenting support group (OPPS). Both groups participated in a 16-week programme on active parenting conducted by an indigenous peer educator in the home of each participant. The programme emphasised the child's psychological and behavioural goals, logical and natural consequences, mutual respect, and encouragement techniques. One of the topics was parenting style. The difference with the OPPS group was that the focus of the lessons was exclusively on how improved parenting skills could facilitate the development of appropriate eating and exercise behaviours in children. Parents completed separate 3-day food records documenting their food intake and that of their children.	*Confounders adjusted for* None *Limitations* There was no control group that received no information. The generalisability of results to other ethnic groups may be limited.	The only difference in nutrition intake was that the OPPS group consumed slightly, but not significantly, less ($p = 0.06$) energy compared to the PS group. Mothers in the OPPS group reported significantly lower restriction scores at the end of the intervention, and this change was significantly different from that in the PS group ($p < 0.05$).
Galloway et al 2006[95]	27 children aged 3−5 years, and their mothers, from preschool full-day care programmes at Pennsylvania State University.	The 2 experimental conditions were pressure to eat (intervention) and no pressure (control). During an 11-week conditioning period children were presented with 2 different flavours of soup and were randomly assigned to receive 1 soup associated with pressure to eat and the other presented with no pressure. During the pressure condition research assistants reminded children to "Finish your soup, please". The amount of soup	*Confounders adjusted for* None *Limitations* Laboratory settings can be artificial.	During the conditioning phase there were no significant differences in intake between the pressure and no pressure conditions. There were significantly more negative comments by children during the pressure condition compared to the no pressure condition ($p < 0.001$). In total, children made 157 negative

		eaten during each session was recorded, as were all comments made by the children. Pre- and post-test assessments were conducted before and after the conditioning trials, where 120 g serves of the soups were offered either one at a time or simultaneously. Children were asked to eat as little or as much as they wanted. Weighed intakes were recorded. Each mother's use of pressure to encourage their children to eat more was measured by 4 items from the child feeding questionnaire (CFQ), (e.g. "my child should eat all of the food on the plate").		comments during the pressure condition and 30 during the no-pressure condition. During the pre- and post-test assessment, the no-pressure condition was associated with significantly greater increases in intake than the pressure condition ($p < 0.05$). Children who were more pressured at home were less affected by the pressure in the laboratory setting compared to children who were not pressured at home ($p < 0.05$).

Appendix I. Studies investigating the association between home/family food availability and accessibility and food habits and behaviours

Author, year (reference)	Study sample	Measure of dietary intake	Measure of food availability and/or accessibility	Confounders adjusted for/ limitations	Main outcomes
Cross-sectional studies					
Reynolds et al 1999[81]	414 3rd grade children, and their parents, were recruited from participants providing baseline data for the High 5 intervention project.	Each participant completed a 24-hour recall. Dietary outcomes included fruit and vegetable consumption.	Parents completed a self-administered questionnaire assessing the presence in the home of 11 fruit and 11 vegetables commonly eaten in the southern US. Parents also indicated the presence of 9 other forms of fruit and vegetable in the home (e.g. 100% fruit juice).	*Confounders adjusted for* Gender-specific analyses. *Limitations* Only 1 x 24-hour recall assessed dietary intake.	There were significant positive associations between availability and consumption of fruit and vegetables ($p < 0.05$).
Kratt et al 2000[82]	1196 4th-grade children, and their parents, from Alabama, USA. These were providing baseline data for the High 5 Alabama intervention project.	Children completed a 24-hour recall in a face-to-face interview to assess fruit and vegetable intake.	Parents completed a questionnaire on fruit and vegetable availability within the home. This was assessed by 3 sets of questions about the presence of fruit and vegetable available in the home during the week prior. The first set of questions comprised 5 items addressing the availability of generic types of fruit and vegetables; 22 items assessed whether 11 of the most commonly eaten fruit and vegetables were	*Confounders adjusted for* Parent and child expectations, knowledge, and self-efficacy. *Limitations* Only 1 x 24-hour recall assessed dietary intake.	As fruit and vegetable availability increased from low to high, intake by children increased significantly ($p < 0.01$).

			available; 4 items addressed the location and preparation of fruit and vegetables in the home.		
Cullen et al 2003[34]	225 children from grades 4−6, and their parents (n = 88), from 9 schools in the greater Houston, Texas, area.	Children completed a food diary over 5−7 days. Dietary outcomes included intakes of fruit, 100% fruit juice and vegetables (FJV).	Self-administered questionnaires were completed by children regarding both availability and accessibility of 100% fruit juices, fruits and vegetables. Parents completed the availability and accessibility questionnaire during telephone interviews.	*Confounders adjusted for* Not stated. *Limitations* A moderate response rate of 65% from children, and a low response rate from adults. French fries were counted in total vegetables.	Availability and accessibility accounted for about 10% of the variance in FJV consumption (35% in girls) and were significant predictors of FJV consumption ($p < 0.05$). For children with high FJV preference, FJV availability was a significant predictor ($p < 0.05$), whereas both availability and accessibility were significant predictors for children with low FJV preferences ($p < 0.05$).
Bere & Klepp 2004[55]	1950 children, mean age 11.8 years, and 1647 of their parents, from 38 schools in Hedmark and Telemark counties in Norway. These cross-sectional data were drawn from baseline information collected from an intervention study.	Fruit and vegetable intake was measured by 4 frequency items in a self-administered questionnaire completed by children and parents.	Children and parents both completed a self-administered questionnaire, including 5 items on accessibility (e.g. mother or father sometimes cuts up fruit or vegetable for a snack).	*Confounders adjusted for* Parent and children scales of intent, modelling, preferences, self-efficacy, awareness, parental intake. *Limitations* Children whose parents did not participate differed from children with participating parents with regard to demographic variables, health-related behaviours and fruit and vegetable intake measures. Parents and children appeared to perceive children's accessibility	Accessibility assessed by children was positively associated with fruit and vegetable intake ($p < 0.01$). Child's accessibility assessed by parents was associated with children's fruit and vegetable intake ($p = 0.04$). When both parent and child scales of accessibility were included, accessibility was not associated with children's fruit and vegetable intake.

				differently.	
Grimm et al 2004[71]	560 children aged 8−13 years completed a survey in an educational publication for children produced by Miami University. The magazine was distributed to elementary and middle schools across the US.	Children were asked how often they drank soft drinks and what type they consumed (e.g. diet vs regular).	The survey included questions on the availability of soft drinks in the home.	*Confounders adjusted for* Age, sex, taste preference for soda, parental soda intake, TV viewing, friends' soda intake, soda availability in school, taste preference for milk and taste preference for water. *Limitations* There was limited demographic information about the children (e.g. no information on socio-economic status or ethnicity).	Availability of soft drinks in the home was significantly associated with soft-drink consumption. Children from households with high availability of soft drinks had intakes 2.82 (95% CI: 1.51−5.29) times higher than children from households with low availability.
Young et al 2004[72]	366 children aged 12−16 years, from 3 middle schools in 2 northeast Georgia counties.	Children completed a questionnaire containing 2 items for fruit consumption and 4 items for vegetable consumption.	Children completed a self-administered questionnaire including 10 items on fruit and fruit juices availability and 10 items on vegetable availability.	*Confounders adjusted for* Gender, grade, socio-economic status, school, and ethnicity. *Limitations* A moderate response rate of 59%.	Perceived fruit and vegetable availability was a significant predictor of fruit and vegetable consumption ($p < 0.001$).
Hanson et al 2005[62]	902 adolescents, and 1 parent/ guardian each, from public middle and high schools in the Minneapolis / St Paul and Osseo districts in Minnesota.	Each adolescent completed a 149-item semi-quantitative Youth Adolescent Food Frequency Questionnaire administered by trained staff. Parents completed a semi-quantitative food survey on fruits,	Parents completed a survey by telephone assessing how often fruits, vegetables, milk and soft drinks were available in the home.	*Confounders adjusted for* School level, parental socio-economic status, parent gender and race/ethnicity. *Limitations* Low response rate from lower socio-economic groups. The food availability tool was not	Intakes of fruit and vegetables were positively associated with household availability for girls ($p < 0.01$), but not for boys;1.3 additional serves of fruits and vegetables were consumed by girls in homes where they were always available vs sometimes/never available; and 1.4 additional serves of milk were consumed by boys in homes

		vegetables and dairy foods consumed over the previous week, administered by telephone interviews. Dietary outcomes included fruit, vegetables, milk and soft-drink intake		validated.	where milk was always served with meals vs never available. The trend was not significant for girls. In homes where soft drinks were usually or sometimes available, girls consumed 1 less serving of dairy per day than those who never had soft drinks at home.
Vereecken et al 2005[73]	207 children aged 11−12 years, from 3 primary schools in Flanders.	Fruit and vegetable consumption was measured by 2 items in a self-administered questionnaire completed by each child.	Availability was assessed with a self-administered questionnaire completed by the children.	*Confounders adjusted for* Not stated. *Limitations* Availability of fruit and vegetables was high in most children in this study.	Available fruit variety was significantly correlated with fruit consumption ($p < 0.01$).
Campbell et al 2006[15]	560 families with children aged 5−6 years, from 3 distinct socio-economic districts in Melbourne, Australia.	A 56-item food frequency questionnaire was completed by parents on behalf of their child. Dietary outcomes included energy intake, vegetable savoury snack, sweet snack, and high-energy drink consumption.	Parents completed a 59-item self-administered food environment questionnaire, including questions on food availability.	*Confounders adjusted for* Maternal education, clustering by school, perception of adequacy of diet, parenting styles, food availability, confidence in cooking, cost and preference for fruit and vegetables, mealtime interruptions, TV viewing. *Limitations* Response rate varied according to socio-economic status (49% high, 26% middle and 29% low).	Food availability was not associated with any of the dietary outcomes measured.
Larson et al 2006[48]	4079 adolescents aged 11−18 years,	A 149-item validated Youth Adolescent Food	Each adolescent completed self-administered	*Confounders adjusted for* Race, grade level, weight	Milk served at meals was significantly positively correlated

	from 31 junior and senior high school in the St Paul / Minneapolis area of Minnesota.	Frequency Questionnaire was used to assess energy and calcium intakes, servings of dairy and milk.	questionnaires, including questions on home food availability.	status and caloric intake, and covariates including socio-economic, personal and behavioural factors. *Limitations* FFQ may not be appropriate for all ethnic groups.	with calcium, milk and dairy intake, and was one of the strongest correlates of calcium intakes ($p < 0.001$).
Matheson et al 2006[74]	108 Mexican-American children aged 9−13 years and their mothers, from 8 schools participating in an obesity prevention trial.	Three 24-hour recalls were conducted with children as primary respondents. One was collected in a face-to-face interview and 2 were conducted over the telephone. Dietary outcomes included fruit, vegetable, sweets and snacks consumption, % energy from fat and energy density.	Mothers' attitudes about making healthful foods available for their children was measured by 6 items in a questionnaire completed via face-to-face interviews.	*Confounders adjusted for* Results were analysed separately for food-secure and food-insecure households. *Limitations* Results may only be applicable to Mexican-American families. Questions on food availability involved attitudes about making healthful foods available rather than making them actually availability.	In food-insecure households attitudes about making healthful foods available were inversely associated with children's daily energy intake ($p < 0.05$). In food-secure households attitudes about making healthful foods available were positively associated with children's fruit intake ($p < 0.001$) and percentage energy from fat ($p < 0.05$).
Wind et al 2006[76]	2468 children, mean age 11.6 years, from 98 schools in Belgium and the Netherlands.	Fruit and vegetable intake were assessed by 1 and 3 food frequency questions, respectively	A self-administered questionnaire was completed by children, including questions on the availability of fruit and vegetables at home.	*Confounders adjusted for* Sex, physical environment and social environment, personal factors. *Limitations* Perceived availability was assessed, rather than actual availability.	Higher perceived availability of vegetables at home was positively associated with vegetable intake ($p < 0.01$). No association was found for fruit.
Campbell et al 2007[57]	347 adolescents aged 12−13 years,	Each adolescent completed a 56-item	Each adolescent completed a self-administered	*Confounders adjusted for* Maternal education and	The availability of unhealthy food in the home was positively related

	and both their parents, were recruited from participants of the longitudinal Nepean Study (a birth cohort born between August 1989 and April 1990 at Nepean Hospital) Penrith, in Western Sydney, Australia.	food frequency questionnaire. Both parents completed their own separate food frequency questionnaire. Dietary outcomes included sweet and savoury snacks, high-energy fluids and take-out foods.	questionnaire, including 10 items assessing the availability of "healthy" and "unhealthy" foods in the home environment.	all independent variables, including parenting style, parents' consumption of high-energy drinks, sweet and savoury snacks, take-out foods, parents' difficulty spending time with child, pressure, kitchen set-up, parental praise, high cost of fruit and vegetables, family conflict. *Limitations* Results are likely to be less applicable to families with mothers with a high educational level.	to the consumption of high-energy drinks ($p = 0.058$, not significant), savoury snacks ($p = 0.002$ $p < 0.001$), and sweet snack consumption ($p < 0.001$) in girls. The availability of unhealthy food in the home was positively related to consumption of savoury snacks in boys ($p = 0.002$).
Nanney et al 2007[103]	1658 pre-school children aged 2−5 years, and their parents, were recruited from the 16 Parents as Teachers programme sites located in 8 rural south-east Missouri counties.	Parents completed a 29-item fruit and vegetable food frequency questionnaire for themselves and their children via a telephone interview. Dietary outcomes included fruit and vegetable intake and diet quality.	Parents completed questionnaires on the home food environment, and home-grown fruit and vegetable intake, via a telephone interview.	*Confounders adjusted for* Race, income and education.	Parents who almost always eat home-grown fruit and vegetables were 3.2 times more likely to eat 5 serves of fruits and vegetables per day compared to the rarely/never eaters, and ate on average 1.3 additional fruit and vegetable servings ($p < 0.001$). Vitamins A and C and fibre intake were higher in regular consumers of home-grown fruit and vegetables. Children who almost always eat home-grown fruit and vegetables were 2.3 times as likely to eat 5 serves of fruit and vegetables per day compared to the rarely/never eaters ($p < 0.001$). Intake of vitamins A and C and fibre were

					higher in regular consumers of home-grown fruit and vegetables. The almost-always home-grown fruit and vegetable families had more fruit and vegetable options in the home the previous weeks (5.2 vs 4.3 choices, $p < 0.001$).
Reinaerts et al 2007[66]	A convenience sample of 1739 parents of children aged 4−12years were recruited from a larger longitudinal study. The sample was recruited from 49 primary schools in the southern part of the Netherlands.	Fruit and vegetable intake of children was determined by a food frequency questionnaire completed by parents. Parental fruit and vegetable intake was assessed by a validated 10-item food frequency questionnaire.	Parents completed self-administered questionnaires, including 2 items on food availability (e.g. having fruit and vegetables available at home) and 1 item on food accessibility (e.g. preparing fruit and vegetables for children, peeling, cutting, washing).	*Confounders adjusted for* Demographic variables: child's sex, age, ethnicity, BMI, siblings (yes/no); and parents' age, marital status, education level, and other covariates, including parental consumption, habit, self-efficacy, attitude, preferences, modelling, social influence and intention.	Availability, but not accessibility, was positively related to fruit ($p < 0.001$). Neither availability nor accessibility was associated with vegetable consumption.
Intervention studies					
Author, year (reference)	**Study sample**	**Intervention**	**Measure of food availability and/or accessibility**	**Confounders adjusted for/ limitations**	**Main outcomes**
Baranowski et al 2000[85]	1253 children were recruited from 16 elementary schools (4 from a major south-eastern metropolitan area and 12 from a south-eastern suburban school system). Schools	The intervention was based on social cognitive theory and was school-based, with 12 sessions per year. Weekly newsletters taken home to parents, home assignments and family nights were included to involve the family. Dietary outcomes included	A telephone interview with parents assessed food availability (e.g. were particular foods in the home last week) and accessibility (e.g. were particular foods out in the open in the home last week).	*Confounders adjusted for* None *Limitations* Availability and accessibility was only one aspect of the intervention.	FJV combined ($p = 0.038$) and vegetables ($p = 0.004$), but not fruit intake, increased significantly in the intervention group.

	were assigned to treatment and control groups. An annual random sample of 13−16 parents from each school was selected for telephone interviews.	fruit, juice and vegetable intakes of children measured by 7-day food record.			
Wardle et al 2003[77]	156 parents of 2−6-year-olds, who had taken part in a large study of predictors of children's fruit and vegetable intake, and who expressed interest in participating in a further study to modify their children's acceptance of vegetables, were recruited.	An exposure-based intervention carried out in the home to increase children's liking for a previously disliked vegetable. Exposure vs information vs control group.	Parents of children assigned to the exposure group were asked to offer the target vegetable every day for 14 consecutive days.	*Confounders adjusted for* None. *Limitations* The study investigated increased exposure rather than availability and accessibility. There was no long-term quantitative follow-up to see if changes were sustained. Participants were predominantly white and of higher SES.	Overall liking ratings increased in the exposure group compared to the other groups ($p < 0.05$). The exposure group ranked their preference for the target vegetable higher than the information group, but not the control. There was a significant increase in intake and the willingness to eat the target vegetable in the exposure group only.
Evans et al 2006[105]	18 intervention and 21 control children, from 2 elementary schools in a South Carolinian school district.	The intervention targeted both children and parents, with 12 x 2-hour sessions over 6 weeks, including nutrition education, media literacy and health communication sessions. The children developed a media campaign to increase	A 9-item questionnaire measuring availability and accessibility was completed by parents.	*Confounders adjusted for* Pre-test scores in psychosocial variables. *Limitations* A relatively small sample. The intervention group had significantly more girls and more children from lower SES households.	The intervention appeared effective at increasing the availability of fruit and vegetables ($p < 0.05$) compared to the control group, but was not effective in changing the fruit and vegetable consumption of the children.

		fruit and vegetable consumption, to which parents were exposed.			

Appendix J: Cross-sectional studies investigating the relationship between family environment and physical activity (PA) in children

Paper	Subjects	Assessment of family/ parental behaviour	Assessment of child physical activity	Confounders adjusted for	Main outcomes
Brustad 1996[109]	107 children, mean age 10.6 years, in physical education classes at low SES schools in Los Angeles, USA.	Students rated their parents on level of encouragement for child's physical activity (PA), parent's enjoyment of PA & parental level of PA.	Children rated their attraction and interest in PA using a 26-item questionnaire.	Sex-specific analyses.	Perceived parental encouragement and enjoyment of PA were associated with increased perceived competence and attraction to PA in boys and girls.
Hovell et al 1996[110]	486 4th-grade children, mean age 9.5 years, at schools in the USA.	Parents reported the number of times they did PA – mild, moderate, strenuous – in a typical week. Parents reported their support for child's PA by their frequency of encouragement, of doing PA with child, and of transport of child to PA.	Child's PA measured by accelerometer over 2 days.	Not stated.	Parental PA was associated with PA by male children only; while frequency of playing with children was associated with PA by both male and female children.
Kimiecik et al 1996[111] (sample same as Kimiecik & Horn 1998)[113]	81 children aged 11−15 years, living with 1 or 2 parents, selected from schools in a US Midwestern city.	Children rated their parents' beliefs about their child's fitness using a 9-item questionnaire.	Children recalled the number of moderate-to-vigorous activities over 2 days, and also rated their PA levels with that of their peers.	None stated.	No association between child's perception of parents' beliefs about fitness and child's level of PA ($p > 0.05$).
Aarnio et al 1997[129]	3254 twins aged 16 years from a population-based twin register in Finland, and their parents and grandparents.	Parents answered a mailed questionnaire about the frequency and intensity of their PA in the last month.	Adolescents reported in a mailed questionnaire the frequency and intensity of their PA outside school in the last month.	Sex-specific analyses.	Compared with inactive mothers, very active mothers were more likely to have active daughters (33.3% vs 15.45, $p < 0.001$) but not sons (25.5% vs 23.5, $p = 0.14$). There was no association between paternal

					activity and child activity ($p > 0.05$).
Bungum & Vincent 1997[112]	852 girls, aged 14−18 years, at 8 high schools in rural South Carolina, USA.	Students reported on the frequency of exercising by their parents, and on the encouragement and involvement of family members with them in PA.	Students recalled the frequency and intensity of PA over the previous 7 days, which was then converted to energy expenditure.	Age, ethnicity, TV watching, attitudes towards exercise, participation in organised sports.	Support for PA by fathers was associated with PA by girls ($p = 0.016$).
Shropshire & Carroll 1997[134]	924 children aged 10−11 years at 32 primary schools in a North West Education Authority area, UK.	Students were asked if their father or mother often played any sport or did any physical exercise.	Students reported the frequency, length of time, and intensity of PA outside school in the previous week.	Sex.	Boys and girls with a father who exercised spent more time doing PA than those with a non-exercising father (241 vs 168 mins/week; $p < 0.01$). Exercise by mothers was not related to time doing PA by children (227 vs 186 mins/week; $p = 0.28$).
Kimiecik & Horn 1998[113] (sample same as part of Kimiecik et al 1996)[111]	60 children aged 11−15 years, with 2 parents, selected from schools in a US Midwestern city.	Parents were asked the number of days per week they did vigorous PA that made them sweat, and were also asked about their beliefs regarding their child's level of PA (e.g. perceived fitness, competence, value of fitness).	Children recalled the number of moderate-to-vigorous activities over 2 days, and also rated their PA levels with that of their peers.	None stated.	No association between PA levels of parents and their children ($p > 0.05$). However, parents' beliefs about their children's competence to do PA was positively related to the PA levels of children ($p < 0.05$).
Vilhjalmsson & Thorlindsson 1998[135]	1131 random sample of 10th-grade students, aged 15−16 years, in Iceland.	Students recorded the frequency of PA by their father, mother, older brother and older sister (never, < 1 /week, ≥ 1 / week).	Students recorded the frequency and time spent doing sports, gymnastics, swimming or other PAs each week.	Sex, attitudes and beliefs about sport, school experiences, sociability, support of friend, paid work, TV viewing.	PA by father ($p < 0.01$) and older brother ($p < 0.001$) were each associated with increased PA by students, independent of other risk factors. PA by mother and older sister was not associated with PA by students ($p > 0.05$).

Fogelholm et al 1999[130]	129 obese and 142 normal-weight children, mean age 9.6 years, from a community sample in a town in Western Finland, and their parents (245 mothers, 222 fathers).	Parents completed a 3-day diary of PA, and answered questions about the frequency of vigorous or moderate PA during leisure time.	Children completed a 3-day diary of PA, and answered questions (6 items) about their habitual PA.	Child's age, sex relative weight and number of siblings; parents' weight and education.	Inactivity by the mother and the father were independent risk factors for inactivity by children ($p < 0.001$), after controlling for confounders. Present PA level of the child was associated with present PA level of the mother ($p = 0.003$) and of the father ($p = 0.003$).
Mota & Silva 1999[136]	401 students, mean age 14.3 years, randomly sampled from 7 public schools in the Porto region of Portugal.	Parents rated their level of habitual physical activity as being active or inactive.	Students recorded the frequency and intensity of doing 20 PAs in the last week.	None stated.	Adolescent PA levels were significantly correlated with self-reported parental PA by both fathers ($r = 0.16$, $p < 0.05$) and mothers ($r = 0.23$, $p < 0.001$).
Raudsepp & Viira 2000[133]	375 students, 13−14 years of age, from 2 randomly selected schools in Tartu, Estonia.	Parents recalled their time spent doing PA, and its intensity, over the previous 7 days.	Students recalled their time spent doing PA, and its intensity, over the previous 7 days.	Sibling PA; sex-specific analyses.	Moderate-to-hard PA by fathers and mothers was associated ($p < 0.05$) with PA by both boys and girls.
Hoefer et al 2001[157]	1678 students, mean age 13.0 years, from 24 middle schools in southern California; and 1 parent per student (USA).	Parents answered a questionnaire brought home by their children, which included the number of times per week their child had been transported to do PA.	Students answered questions at home about the number of times, and time spent, doing 41 PAs outside school in the previous 7 days.	Age, sex and ethnicity of child, number of children in family, parents' education.	Parental provision of transportation was a contributor for out-of-school PA, by girls ($p = 0.001$) more than by boys ($p = 0.06$), and for participation in sports teams and activity classes by both girls ($p = 0.001$) and boys ($p = 0.04$).
Kalakanis et al 2001[126]	51 children, aged 8−12 years, seeking treatment for obesity in Buffalo, New York State.	PA by 1 parent assessed by accelerometers worn for same 3−4 days as child.	PA by children assessed by accelerometers worn for 3−4 days.	Child's age, gender, % overweight, SES, and % overweight by mother and father.	Frequency (not duration) of moderate-to-vigorous PA by child associated with PA frequency of parents ($p < 0.05$).
McGuire et al 2002a[114] (sample same as part of McGuire 2002b)[127]	900 adolescents from 31 schools in Minneapolis, age not stated (USA).	Parents contacted by phone and reported how much they did vigorous PA during a normal week, and how much	Students answered questions in class about how many hours in a usual week they spent doing strenuous,	Parental gender, SES, and adolescents' grade and school.	PA by students was associated with parental encouragement of their child to be fit, particularly in girls, but not with parental PA level.

		time they spent watching TV and videos. Parents also rated the level of encouragement they gave to their children to do PA.	moderate and mild exercise, and the number of hours watching TV and videos. Students rated their parents' care and encouragement for PA.		
McGuire et al 2002b[127] (sample same as McGuire et al 2002a)[114]	4746 adolescents, in 7th and 10th grade, at 31 schools in Minneapolis, aged not stated (USA).	Students rated how much their parents cared about them (students) being fit, and parental encouragement for PA.	Students answered questions in class about how many hours in a usual week they spent doing strenuous, moderate and mild exercise, and the number of hours watching TV and videos.	SES, school, grade, race and BMI.	Concerns about fitness by either parent were significantly ($p < 0.001$) correlated with time spent doing PA in both boys and girls.
Prochaska et al 2002[115]	138 students, mean age 12.1 years, from a public school in San Diego, USA (12% response).	Parental support for their child's PA was assessed on a 5-item scale that measured participation encouragement, praise, transportation, watching.	PA levels in children were assessed by each wearing an accelerometer for 5 days, with counts converted to METS, and recalling the number of days they did moderate-to-vigorous PA over the 7 days prior to interview.	Gender, race, peer support for PA.	No association between parental support with either measure of PA ($p > 0.05$).
Sallis et al 2002[116]	781 students in grades 1−12 attending 9 schools in Massachusetts, USA.	Parents completed self-report questionnaire at home with questions on parental PA (walking, house chores, gardening and sport); support for PA by child (exercised with child, encouragement, provided transportation,	Child PA (frequency and duration of 46 activities in previous 7 days) measured by reports completed by parents or by child (grades 7−12). A sub-sample (n = 200) wore accelerometers for 7 days.	Age, race, number of parents in household, enjoyment of PA, co-ordination, use of recreational time, diet, peer support, park distance and safety.	Family support and parental PA were not associated with child PA after adjusting for confounders for either questionnaire or accelerometer measures.

		watched child play sports).			
Davison et al 2003[156] (sample same as part of Davison et al 2006)[149]	170 non-Hispanic white 9-year-old girls, living with both biological parents, recruited with flyers and adverts in Pennsylvania. Cross-sectional data from cohort study during girls' ages 5 to 9 years.	Parents completed self-report questionnaires that measured logistic support for PA and PA modelling by mothers and fathers (separately).	Interviewer collected 3 measures of girls' PA from questions on inclination towards activity and participation in organised sports, and assessment of physical fitness by endurance run. Three measures combined into a single summary PA score.	Girls' percentage body fat. Parental income, education and work hours were not adjusted as none were related to parental support.	The proportion of girls with above-average PA scores increased with parental support, from 32% with neither parent supporting, to 56% for 1 parent and 70% for both parents supporting. Fathers' explicit modelling of PA and mothers' logistic support for PA were both associated with the summary PA score for girls ($p < 0.05$).
Dunton et al 2003[117]	87 low-active adolescent girls, aged 14−17 years, recruited into an intervention study in California, USA.	Students completed self-report measures of the availability of home exercise equipment (eg. bicycle, treadmill, trampoline).	PA measured from 2-day recall questionnaire, which was converted to energy expenditure. Doing 6 PA lifestyle activities, such as walking instead of driving, was also measured.	None.	Home use of exercise equipment was associated with doing vigorous physical activity ($r = 0.276$, $p < 0.05$) and with the number of PA lifestyle activities ($r = 0.262$, $p < 0.05$), but not with energy expenditure ($r = 0.096$, $p > 0.05$).
Trost et al 2003[118]	380 students in grades 7−12 (mean age 14.0 years), living with both parents, recruited from 1712 students at both high schools in Amherst, Massachusetts, USA.	Parents completed take-home questionnaires that measured their level of PA, support for activity, rating of the importance of activity, and their enjoyment of PA.	Interviewers asked students about: ▪ the number of times they performed 46 PAs in the last 7 days (converted to weekly activity index) ▪ their confidence to overcome barriers to PA.	Multivariate models, which included students' age and gender.	Child PA was associated with parental support ($p < 0.0001$) but not with parental PA ($p = 0.28$).
Viira & Raudsepp 2003[132]	197 7th-grade students, mean age 13 years, from 3 schools in the city of Tartu, Estonia, followed	Children rated level of PA by their parents, and parental financial support for and attitude	Children self-reported on 19 activities over the previous month, at baseline and follow-up.	Parental age, income, education and PA, and child's enjoyment of PA,	Not all results reported in the abstract are described in the main results section of the paper. For the latter: no

	for 1 year.	to child's PA, at baseline and follow-up.		attitudes of parents, coach and friends to PA, PA fees paid, transport to school. Cross-sectional analyses, as baseline parental PA, were not analysed as predictor of child PA at follow-up.	association between child and parent PA at baseline and follow-up, except for an inverse association between girls' and mothers' PA levels at follow-up ($p = 0.01$). Paying fees for PA was associated with increased PA by boys at follow-up only ($p = 0.03$).
Welk et al 2003[19]	994 children, mean age 10.0 years, in grades 3−6, attending 4 suburban schools in the US (locale not stated by authors), and 536 parents.	Children completed a questionnaire about parental role modelling and support for child PA. Parents reported how often they did vigorous and moderate PA.	Children completed a 9-item instrument which summarised their PA at school, recess, after school, evenings and weekends.	Not stated.	Parental influence (role modelling, encouragement, involvement and facilitation) accounted for 19.7% in the variation of child PA ($p < 0.001$). There was a significant correlation between parental PA and child PA ($p < 0.01$).
Adkins et al 2004[119]	52 African-American girls, aged 8−10 years, in a pilot study in Minneapolis, Minnesota, USA.	Parents completed a questionnaire about doing PA with their daughter and their support of their daughter's PA levels.	Interviewers asked girls about their perception of parental support for PA at home. PA by girls as measured by an accelerometer worn for 3 days.	None.	PA by girls was associated with parents' perceived rating of doing PA with their daughter ($p = 0.001$), but not with girls' perception of support for PA at home ($p = 0.23$).
Davison 2004[120]	202 middle school children, mean age 12.6 years, from a rural Pennsylvania community, USA.	Parents completed a 7-item, and children a 27-item, questionnaire about parental support for PA. Children also reported on sibling support for PA.	Three self-report measures of PA by students (a scale to measure tendency to PA, a PA checklist for frequency of 28 activities, and questions on general levels of PA) were summarised into a single summary PA score.	Family income and parent education.	Students with 1 or more parents providing a high level of support were more likely to be highly active (above median PA score) than those with no parents providing a high level of support (boys: 78% vs 38%, $p < 0.001$; girls: 68% vs 30%, $p < 0.001$).

Saunders et al 2004[121]	1797 8th-grade students (out of 4044) attending 24 schools in South Carolina, USA.	Students were asked about 5 measures of family support to do PA or play sports.	Students recalled the time spent doing moderate-to-vigorous PA over 3 days in the previous week to interview, and team sport involvement over the past 12 months.	Student attitudes, normative beliefs, perceived behavioural control, and social provisions.	Family support for PA was significantly associated ($p < 0.001$) with moderate-to-vigorous PA and team sport involvement.
Wagner et al 2004[137]	3437 children, mean age 12 years, in randomly sampled classrooms at 88 schools in eastern France, and their parents.	Parents' PA level was determined by their response as to whether they engaged in sports activities.	Children reported the number of times per month, and average weekly time, they participated in organised PA outside school in the last year	Parents' excess weight, child's excess weight, child's level of sedentary behaviour, family structure and number of siblings.	A positive association was found between the number of parents practising sport and the odds ratio of a child participating in non-school organised sport: boys 1.97 (95% CI: 1.39−2.79); in girls 1.56 (1.18−2.08); for children with both parents practising sport compared to neither.
Ziviani et al 2004[142]	164 children (out of 360), mean age 9 years, attending a state primary school in Brisbane, Australia.	Parents rated the importance of PA (on a 3-point scale: very, somewhat, or not), and reported whether they themselves had walked to school.	Parents recorded the number of times their child walked to or from school each week.	Not fully stated, but includes walking distance to school and "other" factors.	Parents' history of walking to school themselves, and their rated importance of PA, were both significantly associated with a *decreased* risk of child walking to school. (NB: This appears to be an error, as the text suggests that the above parental factors are associated with an increased risk of child walking to school.)
Duncan et al 2005[122]	372 children aged 12 years (and 1 parent) recruited from 48 urban neighbourhoods in Oregon, USA.	Social support for child PA − by parents and older siblings − was asked re. their encouraging, co-participating, watching, talking about, or transportation to places	PA by children measured at home using a 7-day record and pedometer worn for 4−7 days.	Age, gender and income.	PA by children was associated ($p < 0.05$) with reported watching of PA by parents, siblings and friends.

		to do physical activity.			
Martin et al 2005[139]	National surveys of Australian children aged 10−13 years in 1985 (n = 2463) and 1997−99 (n = 1469). No details of sample selection reported.	Children were asked if their parents undertook regular exercise (no = exercising less than twice/week).	Children were asked if they played sport (for school, club, both or neither) in the past year.	None.	In the 1985 survey active fathers were more likely (than expected) to have sons who played sport, while inactive mothers were less likely to have daughters who participated in sport. No parent−child associations were reported in the 1997−99 survey.
Salmon et al 2005[140] (sample same as part of Timperio et al 2006)[141]	878 children, mean age 11.5 years, recruited from 19 primary schools in Melbourne.	Parents completed a questionnaire at home about their screen-based behaviours.	Children wore an accelerometer for 8 days, with those in the lowest quartile of counts classified as inactive.	Maternal income, internet use, pay TV and having E-games, supervision of TV and computer.	Children with parents who used the computer ≥ 30 minutes per week were 1.7 to 1.9 times more likely to be inactive.
Arredondo et al 2006[94]	812 Latino children, mean age 6 years, and 1 parent for each, recruited from 13 schools in San Diego County, USA.	Parents answered a questionnaire with 10 items about their child's PA that rated their parenting style on: monitoring, discipline, control, limit setting and reinforcement.	Parents rated their child's level of PA against that of other children. This measure correlated with other PA questions (e.g. total number of sports child participated in).	Parent's age, marital status, employment and education.	Parental monitoring (e.g. keeping track of the amount of exercise by the child) and reinforcement (praising the child for being active) were each positively associated with PA rating of the child ($p < 0.001$). Parental discipline, limit setting and control were unrelated to PA by the child.
Beets et al 2006[125]	363 students, mean age 12 years, at 1 school in rural Midwest, USA.	Students report the level of PA support from their mother and father for praise, transportation, encouragement, doing PA with, and watching.	Students were asked to recall the frequency of moderate and vigorous PA in the last 7 days.	Age, sex, peer support.	Transportation to PA by parents was significantly associated with student PA ($p < 0.05$).
Heitzler et al 2006[123]	3114 parent−child pairs, children aged 9−13 years, recruited in US national random-digit telephone survey (response rate	Parents answered questions about their beliefs and barriers to PA by their child. Children answered	Children recalled all PA sessions (organised or in free time) during the previous 7 days. PA was assessed by number of	Age, sex and ethnicity of child; education and annual income of parent.	Parental support and parental beliefs were associated with increased odds, and parental barriers associated with decreased odds, of child

	43%).	questions about the level of parental support for PA.	PA sessions.		participating in organised sport.
Raudsepp 2006[131]	566 10th-grade students, mean age 13.8 years, attending 4 public schools in Tartu, Estonia. Both parents of each student were also surveyed.	Parents completed self-report questionnaires that measured logistic support for PA and PA modelling by mothers and fathers (separately).	Hours per week of PA were calculated from an interviewer-administered 7-day recall questionnaire.	Social class and other parental PA variables.	PA modelling by both father and mother, plus logistic support by father, each independently associated with increased PA in children ($p < 0.05$).
Springer et al 2006[128]	718 female students, aged 10−14 years, participating in a health education intervention at 12 public middle schools in a large city in Texas, USA.	Students reported how often in the past month the family did PA with them or encouraged them to be PA.	Students recalled intensity and duration of 22 common PAs in 1 day prior to interview.	Ethnicity, BMI for age, other social support variables (including from peers).	Family encouragement ($p < 0.01$), but not participation, was positively associated with moderate-to-vigorous PA, but not vigorous PA.
Timperio et al 2006[141] (part of sample same as Salmon et al 2005)[140]	235 children aged 5−6 years and 677 children, aged 10−12 years, recruited from 19 primary schools in Melbourne.	In a self-administered questionnaire, parents indicated whether there was an adult at home to supervise outside play by their child after school.	Parents completed a questionnaire at home about frequency of walking and cycling to school by their child during the school year.	None.	There was no association between presence of adult at home after school and frequency of active transport to school by child.
Zambon et al 2006[138]	4386 children aged 11, 13 and 15 years, in 314 randomly selected classes in 5 geographic areas in Italy.	Children rated how easily it was to talk to their mother or father about "really troubling issues".	Children reported their frequency of doing physical exercise, with low PA defined as doing 1 hour of exercise ≤ 2 times per week.	Age, gender and family affluence scale.	Type of relationship with mother or father was not related to odds of having a low PA score.
Ammouri et al 2007[124]	300 youth aged 10−19 years, recruited from a youth outpatient clinic at a hospital in a large US mid-western city.	Parents were asked about the frequency (per week) they did strenuous, moderate and mild exercise. Youth were asked about their level of attachment to parent(s).	Youth PA was assessed using a checklist which asked the number of times spent doing each PA in a typical week.	Age, BMI, ethnicity, depression, perceived health status, environmental opportunities and screen time.	Relationship with parents associated with PA in girls ($p < 0.05$) but not in boys. Parental exercise was not related to PA in youth ($p > 0.05$).
Hohepa et al 2007[144]	3471 students, aged 12−18 years, from 7 low SES decile high schools in	Students rated the level of encouragement for PA (5-point scale) provided	Students reported frequency of active transport to school, and	Sex, ethnicity.	Low parental support was associated with reduced odds of being active after school, but

	South Auckland, NZ.	by their mother and father	rated their level of PA at lunch time and after school, in the last 5 school days.		not with lunchtime activity or active transport to school.
Wilson & Dollman 2007[143]	180 male students, mean age 13.6 years, at a single-sex private school in Adelaide, South Australia.	Students rated the support they received from parents with regard to help, encouragement, playing with student and parental PA.	Students recalled the main PA in each 30-minute block over the previous 3 days.	Not stated.	Help by both parents, but particularly the father, was associated with increased PA in students ($p < 0.05$). Parental activity was not associated consistently with student PA.

Appendix K: Cohort studies investigating the relationship between family environment and physical activity (PA) in children

Paper	Subjects	Baseline assessment of family/ parental behaviour	Follow-up assessment of child physical activity	Confounders adjusted for	Main outcomes
Yang et al 1996[153]	1881 boys and girls, recruited into a national cardiovascular risk study in Finland, aged 9−15 years at baseline, followed for 12 years by 3-yearly interviews.	Parents' PA measured by a single question: "How much do you engage in physical activities?"	PA and involvement in sport measured by questionnaire with 5 dimensions, which were combined into a single PA index.	None stated	Father's baseline PA level was correlated ($p < 0.05$) with PA by boys, while both father's and mother's baseline PA level was correlated ($p < 0.05$) throughout the 12-year follow-up period with PA levels of girls aged 9−12 years at baseline.
Trost et al 1997[145]	202 students, median age of 11 years at baseline, from single school in rural South Carolina, followed for 1 year (USA).	Students rated the PA habits of their parents in a single-item question for each.	PA during 24 hours prior to interview was recalled by students.	Race, socioeconomic barriers to PA, community sports (such as PE).	Mother's perceived baseline PA related ($p < 0.05$) to vigorous PA 1 year later in girls, but not in boys. Father's baseline PA not related ($p > 0.05$) to child's PA 1 year later.
DiLorenzo et al 1998[146]	111 children, mean age 11 years at baseline, from 2 randomly selected schools in a Midwestern community, followed for 3 years (USA).	Mothers reported the frequency of their PA at baseline.	Children recorded the time (minutes) and intensity of a range of PAs during the 3 days prior to interview.	Not stated.	Baseline PA level of mother not related to PA level in children after 3 years follow-up.
Sallis et al 1999[147]	732 4th-grade students, mean age 9.5 years at baseline, from 7 suburban public schools in California, followed for 20 months (USA).	Parents reported their frequency of mild, moderate and strenuous PA in a typical week; and their support of PA by their child (do PA with child, encourage child	PA was summarised at baseline in 4th grade, and at follow-up in 5th grade, from 3 measures: 1-day recall by child on 2 days; 1-day accelerometer; parental recall of child's PA	Age, school and baseline physical activity level (and gender-specific).	Transporting children to sport or place to do PA was significantly associated with increased PA at follow-up in both girls and boys.

		to do PA, transport child to sport).	over 1 day.		
Bois et al 2005[154]	152 children, mean age 9.5 years, from 3 small French cities followed for 1 year.	Parents recalled their frequency of doing common PAs over the previous 7 days. Time spent doing activities was summed into a single PA score.	Children recalled their frequency of doing common PAs over the previous 7 days. Time spent doing activities was summed into a single PA score.	Child's age and sex, parent and child assessment of child's competence to do PA.	Mother's baseline PA level, but not father's, predicted the child's PA level after 1 year of follow-up; while father's baseline perception of child's PA competence (but not mother's) predicted child's PA level.
Iannotti et al 2005[148]	351 preschool children from low- to middle-income families in San Diego, 165 of whom were followed for 13 years from ages 4 to 17 years (USA).	At each interview wave, mother's PA was assessed by their recall of time spent in moderate and vigorous PAs during previous 7 days.	Child's PA was assessed by direct observation during ages 4−6, and by recall by the child of time spent in moderate and vigorous PAs during the previous 7 days for ages 11−17 years.	Not stated.	No association between PA by mother and child, at the same point in time, or over time, except for waves 8 and 11 at ages 12 and 16 years ($p < 0.05$). These may be false positive associations that arose because of multiple comparisons. Overall, the authors concluded there was little evidence of a direct causal relationship for PA by mother and child.
Davison et al 2006[149] (sample same as part of Davison et al 2003)[156]	174 non-Hispanic white 9-year-old girls living with both biological parents, recruited with flyers and adverts in Pennsylvania, and followed for 2 years (USA).	Parents completed self-report questionnaires that measured logistic support for PA.	Interviewer collected 2 measures of girls' PA from questions on inclination towards activity and participation in organised sports. Three measures combined into a single summary PA score.	Girls' perceived athletic competence.	Baseline parental support at age 9 years predicted child's PA level at age 11 ($p < 0.01$).
Dowda et al 2007[150]	421 girls, mean age 13.6 years at baseline in 8th grade, followed up in 9th and 12th grade, at	Girls rated family support for PA, which was assessed by a summary score from 5	Girls recalled their PA over the 3 days prior to interview in grades 8, 9 and 12; converted to	Race, perceived behavioural control of PA by girl, and self-efficacy	Family support for PA was significantly associated with an increase in PA as girls progressed from grade 8 to

	schools in South Carolina, USA.	items on the weekly frequency family members: encouraged PA, participated in PA with the girl, provided transport for PA, watched girl participated in PA, or told girl PA was good for her.	METs.		grade 12 ($p < 0.001$).
Duncan et al 2007[151]	371 youth aged 12−17 years, recruited from 58 urban neighbourhoods in the US Pacific Northwest by random-digit dialling, followed for 4 years.	Parents asked how many days, in a typical week, they did PA long enough to work up a sweat. Youth asked the extent to which their parents provided information, and emotional and physical support for PA.	PA by youth was measured annually for 4 years at home using a 7-day record and pedometer worn for 7 days.	Race, sex BMI, physical maturation, parental marital status, household income, peer PA and social support.	Parental factors were not related to youth PA ($p > 0.05$).
Ornelas et al 2007[152]	13,246 youth, in grades 7−12, from 80 randomly sampled US schools (National Longitudinal Study of Adolescent Health), followed for 1 year.	At baseline, students rated the cohesion of their family, level of parental monitoring, communication with their parent, and parental engagement for 6 activities, including playing sports.	PA by youth was measured at 1 year follow-up using a 7-day recall of the frequency of common activities.	Age, race/ethnicity, immigrant generation, family structure, number of siblings, and parent education.	Family cohesion, parent−child communication, and parental engagement (including with other activities besides PA), were each associated with increased PA levels in both male and female students ($p < 0.001$).

Appendix L: Intervention studies investigating the relationship between family environment and physical activity (PA) in children

Paper	Subjects	Methods: design & intervention	Assessment of child physical activity	Confounders adjusted for	Main outcomes
McGarvey et al 2004[155]	186 mothers, and 1 child for each aged 2−4 years at baseline, recruited from 2 Women, Infants & Children (WIC) centres in North Virginia, followed for 12 months (USA).	Mothers attended the WIC centres for group education sessions every 2 months, and individual nutrition sessions every 6 months (control exposure). In addition, mothers at the intervention centre received additional education on 6 key messages, which included increasing their PA, and increasing family PA.	Mothers reported the frequency of engaging in active play with their child in the last 7 days, at baseline and at 12 months follow-up.	Language, and other activity variables: family activity level and watching TV while eating.	Frequency of engaging in active play with the child was significantly increased in the intervention group compared with control ($p = 0.009$), but there was no difference in the change in family activity level between intervention and control ($p > 0.05$).

Appendix M. Methods

Goal of the Scientific Committee
The goal of the Scientific Committee is to provide New Zealand nutrition and physical activity practitioners with practical evidence summaries about issues of interest to Agencies for Nutrition Action (ANA) member organisations.

Topic identification
This topic was identified by the Scientific Committee in consultation with the Chair and the Executive Officer of ANA. The proposed topic was considered to be relevant to ANA and its member organisations, and to reflect the professional expertise of members of the Scientific Committee. Discussion was also held with the Ministry of Health, the Health Sponsorship Council and other agencies about suitable topics, and this topic was endorsed.

Literature identification
Initial discussions by the Scientific Committee and the Executive Officer covered the potential questions and issues that should be incorporated into this report.

A precise and specific search of the literature was conducted using key words such as: Family; AND Motor activity (this is all forms of physical activity); or Food; or Food habits; or Food Preferences; or Diet; or Nutrition Assessment; or Nutrition surveys; or Obesity. A full list of search terms is available on request. Searches were conducted using the following electronic databases and websites: (i) Medline, (ii) PsychInfo, (iii) DARE database (includes a database of abstracts of reviews of effects, a National Health Service economic evaluation database and the Health Technology Assessment database), (iv) HDA evidence base, (v) Ministry of Health website, (vi) NHMRC website, (vii) NICE website, (viii) Research Findings Register and (ix) the Campbell Collaboration. All databases and websites were searched for papers published from January 1996 to July 2007, an arbitrary starting point to make the analyses manageable. Only English-language references and human studies were included.

Data handling process
Each member of the Scientific Committee then reviewed the title and abstract of each of the 475 identified references for relevance. Studies, commentaries and reviews were included if they addressed one of the review questions:

A. What is the context of the family food and activity environment in New Zealand?
B. Is the “family food environment” associated with food habits or behaviours, and if so, how?
C. Is the “family activity environment” associated with physical activity, and if so, how?

Of the 475 article abstracts, 179 were found to be potentially relevant by the members of the Scientific Committee, and so these articles were retrieved for further consideration.

Due to the extended period of this project, a number of other strategies were used to identify potentially relevant papers while the work was ongoing. Consideration of papers up until April 2008 from reference lists, specific literature searches for papers recommended by colleagues and new research released were rich sources of new information. The initial search strategy was narrow in its year range and a number of papers were therefore not picked up. It is good practice to source literature using as many methods as possible, and this was reflected in the extra papers that were included for further consideration using this mix of methods.

Assessment of papers

The initial 179 papers were separated into three groups based on the research question addressed by the paper. Scientific Committee members were allocated specific research questions (RQ – question 1; RB – question 2; and RS – question 3), and so relevant groups of papers were sent to each member to critically appraise for relevance and quality. Where a paper was found to be equally relevant to multiple questions, the paper and critical appraisal were shared with the other relevant member(s). There was no blinding of authorship of retrieved papers.

A critical appraisal form based on the Scientific Advisory Committee's form used in the ANA breakfast review[157] was used in this review. The original form was based on the NHMRC tools for assessing individual studies and the Health Development Agency tool for assessing reviews and systematic reviews. The appraisal form included questions relating to the type of study, populations studied, methods used, and the strengths and weaknesses of each study type. Each member made a sole decision about whether a document should inform the report or be discarded.

Data were extracted into tables for ease of use, and split by type of study methodology, capturing such information as author, year, subjects, methods (and length of follow-up if appropriate), definitions, confounders adjusted for, and main results.

Writing the report

An initial draft of the report was produced by all three members, with members taking specific research questions to write. The appraisal form recorded which questions of interest each article covered, allowing the writing of the report to be easily split up in this way. Drafts of each section and subsequent amendments were circulated among all members, and written and verbal comments (at teleconferences) were incorporated into subsequent drafts. Wording in the final summary statements was informed by the World Cancer Research Fund's evidence judgement criteria and the members' own judgement. The words, in order of significance, that have been chosen to reflect the consistency, strength and quality of evidence, and the number of studies for each research question, are: considerable, reasonable, possible, insufficient. The report was sent for external review.

All authors contributed to the review process and writing of the report, and all members of the Scientific Committee have final responsibility for the report.

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