REPORT

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Children and healthy eating: a systematic review of barriers and facilitators

Evidence for Policy and Practice
Information and Co-ordinating Centre

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NB This version of the report contains some amendments to section 5.2.1 compared to the version originally published. The findings and conclusions are unchanged, however.

A searchable database which includes the studies reviewed in this report will be available on the EPPI-Centre website (http://eppi.ioe.ac.uk).

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PREFACE

Scope of this report

This report describes the methods and findings of a systematic review of research relevant to the barriers to, and facilitators of, healthy eating amongst children aged four to 10 years old. This review was commissioned by the Department of Health (England) to provide practitioners, policy-makers and researchers with a summary of evidence to help them plan interventions for children that are likely to be effective in bringing about sustainable behaviour change, and to identify future research needs.

The review examines the number, types and quality attributes of existing research studies. It synthesises the findings of a sub-set of these studies to assess what helps and what stops children eating fruit and vegetables. There are three main syntheses in this review: 1) a statistical meta-analysis of studies which attempt to increase children's consumption of fruit and vegetables; 2) a thematic qualitative synthesis of studies focused on children's views of healthy eating; and 3) a 'cross-study synthesis' which uses the results of 2) in order to interpret the findings of 1).

The policy and practice implications of the findings of the review are discussed and recommendations for future interventions, development and research are made.

There are many useful messages in this work for policy-makers, commissioners, practitioners and researchers who have a remit to promote or conduct research on healthy eating amongst children. The key messages of this review may particularly help:

- policy-makers by highlighting where current policy relevant to promoting healthy eating amongst children is supported by research evidence and where there are contradictions or gaps;

- health authorities and other services to assess the evidence-base for delivering to children the preventive aspects of the National Service Framework for Coronary Heart Disease;

- schools, Local Education Authorities and health services involved in achieving the National Healthy School Standard for healthy eating; to advise schools on which school-based interventions can be effective in promoting fruit and vegetables (and which interventions are ineffective or harmful and which do not yet have evidence of effectiveness); and

- services to support the NHS's commitment to involving the public in the development and delivery of services.

How to read this report

Because this review is a *systematic* review, using explicit and rigorous methods to synthesise the evidence in this topic area, the report is necessarily detailed. Complexity and length have also been increased because the review synthesises evidence from 'qualitative' research together with experimental evaluations of interventions, something which most systematic reviews do not do. Some readers will be interested in the whole review to get an overall picture of, not only the findings of the review, but also how we came to those findings. Others will want to be directed to the parts most relevant to their needs.

As a quick guide, readers who want ***detailed information on effective interventions and how to implement these*** (e.g. practitioners, service commissioners, policy specialists) may be most interested in chapter five and in chapter seven which illustrates whether/how these interventions match children's views on the barriers to, and facilitators of, their healthy eating.

Readers interested in ***details of the views of children on healthy eating and how it might be promoted*** (e.g. practitioners, service commissioners, policy specialist, researchers) may be most interested in reading chapter six and chapter seven. chapter six describes the findings of studies that elicit children's views, while chapter seven compares children's views on healthy eating to the kinds of approaches for promoting fruit and vegetable consumption that have been evaluated.

Readers wanting ***guidance on the kinds of interventions they should be developing and testing further and why*** (e.g. practitioners, service commissioners, policy specialists, researchers, research commissioners) may be most interested in reading chapters seven, eight and nine. Chapter eight contains a discussion of how the findings of the review relate to current policy and practice in the promotion of fruit and vegetable consumption. Examples of healthy eating interventions not covered in the in-depth review can be found in chapter three.

Readers interested in ***guidance on how best to evaluate the effectiveness of interventions to promote fruit and vegetables*** may be most interested in section 8.4.1 of chapter eight, and those whose concern is ***how best to involve children in the development of interventions*** will find section 8.4.2 of chapter eight particularly relevant.

Readers whose brief includes ***details of the amount and quality*** of research conducted on the topic of children and healthy eating (e.g. researchers, research commissioners) may be most interested in chapters three, five and six.

Finally, ***details about the methods used in this systematic review*** are given in chapters two and four, with a reflection on the methods used in chapter eight and additional detail in the appendices.

EXECUTIVE SUMMARY

Background and aims

Healthy eating is encouraged amongst children in the belief that they will benefit from the long term physiological consequences of a good diet in childhood, and that healthy eating in childhood is more likely to lead to healthy eating later in life. An over-consumption of energy-dense foods has been linked with obesity, and the proportion of children classed as obese is rising. Diets high in fruit and vegetables have been associated with reductions in a range of diseases including certain cancers, cardiovascular heart disease, hypertension and tooth decay. Recent surveys have found that British children are eating less than half the recommended five portions of fruit and vegetables per day. There is evidence to suggest that material and social context affect children's intake, with children living in low-income households eating less fruit and vegetables than those living in high-income households.

This report describes a systematic review aiming to survey what is known about the barriers to, and facilitators of, healthy eating amongst children aged four to 10 years old. It focuses in particular on barriers and facilitators in relation to fruit and vegetables. It is the second of two reviews concerned with children aged four to ten years; the first focused on physical activity. This review also advances systematic review methodology. It is the first systematic review (as far as we are aware) to integrate, in a rigorous and systematic way, the findings of a statistical meta-analysis with the findings from a synthesis of qualitative research. These methodological advances provide a much more trustworthy basis for policy-making, avoiding the partial picture likely to be revealed by relying on syntheses of any one type of research in isolation.

Methods

We carried out the review in two stages: a mapping and quality screening exercise which described the characteristics of all the relevant research we identified; and an in-depth review synthesizing the findings of a particular sub-set of studies. The review was restricted to studies focused on children aged four to 10 years old, and to those studies published in the English language. We sought evaluations of the effects of interventions to promote healthy eating amongst children ('outcome evaluations') carried out in any country from around the world. We also sought 'non-intervention' research aiming to describe factors influencing healthy eating amongst children in the UK; evaluations looking at the processes involved in implementing interventions ('process evaluations'); and previous systematic reviews. Literature searches of multiple sources were undertaken to identify such research.

The narrower focus of the in-depth review, chosen in consultation with users of research, was on the barriers to, and facilitators of, children's consumption of fruit and vegetables. We therefore only reviewed in-depth intervention studies that had measured fruit and vegetable outcomes. There was also an interest in including studies that had examined children's own perspectives on food and eating to assess how these might illuminate fruit and vegetable barriers and facilitators. Statistical

meta-analysis was used to pool the effect sizes from outcome evaluations (supported by specialist software developed at the EPPI-Centre) and qualitative analysis techniques were used to synthesise the findings of studies of children's views (supported by the specialist software NVivo). A final stage of the in-depth review involved a cross-study synthesis to integrate the findings from the two types of studies.

Findings

The searches produced a substantial amount of potentially relevant literature – 660 full text reports were retrieved after screening 9947 titles and abstracts. After screening full reports, a total of 272 reports of 193 separate studies were available for inclusion in the mapping exercise.

Results of the mapping exercise

The majority of the 193 studies were outcome evaluations (n=141) carried out in 12 different countries (15 were from the UK). Thirty-three UK non-intervention studies were also identified, alongside nine process only evaluations, which were all carried out in the USA. Most of the studies focused on children in general (n=120) rather than more specific groups such as those from families on a low income or ethnic minorities; and focused on other aspects of healthy eating (n=138) rather than fruit and vegetables. We also identified 10 systematic reviews. None of these had the same population and topic scope as this review.

Forty-one studies met the inclusion criteria for in-depth review: eight studies of children's or parents' views and 33 outcome evaluations.

Synthesis of effectiveness findings from outcome evaluations

Three of the 33 outcome evaluations studied interventions to encourage children to try unfamiliar fruit and vegetables. Of the 30 which studied interventions to increase children's consumption of any fruit and vegetables, 19 were entered into a statistical meta-analysis (11 were excluded on the grounds that methodological problems meant that their findings could not be relied on).

The types of interventions evaluated by these studies were largely school-based, and often combined learning about the health benefits of fruit and vegetables with 'hands-on' experience in the form of food preparation and taste-testing. The majority targeted parents and/or involved them in intervention delivery alongside teachers and health promotion practitioners. Some included environmental modification involving, for example, changes to the foods provided at school. Some interventions targeted more than one outcome (for example, fruit and vegetable consumption, fat intake, knowledge, self-efficacy, Body Mass Index (BMI) and physical activity).

The results of the meta-analysis revealed that these kinds of interventions have a small, but significant positive effect. Pooled estimates from the nineteen studies suggest that implementation of these interventions will, on average, increase children's fruit intake by one-fifth of a portion per day and their vegetable intake by a

little less then one-fifth of a portion per day. These are averages though, and different interventions produced different effects. Bigger effects are associated with targeted interventions for parents with risk factors for cardiovascular disease (increasing fruit and vegetable intake by almost two portions) and with those interventions which do not 'dilute' their focus on fruit and vegetables by trying to promote physical activity or other forms of healthy eating (for example, reduced intake of sodium and fat) in the same intervention (effects sizes were three times higher in these studies). Single component interventions, such as classroom lessons alone or providing fruit only tuck shops, were not effective.

Two main messages emerged from the findings of studies that conducted integral process evaluations: promoting healthy eating can be an integral and acceptable component of the school curriculum; and effective implementation in schools requires skills, time and support from a wide range of people.

The results of the meta-analysis suggest that it is easier to increase children's consumption of fruit than vegetables. Three outcome evaluations studied interventions that attempted to address children's apparent greater dislike for vegetables by 'exposing them' to new or previously disliked vegetables. Their results revealed that it is possible to get children to try these vegetables (although allowing them a choice appears to be more effective than enforcing or rewarding this behaviour), but it is unclear whether such strategies would lead to increases in children's everyday consumption of vegetables.

Synthesis of children's views studies

Children were able to provide valuable insights into their perspectives on food, eating and healthy eating. Looking for barriers and facilitators within these perspectives led to the emergence of six main contextual issues which any programmes to promote healthy eating amongst children need to consider: (1) children do not see it as their role to be interested in health; (2) children do not see messages about future health as personally relevant or credible; (3) fruit, vegetables and confectionery have very different meanings for children; (4) children actively seek ways to exercise their own choices with regard to food; (5) children value eating as a social occasion; and (6) children see the contradiction between what is promoted in theory and what adults provide in practice. Nine implications for appropriate interventions for promoting fruit and vegetables to children were derived from these themes. Implications ranged from simple strategies such as 'branding fruit and vegetables as tasty rather healthy' or 'do not promote fruit and vegetables in the same way' to more challenging strategies such as ' make health messages relevant and credible to children' and 'create situations for children to have ownership over their food choices'.

These findings were generated from eight studies involving 1091 children (aged five to 11 years old) and 92 mothers living in Scotland or England (the south, middle and north). Children from families of both lower and higher socio-economic status were represented, but the representation of children from ethnic minority groups was unclear. Three of the eight studies were judged to be of a poorer quality, meeting six or less of the 12 criteria used to assess their quality. We decided not to exclude these studies, however. When we checked, their findings did not contradict those from studies of a higher quality. However, these studies had very little to contribute to the synthesis.

Cross-study synthesis

Our chosen methods for combining qualitative and quantitative studies in our cross study synthesis compared interventions studied by sound or other outcome evaluations to the nine implications for appropriate interventions derived from studies of children's views. This process revealed a number of matches, mismatches and gaps. When there were sufficient numbers of sound studies evaluating interventions with components matching children views, a meta-analysis was conducted in order to explore whether these interventions led to bigger effects than studies evaluating interventions which did not match.

Of those interventions with components matching children's views, some were clearly effective, some were unclear in their effects, but none were ineffective or harmful. Those interventions which led to bigger increases in fruit and/or vegetables consumed included one or more of the following components which matched children's views: the promotion of fruit and vegetables in separate interventions or in different ways within the same intervention; a reduction in the emphasis on health messages; or the promotion of fruit and vegetables in educational materials accompanied by access to fruit and vegetables. However, the effectiveness of interventions with the following components matching children's views is unclear, and further evaluation is required: branding fruit and vegetables as exciting or child-relevant products; and encouraging situations for children to express choice.

Gaps between evaluated interventions and children's views revealed the following opportunities for developing and evaluating innovative interventions based on children's views. These included: branding fruit and vegetables as 'tasty' rather than 'healthy'; creating opportunities for children to influence the social context in which they eat; and making health messages credible for children.

Conclusions

Our review has uncovered a relatively solid evidence-base for informing policy and practice for the promotion of fruit and vegetables to children aged four to 10. Pooling the findings from good quality trials indicated that interventions can have a small, but significant positive effect, increasing children's fruit intake by one-fifth of a portion per day and their vegetable intake by nearly one-fifth of a portion per day. Assessing the significance of these effects requires their translation into estimates of health gain and clinical significance together with their potential savings for health care services. Our synthesis of effectiveness research has indicated the types of interventions and their components which lead to larger or smaller effects (e.g. those which targeted families at high risk for cardiovascular disease had higher effect sizes; those intervention which diluted their focus on fruit and vegetables by trying to promote physical activity or other forms of healthy eating tended to have lower effect sizes).

Clear implications regarding the development of appropriate interventions were derived from studies eliciting children's own perspectives on food, eating and healthy eating. Moreover, within our cross-study synthesis we found a relationship between what children say is important and intervention effectiveness. We were able to use these findings to identify further intervention components that lead to larger effects (e.g. interventions which did not emphasise the health benefits of fruit and

vegetables showed larger effects than those which did). These patterns in effectiveness form the basis of our recommendations for policy and practice.

Our cross study synthesis also highlighted a number of promising directions for the future development and testing of interventions to promote fruit and vegetables. In particular, there is scope to explore the effect of interventions which brand fruit and vegetables as being tasty rather than healthy and in creating opportunities for children to influence the social context in which they eat. Additionally, one challenging implication calls for health messages to be made relevant and credible for children. Future evaluations need to involve researchers, practitioners, children and their parents working in partnership, and employ rigorous evaluation methods.

There remains, however, a weakness within the evidence-base regarding inequalities in health. Whilst the studies we identified for this review included children from diverse groups (e.g. ethnic minority groups and children from areas of social and economic deprivation), the studies had little to say about reducing health inequalities. None set out to evaluate the impact of interventions in reducing inequalities in this area, or reported their data in such a way as to enable others to evaluate this (i.e. results were not reported according to different sub-groups of children). This is an area that needs to be taken forward in any future research agenda on this topic.

AIMS

The aims of the review were:

- to undertake a *systematic mapping* of research undertaken on the barriers to, and facilitators of, healthy eating amongst children;
- to select a sub-set of studies to review *in-depth* in collaboration with our steering group;
- to *synthesise* what is known from these studies about barriers to, and facilitators of, healthy eating among children;
- to identify gaps in existing research evidence.

This review was preceded by a similar review in the area of physical activity. These two reviews build on, and extend, a recently completed series of reviews on the barriers to, and facilitators of, physical activity, healthy eating and good mental health amongst young people. The reviews have all been undertaken within the health promotion stream of work at the Evidence for Policy and Practice Information and Co-ordinating Centre (EPPI-Centre) at the Social Science Research Unit, Institute of Education, University of London.

In addition to producing substantive findings, these reviews also aim to advance methodology for integrating diverse study types, including 'qualitative' research, within systematic reviews of social interventions. A framework for achieving this was developed within the recently completed series (Harden *et al.*, 2001b; Rees *et al.*, 2001; Shepherd *et al.*, 2001), building on our previous attempts to include non-experimental studies in systematic reviews (Harden *et al.*, 2001a; Oliver and Peersman, 2001). This framework was applied and refined in the review on physical activity and developed further within this systematic review.

All of this work builds on our earlier advances in systematic review methods for examining the evidence base for the effectiveness of health promotion (Oakley *et al.*, 1996b; Peersman *et al.*, 1998; Peersman *et al.*, 1996), see also (France-Dawson *et al.*, 1994; Oakley and Fullerton, 1994; Oakley and Fullerton, 1995; Oakley *et al.*, 1995a; Oakley *et al.*, 1995b; Oakley *et al.*, 1995c; Oakley *et al.*, 1994a; Oakley *et al.*, 1994b).

1. BACKGROUND

Outline of Chapter

This chapter sets out the context for this systematic review. In addition, it lays out the scope and approach taken in the review. This chapter will therefore be of interest to ***all readers*** *of this report.*

Key Messages

- *Definitions of healthy eating vary, although emphasis on a balanced diet is common. Recommendations may include increasing bread, cereals, potatoes, fruit and vegetables, with moderate amounts of dairy products and meat, and little fat or salt.*
- *Diets high in fruit and vegetables are associated with reduced cancers, cardiovascular heart disease, blood pressure and tooth decay.*
- *Increasing prevalence of obesity and children's poor eating patterns in the UK justify attempts to encourage children to adopt long term healthy eating habits and attain long term physiological benefits.*
- *Recent UK policy initiatives make healthy eating a key component for reaching specific targets in preventing chronic disease.*
- *A range of programmes aim to encourage healthy eating amongst children; some of these focus specifically on increasing fruit and vegetable consumption.*
- *Research on the barriers to, and facilitators of, healthy eating amongst children is extensive. This systematic review was therefore carried out in two stages: a descriptive mapping of all relevant research, and an in-depth review of a sub-set of studies.*
- *Commissioners and potential users of this review prioritised for in-depth review: UK studies which seek descriptions from children, and their parents and carers, of what helps children to eat healthily and what stops them from doing this; and high quality studies evaluating the effects of interventions that aim to increase fruit and vegetable consumption.*

1.1 Why promote children's healthy eating?

1.1.1 What is healthy eating?

The subject of healthy eating is a contested – and sometimes political – area. There are many competing views and, since it has such a high political profile at present, each pronouncement from 'experts' is subjected to more intense media scrutiny than would have been the case a generation ago. A quick search on the World Wide Web reveals hundreds of sites offering advice on healthy eating – some of it conflicting – and the results of research evidence are not always easy to interpret.

Definitions of healthy eating vary, but an emphasis on achieving the right balance of different foods is a common component. Recommendations from the Health Education Authority (HEA) (Health Education Authority, 1995) suggest eating increased amounts of bread, cereals, potatoes, fruit and vegetables, and moderate amounts of milk and dairy foods, meat fish and alternatives. Roe *et al*. (1997, p. 16) define healthy eating as 'a diet reduced in fat or salt; or increased in starchy foods, fruits or vegetables'. Fruit and vegetables have been singled out as an important component of a healthy diet for all age groups. It is recommended that at least five portions of a variety of fruit and vegetables should be eaten per day. One portion of fruit is, for example, half a large grapefruit, or a slice of melon, or two satsumas. One portion of dried fruit counts (1 portion = for example 3 dried apricots, or 1 tablespoon of raisins), but other types of fruit and vegetables should be eaten to meet the rest of the 5 A DAY target. (http://www.doh.gov.uk/fiveaday/portions.htm).

1.1.2 Benefits of healthy eating

The disease prevention benefits associated with 'healthy eating' provide an important impetus for its promotion amongst children. An international consensus has emerged linking diets high in fruit and vegetables with reductions in a range of diseases including certain cancers, cardiovascular heart disease, hypertension and tooth decay (World Health Organization, 2003). In summarising the situation regarding cancer, the UK Government report, Our Healthier Nation, states that 'research suggests that a third of all cancers are the result of a poor diet' (Department of Health, 1998: paragraph 2.19). This concern is shared internationally and the World Health Organisation (WHO) stated recently that reduction in cancers of the oral cavity, oesophagus, stomach and colorectum might all be reduced by observing a diet with sufficient quantities of fruit and vegetables (World Health Organization, 2003). In addition, increased fruit and vegetable consumption in childhood may help to prevent problems in adulthood. For example, studies have shown that increasing fruit and vegetable intake may be associated with reduced blood pressure, improved management of diabetes, delayed cataract development, and improved bowel function, and may impact on recommendations to increase fibre and reduce fat intake (Cox *et al*., 1998; Department of Health and COMA, 1994; Department of Health and COMA, 1998; John *et al*., 2002; Taylor *et al*., 1995).

Preventing or reducing obesity provides another reason to promote healthy eating amongst children. A number of studies have found that the proportion of obese children in high-income countries has risen sharply (Chinn and Rona, 2001; Rudolf *et al*., 2001).The WHO has expressed concern that the increase in 'passive over consumption' of highly processed energy-dense foods is at least partially responsible for the increase in obesity and recommends a higher intake of energy-dilute foods (i.e. vegetables and fruits) and wholegrain cereals to help to combat this. In the UK however, the impetus for increasing consumption of fruit and vegetables has been their role in protecting against disease rather than preventing obesity. Whilst research has demonstrated an association between obesity and diets low in fruit and vegetables, it is not clear that a low consumption of these foods is actually a cause of obesity.

1.1.3 Eating patterns amongst children in the UK

In June 2000 the National Diet and Nutrition Survey of Young People was published (Department of Health, 2000a). Its main findings were that, on average, British children were eating less than half the recommended five portions of fruit and vegetables per day, that one in five, four to 18 year olds did not eat any fruit during the week of the study and that children from low-income households consumed significantly less fruit and vegetables than those from high-income households.

The Health Survey for England 2001 (Doyle and Hosfield, 2003) portrayed a similar picture with children eating fewer servings of fruit and vegetables per day than adults. This survey found virtually no difference in consumption between boys and girls with both eating, on average, 2.7 portions per day. Eleven percent of children aged between five and nine years old had eaten five portions during the day before the interviews; 15 percent of those aged five to 15 had consumed less than one portion during the previous day. This survey also found that children living in low-income households ate less fruit and vegetables than those living in high-income households.

1.1.4 Why is promoting healthy eating in children a priority?

Promoting healthy eating amongst children is a logical response to research evidence about the prevalence of disease related to poor diet. Healthy eating is encouraged amongst children in the belief that they will benefit from the long-term physiological consequences of a good diet in childhood, and that healthy eating in childhood is more likely to lead to healthy eating later in life.

1.2 Current policy relevant to children and healthy eating

1.2.1 Overall policy framework in the UK

Our Healthier Nation, the government's strategy for health (Department of Health, 1998) set the aim to reduce the risk from chronic and preventable disease and the promotion of positive health across all population groups. 'Saving Lives', which came out a year later (Department of Health, 1999b), set specific targets for the prevention of chronic disease from cancer, coronary heart disease, stroke, accidents and mental illness. Healthy eating is central to these targets: a good diet can play a significant role in reducing the risk of coronary heart disease, cancer, stroke and diabetes, as well as promoting an overall sense of well-being.

The importance of nutrition was re-affirmed in 2000 with the publication of the NHS Plan (Department of Health, 2000d). Priorities for nutrition included emphasis on increased consumption of a variety of fruits and vegetables, specifically promoting consumption of at least five portions a day; tackling some of the consequences of poverty through ensuring that pregnant women, mothers and young children in low income groups have access to healthy foods; collaboration between the Department of Health and the food catering industries to increase the provision of healthy foods (e.g. establishing local food co-operatives), as well as recommendations to food

manufacturers to provide an overall balance in diet, including reductions in the use of salt and sugar in collaboration with the Food Standards Agency.

The promotion of healthy eating has therefore been firmly embedded within more specific policy documents concerning different aspects of the NHS such as the NHS Cancer Plan (Department of Health, 2000c) and the National Service Frameworks (NSF) on Coronary Heart Disease (CHD) (Department of Health, 2000b) and Diabetes (Department of Health, 2001). For example the NSFCHD set out service standards for health authorities for treatment and prevention, including initiatives to promote healthy eating. By April 2001 all NHS bodies in collaboration with local authorities should have agreed, and be contributing towards, a local programme of effective policies on promoting healthy eating, physical activity, reducing overweight and obesity, as well as reducing the prevalence of smoking.

Underpinning all of the above is the need to tackle health inequalities, in recognition of evidence that the homeless, the unemployed, the abused, the chronically ill and ethnic minorities, amongst others, are all at elevated risk of ill-health (Acheson, 1998). For example, Standard one of the National Service Framework for Coronary Heart Disease aims to reduce the risk of the prevalence of coronary risk factors in the population, and reduce inequalities in these risk factors (Department of Health, 2000b).

Specific programmes to arise out of this overall policy framework are therefore especially tailored towards establishing healthy eating patterns through environmental changes and/or tackling risk factors arising from inequalities. In recognition that tackling health inequalities goes beyond the remit of single agencies, many of these involve cross agency working at both national and local levels. Examples of these are detailed below.

1.2.2 Examples of specific programmes in the UK

Examples of programmes to help ensure that children are able to eat healthily that have been rolled out nationally or are currently undergoing piloting include:

- As part of the '5 A DAY' Programme, the 'National School Fruit Scheme' aims to entitle all four to six year old children attending state schools (around 2.5 million children) to a free piece of fruit every school day. The scheme has thus far been provided to approximately 800,000 children in areas of greatest need within England.

- A further series of local '5 A DAY' initiatives focus more specifically on increasing fruit and vegetable consumption amongst children. Components of this programme include:

    1. Community '5 A DAY' pilots, which took place in five disadvantaged areas across England. Community agencies and groups worked collaboratively on a range of activities to explore the feasibility of promoting fruit and vegetables in their locality.
    2. In conjunction with a National Lottery Distributor and the New Opportunities Fund, the Department of Health is offering grants for evidence based community-wide projects, which raise awareness of

the benefits of eating fruit and vegetables and test approaches to improving access to and increasing consumption of fruits and vegetables.

- The 'Healthy Schools Programme' and the 'National Healthy School Standard' run jointly by the Department for Education and Employment (DfEE) and the Department of Health (DoH) (Department for Education and Employment, 1999) and managed by the Health Development Agency (HDA) encourage schools to provide education about nutrition within the curriculum supported by the provision of healthy school meals and snacks.

- The 'Food in Schools (FiS) Programme' aims to support the National School Fruit Scheme and the National Healthy School Standard by encouraging healthy eating via curriculum and extra-curricular activities. Announced in 2001 as a joint venture between the DH and the Department for Education and Skills (DfES), the FiS Programme has provided £2.2m to fund a range of demonstration projects with the aim of bringing together all food-related initiatives in schools to assist them in developing sustainable programmes to promote healthy eating in children. The FiS Programme includes the following:

    1. Compulsory regulations stating minimum standards for school lunches stipulating that at least two items from the following should be available every day during lunch: starchy foods (bread, potatoes, pasta); vegetables and fruit; milk and dairy foods; meat, fish and alternative sources of protein (non-dairy) (Department for Education and Employment, 2000).
    2. The DfEE/DoH 'Cooking for Kids' initiative, launched in 1999 in association with the Food Foundation, the Royal Society of Arts and Food Federation, aims to teach practical cookery skills to school pupils (in years 6 and 7), making use of facilities outside of school hours. Celebrity chefs visit schools all over England to emphasise the benefits of healthy eating and that cooking can be fun.
    3. 'Breakfast Clubs' which are open an hour before school, provide foods such as cereal, toast and fruit juice and are located in community or school settings to ensure that children and young people eat before going to school.

- Recent reforms to the 'Welfare Foods Scheme (WFS)' aims to provide more access to fruits and vegetables to children living in poverty, through more effective resource use.

1.3 Using research to inform policy and practice

The purpose of a systematic review such as this one is to disentangle the debates and prejudices occupying a particular field from the research evidence in order to enable policy makers and practitioners to make informed decisions about competing claims. Some research is better than other research and therefore the reviewing process needs to be able to come to a judgement regarding the reliability of each study and its ability to answer the question at hand.

Systematic reviews have been used to examine whether programmes such as the ones described above are effective. For example, questions about the effectiveness of the National School Fruit Scheme could include: will a scheme which provides children with one portion of fruit a day increase fruit consumption outside the classroom?; or will children's acceptance of fruit be enhanced by their exposure to it, or will the fact that it is given free of charge in some way diminish its value to them?

This systematic review aims to go beyond addressing effectiveness questions to provide a synthesis of research on what is known about the barriers to, and facilitators of, healthy eating among children. The policy initiatives above indicate a wide range of factors that are thought to prevent children from eating healthily (barriers) or which help children to eat healthily (facilitators). For example, within the documentation describing the '5 A Day' programme, two main barriers to eating more fruit and vegetables are identified: access/availability and attitudes/awareness.

Research can help to illuminate such barriers and facilitators, addressing issues such as 'which facilitators are most important for which groups of children in which contexts?' and 'if interventions address barrier X, will children eat more healthily?' Research on barriers and facilitators can fall into one of two broad 'types':

- Studies aiming to describe the factors influencing children's healthy eating either positively or negatively; and

- Studies evaluating the effectiveness and appropriateness of interventions designed to promote children's healthy eating.

Examples of studies in the first category are those which examine factors (e.g. age, social class, gender, attitudes) associated with healthy eating amongst children, and studies whose aim is to explain *how* these factors are related – for example, some may impact on healthy eating directly, and others may play a mediating role. Many of these studies examine children's or parents' views about what affects healthy eating. Relevant research designs range from large-scale surveys and epidemiological analyses of large datasets, to 'qualitative' studies examining views through in-depth interviews or focus groups, or even illuminative techniques such as the 'draw and write' method (MacGregor *et al.*, 1998; McWhirter *et al.*, 2000).

A number of previous systematic reviews in the area of healthy eating have included a focus on interventions with children, though there are none specifically focused on increasing fruit and vegetable consumption. The review by Ciliska *et al.* (2000), did have a focus on interventions to increase fruit and vegetable consumption, although the population focus was broader than just children. McArthur (1998) and Resnicow and Robinson (1997) both undertook reviews of school-based interventions with a focus on cardiovascular disease prevention. The reviews by Lytle (1994) and Contento *et al.* (1992) also reviewed studies concerning school-aged children but the focus was nutrition in general. Hursti and Sjödén (1997) reviewed intervention studies that aimed to change food habits in children and adolescents. The focus of a review by White *et al.* (1998) was the promotion of healthy eating amongst minority ethnic groups. Other reviews have focused on weight loss and weight gain amongst youth (Fulton *et al.*, 2001) and childhood obesity (NHS Centre for Reviews and Dissemination, 2002).

1.4 Some notes on research with children

Examining the views of research participants and service-users is crucial in the genesis of policy- and practice-relevant research findings (see e.g. Mayall and Foster, 1989; Oliver, 1997). The NHS is committed to considering the views of the public in the development and delivery of services (Department of Health, 1999a). As health is shaped by specific social, cultural and economic factors which need to be understood within the specific context of children's everyday lives, the most effective and appropriate strategies for promoting children's health are only likely to be developed when children's own views are considered (Brannen *et al.*, 1994; Moore and Kindness, 1998; Peersman, 1996; Shucksmith and Hendry, 1998). Hence the need to develop ways of understanding the sociology of childhood and child-relevant public policy based on the experiences of children themselves (McKendrick *et al.*, 2000), and across different sectors, for example home and school, traditionally separated in adult discourse about children (Edwards, 2001).

Research with, and for, children, especially young children, raises specific ethical and methodological issues. Traditionally, research has been done 'on' children, in line with a view of what is in the children's 'best interests'. Judgements about their best interests, for instance children's welfare, are not usually based on asking them what they want or need, but on what other people consider to be the case (Oakley, 1993). Hood and colleagues (1996) similarly note the 'welfarist' or 'developmental' underpinnings of research 'on' children, highlighting how children are predominantly constituted as a 'social problem', with the role of adults being defined as protecting and controlling them (Hood *et al.,* 1996: p. 119). The distinction between research 'with' or 'for', rather than 'on', children has only very recently been made. The emergence of a 'sociology of childhood' (see e.g. Mayall, 2002) has led to new ways of thinking about research with children, challenging researchers to undertake research with children in the light of the same principles of respect they would use in working with other social groups.

Children constitute a social minority group, and childhood is a socially constructed category (James and Prout, 1997). Children, like other people, are able to contribute meaningful research data; their views or actions should not be judged in terms of how these compare with some normative or 'adultist' perspective. Hood and colleagues (1996: p. 119) outline what they see as the implications of this for conducting research with children when the researcher(s) is/are adults. They argue that research with children should involve 'listening attentively to their agendas, and participating with them in the research process' and that research should be done explicitly 'for' children, as 'in the end the justification for the research – for 'collecting the data' - is to help make children heard'. Following ethical and methodological principles for research 'with' children means that: the research should be fully explained to children; attention should be paid to acknowledging and minimising the power relationships arising from differences in age, class, ethnicity and gender between the researcher and children; the researcher should avoid relating to children in the role of 'mother' or 'father'; and steps should be taken to guard against the exploitation of the 'pseudo-friendships' between researchers and children which can develop during research (Oakley, 1993).

How do such ideals actually translate into the practice of conducting research? Asking children for their consent still appears to be the exception rather than the rule, even though researchers in the 1970s demonstrated how children could consent to

research meaningfully following careful explanations of what the research is about (see e.g. Alderson, 1990; Lewis *et al.*, 1978). Mauthner (1997) describes the dilemmas, and some of the solutions, arising in several areas of research involving children. Negotiating a private context for researchers to work with children can often be problematic, as parents or teachers sometimes do not share the same view of a child's right to privacy. Hood and colleagues (1996) and Alderson and Goodey (1996) document similar issues in their research. Hood and colleagues (1996: p. 127) draw attention to the 'gate keeping' role of adults in allowing researchers access to children; while 'adults gave priority to adult duty to protect children from outsiders; this took precedence over children's right to participate in the decision to talk with [researchers]'. Mauthner (1997) describes several strategies which can be useful in minimising unequal power relationships: allowing children flexibility in terms of what they talk about; encouraging children to describe their lives through story-telling (rather than in question and answer format); using focus groups made up of groups of friends to mimic as much as possible how children usually interact; and encouraging children to engage with, and voice opinions about, the research process.

These examples highlight the experience researchers are gaining in conducting research with children. The challenges arise across a range of study designs, including surveys and statistical analyses (Qvortup and Christoffersen, 1990). The underlying issue is reframing the world to be researched *from the perspectives of children themselves* (Mayall *et al*., 1996). The current review attempts to assess research with children on healthy eating according to some of the principles of good practice suggested above. In her (1995) report produced for Barnardos, *Listening to Children*, Alderson presents a list of ten topics to consider when conducting or evaluating research with children. These topics, framed as questions, include: can parents be present or absent as the child prefers?; who is included in, and who is excluded from, the research (for example, have some children been excluded because of speech or learning difficulties?); have children or their carers helped to plan or comment on the research?; do researchers explain the project and encourage children to ask questions?; do children know that if they refuse or withdraw from the research this will not be held against them in any way?; and do the researchers try to draw unbiased conclusions from the evidence, or do they simply use the data to support their own views?

Where parents or carers provide data on behalf of children, it is important to consider the extent to which children's perspectives are likely to have been taken into account. For example, research conducted in the ESRC's Children 5-16 Programme has highlighted differences between parents' and children's perspectives on such issues as perceptions of risk (Scott, 2000) and priorities for urban renewal (O'Brien *et al*., 2000). This is a difficult methodological area, but an important one to consider when reviewing 'qualitative' research where privileging the subjective experience of the researched is often presented as a key criterion of quality and trustworthiness.

1.5 Review questions and approach

Previous systematic reviews within health promotion carried out at the EPPI-Centre and elsewhere have tended to uncover large amounts of research to be considered for inclusion in the review (see e.g. Peersman *et al.*, 1998; Tilford *et al.*, 1997). This is partly as a result of improvements in searching techniques (Harden *et al.*, 1999). However, another important reason is that the questions of interest to health promotion tend to be very broad and encompass a wide-range of possible interventions, health topics and outcomes. Many systematic reviews in other areas of health care address much narrower questions, for example, focusing on the effects of one narrowly defined intervention on one particular outcome. Whilst this ensures that the reviewers' tasks are manageable within given time and resource constraints, it also means that it is much more difficult to piece together the results of narrow reviews to illuminate broader questions (Oliver *et al.*, 1999). There is therefore a dilemma in balancing the need for reviews of health promotion to address broad questions against the need to ensure manageable workloads. The dilemma is solved by following recommendations for a two-stage commissioning process for systematic reviews in health promotion (see Peersman *et al.*, 1999). The review described in this report was carried out in two stages: a **mapping and quality screening exercise**; followed by an **in-depth review** of a sub-set of studies, chosen according to policy and practice needs.

Broad searches were carried out to identify as much as possible of all existing relevant research. This research was then described according to a standardised strategy. Following the mapping of the broad area of research a sub-set of studies were selected for inclusion in an in-depth review. The selection of studies for in-depth review was informed by the EPPI-Centre health promotion Steering Group; a panel with representation from the commissioners of the review, the policy and practitioner community, and other researchers specialising in either children's health or systematic reviews. This panel prioritised the need for evidence relating to increasing fruit and vegetable intake.

Thus our initial review questions about healthy eating were focused more narrowly on fruit and vegetable intake to read:

1. Which interventions to promote healthy eating amongst children aged four to ten are effective for increasing fruit and vegetable intake?

2. Which barriers do they target and which facilitators do they build on?

3. What experiences/ideas do children and their parents have about what helps and what stop them from eating fruit and vegetables?

4. To what extent do interventions build on these experiences/ ideas?

5. What do the above suggest for developing effective and appropriate interventions to be tested in the future?

Two pools of studies were identified for the in-depth review, those presenting children's views on fruit and vegetables, and those presenting evaluations of interventions with a fruit and vegetable component. Three syntheses were then

conducted, the first to examine what children said about fruit and vegetables and indications of the barriers and facilitators to eating fruit and vegetables. The second synthesis was a meta-analysis of the impact of interventions on fruit and vegetable outcomes. Lastly a cross-study synthesis was conducted to examine how well the interventions discussed in the evaluations sat with what children were saying about fruit and vegetables.

1.6 Methodological developments

This series of systematic reviews of health promotion in physical activity and healthy eating for children and young people by the EPPI-Centre have provided a focus for methodological developments. Previous reviews have applied systematic review methods to studies of people's views (Harden *et al*., in preparation) and show the emergence of a framework for integrating different types of evidence in systematic reviews for public policy (Oliver *et al*., in preparation).

This review makes other noteworthy methodological advances. The use of statistical meta-analysis signifies a development in terms of being the first attempt at the EPPI-Centre to apply statistical meta-analysis to a whole field of health promotion policy. The use of commercially available software to support the synthesis of findings from non-experimental studies has increased the systematic nature and transparency of this work. The combination of statistical meta-analysis with a qualitative synthesis within the same document further demonstrates important progress within the field of systematic reviews.

2. METHODS

Outline of Chapter

This chapter describes the methods used in the review. It was carried out in two broad stages:

- *An initial mapping exercise to describe the range of studies available and relevant to illuminating the barriers to, and facilitators of, healthy eating amongst children.*
- *An in-depth review focusing on a sub-set of these studies, chosen in consultation with a range of potential users of the review.*

The mapping exercise *was carried out in three stages: (i) defining the scope of the mapping and developing inclusion and exclusion criteria; (ii) identifying studies falling within that scope; and (iii) describing these studies. Two broad types of studies were included:*

- *evaluations of health promotion interventions ('intervention studies') aimed at promoting healthy eating among children; and*
- *other types of studies ('non-intervention studies' e.g. cohort studies, surveys) examining barriers and facilitators relating to children's healthy eating.*

While intervention studies carried out in any country are included in the review, we restricted non-intervention studies to those reporting UK research.

Consultation with policy-makers, practitioners, and researchers suggested that the in-depth review should focus on barriers to, and facilitators of, fruit and vegetable consumption. We therefore only reviewed in-depth intervention studies that had measured fruit and vegetable outcomes (outcome evaluations). There was also an interest in including studies that had examined children's views and experiences of healthy eating to assess how these might illuminate fruit and vegetable barriers and facilitators.

The in-depth review *was carried out in three stages for each study type respectively: (i) application of inclusion and exclusion criteria; (ii) data extraction and quality assessment; and iii) synthesising the findings of studies. Statistical meta-analysis was used to pool the effect sizes from outcome evaluations and qualitative analysis techniques were used to synthesise the findings of studies of children's views.*

A final stage of the in-depth review involved a cross-study synthesis to integrate the findings from outcome evaluations with the findings from studies of children's views.

Readers who are primarily interested in the findings of the review may skip this chapter, but it might be of interest to:

- ***any readers*** *who want to check how the review was conducted; and*

- ***researchers*** *and* ***information specialists*** *or others interested in carrying out systematic reviews, especially those who want to read about how different types of research can be included in a systematic review, in particular research that is 'qualitative' in nature.*

2.1 Inclusion and exclusion criteria for mapping exercise

As noted earlier, this review of research on children's healthy eating is the second of two reviews concerning children. The first review focused on children's physical activity. Because it seemed likely that many studies would be common to the two review topics, the processes of developing criteria for including studies and identifying and classifying studies were run in tandem for the two reviews.

The scope of the mapping exercise was focused on research in three broad areas:

i) healthy eating or physical activity;

ii) generic and specific barriers to, or facilitators of, healthy eating or physical activity (e.g. socio-economic factors, structural factors, attitudes) or the promotion of positive health or prevention of ill-health; and

iii) children whose average age was between four and 10 years old.

In order to be considered relevant to the mapping exercise of the healthy eating review, a study had to:

i) evaluate a health promotion intervention aimed at promoting healthy eating ('intervention studies') or be a systematic review of such studies; or

ii) identify how various aspects of children's lives are associated with eating healthily, and/or report children's views and/or those of their parents/carers directly ('non-intervention studies' or systematic reviews of non-intervention studies).

We defined the scope of the mapping exercise further by study location and language of publication. While intervention studies were included regardless of their location, we decided to include non-intervention research only if it had been carried out in the UK. The review was also restricted to studies published in the English language. Unfortunately, we had insufficient resources to translate reports published in other languages.

A set of pre-defined exclusion criteria was developed to screen studies for inclusion in the mapping exercise of healthy eating research. The full set can be found in appendix A.

2.2 Identification of studies for mapping exercise

The validity of a systematic review is directly related to the comprehensiveness of its literature search (Mays and Pope, 1995). In addition to database searches, attempts were made to retrieve reports by hand searching journals, by searching reference lists, by contacting authors of included studies and by contacting key organisations involved in the promoting healthy eating or physical activity in the UK.

Systematic searches were conducted in six major databases and eight specialist registers (details are given in appendix B). A highly sensitive database search strategy using controlled vocabulary and free-text terms and combining three conceptual components (children; barriers and facilitators of health promotion; and healthy eating) was devised in MEDLINE and translated to other databases. Searches were conducted in November 2001.

Methodological filters for study design were not used, as these reduce the sensitivity of searches (Harden *et al.*, 1999; Kahn *et al.*, 2001).

The following journals were handsearched: *Education and Health* (from 1983 issue 1 to 2002 issue 2), *Health Education Quarterly* (from 1981 volume 8 to 1996 volume 23). This title continued as *Health Education and Behaviour* (searched from 1997, volume 24(1) to 2002 volume 29(4)).

Bibliographies of relevant studies were scanned. The authors of these studies were also contacted, where possible, and asked for additional reports. Contacts were also made with UK organisations such as the Health Development Agency.

All citations identified by the above searches were downloaded into an EndNote database and scanned for relevance against the review's exclusion criteria.

The above strategy was devised so as to identify a range of different types of studies and publications, within our time and resource limits. Databases were selected in order to cover a range of disciplines: health care, education, social sciences, psychology and health promotion. It was anticipated that the specialist registers and contact with authors and organisations would help to identify unpublished studies and those published outside of journals.

2.3 Classification of studies for mapping exercise

Full reports of relevant studies were obtained and classified according to a standardised keywording system developed by the EPPI-Centre (Peersman and Oliver, 1997). This classifies reports in terms of the type of study (e.g. outcome evaluation, survey, case control study); the country where the study was carried out; the health focus of the study; the study population; and, for reports describing or evaluating interventions, the intervention site, intervention provider and intervention type.

In order to gain a more detailed description, reports went on to be classified according to an additional standardised keywording system which was developed specifically for this review. This keywording system (details of which can be obtained from the EPPI-Centre on request) characterised reports in terms of their topic area, the context and characteristics of children in the study, research design and methodological attributes, and the type of outcomes measured (when relevant).

2.4 From mapping to in-depth review

The mapping exercise identified many studies relevant to identifying barriers to, and facilitators of, healthy eating. This provided a basis for selecting the most appropriate types of studies to include in the in-depth review. We took advice on how to focus the in-depth review from the EPPI-Centre's health promotion Steering Group.

Recognising the policy interest in fruit and vegetables as an important component of a healthy diet, only intervention studies that measured fruit and vegetable outcomes (e.g. knowledge about fruit and/or vegetables; fruit and/or vegetable intake) were included in the in-depth review. A focus on fruit and vegetables would not exclude outcome evaluations that also measured other outcomes of interest such as a reduction in the consumption of high fat and high salt snack foods. However, these outcomes would be of secondary importance since the purpose of much fruit and vegetable promotion is disease prevention due to the special properties of fruit and vegetables and does not necessarily involve a reduction in fat or sugar.

Further decisions about the inclusion of outcome evaluations were made regarding their evaluation design. It was decided that we should only include those studies that employed a control or comparison group. These designs are more reliable for assessing the effects of interventions.

Of the 'non-intervention' studies included in our map, there was an interest in focusing on those which *sought children's own views as to what helps them to eat healthily/or what hinders this,* rather than inferring their experiences through the eyes of researchers. Because of the young age of some of the children studied in this review, studies seeking the views of parents or carers were also considered. We took the further decision to restrict studies of children's views by publication date and location, because the main strength of such studies lies in their ability to describe the specific contextual factors influencing children at a certain point in time and in a certain location. In this case, the interest is in the UK since 1990.

For each study type in turn, the methods used to review them in-depth are described in the remainder of this chapter, with further detail in Appendices C and D.

2.5 In-depth review methods for outcome evaluations

2.5.1 Inclusion and exclusion criteria

Two reviewers independently screened outcome evaluations, and any process evaluations linked to them. Studies were excluded if they:

- Did not measure outcomes on fruit and vegetable intake or other fruit and vegetable related outcomes (e.g. knowledge, attitudes to, intentions for, eating fruit and vegetables).

- Did not employ a control or comparison group.

All remaining outcome evaluations went on to the quality assessment and data extraction phase of the review. Integral process evaluations also went on to the data extraction phase of the review. These did not, however, undergo any quality assessment.

2.5.2 Data extraction and quality assessment

A standardised framework was used to extract data on the development and content of the intervention evaluated, the populations involved, the design, implementation, and quality of the outcome evaluation; and the details of any integral process evaluation (Peersman *et al.*, 1997). Reviewers also used this framework to record authors and their own conclusions about the effects of the intervention.

The procedures and criteria used for assessing methodological quality built on those described in previous EPPI-Centre health promotion reviews (see e.g. Oakley *et al.*, 1996a; Peersman *et al.*, 1998; Peersman *et al.*, 1996). We used four 'core' methodological criteria to divide the outcome evaluations *initially* into two broad groups: 'sound' and 'not sound'. 'Sound' outcome evaluations were those deemed to meet the four criteria of:

(i) providing pre-intervention data for all individuals in each group. (An exception was made for those studies using the Solomon four-group design (Campbell and Stanley, 1966), in which intervention and control/comparison groups are further randomised to receive pre-intervention surveys or not, since this means that the usual range of pre-intervention data is not available for half the participants in each group.)

(ii) providing post-intervention data for each group.

(iii) reporting findings for each outcome measure indicated in the aims of the study; and

(iv) employing a control/comparison group equivalent to the intervention group on socio-demographic and outcome variables.

Recognising that these criteria a) only capture some of the known sources of bias in outcome evaluations; b) do not distinguish between randomised and non-randomised trials; and c) do not distinguish between quality of method and quality of reporting, reviewers could further categorise studies as ‘sound despite not meeting the four ‘core’ criteria’ and ‘meets the four core criteria but still has methodological problems’. Situations in which reviewers applied the former category included studies in which full pre-intervention data were not presented, but in which authors had either stated that there were no differences between the groups, or that any baseline differences had been accounted for when the data were analysed. Situations in which reviewers applied the latter category included cases where there had been problems with data collection which compromised the integrity of the study’s findings.

As a result of this detailed consideration of methodological quality, reviewers judged each study to be of ‘high’ methodological quality, ‘medium’ methodological quality or ‘not sound’.

To accommodate the inconsistent and incomplete reporting of quantitative data from controlled trials, our specialised software, EPPI-reviewer, was adapted to calculate effect sizes from a minimum of available data, both from trials comparing individuals and from trials comparing groups of individuals (e.g. classes or schools). For further information on the calculation of effect sizes see appendix C.

All of the above procedures were carried out by two reviewers independently who then met to compare their findings. Disagreements were resolved through discussion.

2.5.3 Synthesis of findings

Statistical methods were employed to pool the results of the outcome evaluations. Studies addressing the same outcomes were identified (knowledge, attitudes, behavioural measures) and, if statistical tests revealed no significant heterogeneity, their data were pooled and an overall effect size calculated.

We predicted that heterogeneity may result from differences in study type (Randomised Controlled Trial (RCT), Controlled Trial (CT)); study quality (high / medium / four criteria for soundness); study population (sex, country, age); setting of intervention (classroom, school, home, community); type of intervention (fruit and vegetable promotion, healthy eating + fruit and vegetable promotion, fruit and vegetables + other promotion); type of intervention (education, 'hands-on' component). Where statistical tests confirmed the presence of heterogeneity, each of the predicted causes of this heterogeneity were explored in turn in order to comment on the appropriateness of pooling studies and the trustworthiness of the findings. Further details on the methods used for statistical meta-analysis can be found in appendix C.

In addition to pooling effect sizes, the differences between studies were compared on a standardised scale in order to evaluate the relative effectiveness of each study.

2.6 In-depth review methods for studies of children's views

2.6.1 Inclusion and exclusion criteria

Two reviewers screened all UK non-intervention studies identified in the mapping exercise independently. These studies were excluded if they:

(i) did not report on children's or parents'/carers' views about fruit and vegetables;

(ii) did not privilege children's or parents'/carers' views. 'Privileging' here means that children's or parents' views are presented directly as data that are valuable and interesting in themselves, rather than solely as a route to generating variables to be tested in a predictive or causal model.

(iii) were published in or before 1990;

(iv) did not report at least some information on all of the following: the research

question; procedures for collecting data; how these captured the phenomenon under study; sampling and recruitment; and at least two sample characteristics.

2.6.2 Data extraction and quality assessment

All studies not excluded on the above criteria were examined in-depth. A standardised data extraction and quality assessment framework was used (EPPI-Centre, 2002). This had been developed and piloted in a previous EPPI-Centre review of peer-delivered health promotion for young people (Harden *et al.*, 2001a), and a series of reviews examining the barriers to, and facilitators of, mental health, healthy eating and physical activity in young people (Harden *et al.,* 2001b; Rees *et al.,* 2001; Shepherd *et al.,* 2001). This tool was supplemented with an additional standardised data extraction framework developed specifically for this review (and available on request from the EPPI-Centre). Together, these tools enabled reviewers to extract data on many methodological and substantive details of studies, including the findings.

The procedures and the criteria used for assessing methodological quality built on those used in the earlier EPPI-Centre reviews cited above. Studies were assessed according to 12 criteria. These criteria were informed by those proposed for assessing the quality of 'qualitative' research (Boulton *et al.*, 1996; Cobb and Hagemaster, 1987; Mays and Pope, 1995; Medical Sociology Group, 1996) and by principles of good practice for conducting social research with children (Alderson, 1995).

The 12 criteria covered three main quality issues. Five related to the quality of the *reporting* of a study's aims, context, rationale, methods and findings. Each study was assessed according to whether:

(i) the aims and objectives were clearly reported;

(ii) there was an adequate description of the context in which the research was carried out (including a rationale for why the study was undertaken);

(iii) there was an adequate description of the sample used and the methods for how the sample was identified and recruited;

(iv) there was an adequate description of the methods used to collect data; and

(v) there was adequate description of the methods used to analyse data.

A further four criteria related to the sufficiency of the *strategies* employed to establish the reliability and validity of data collection tools and methods of analysis, and hence the validity of the findings. Each study was assessed according to whether there had been: 'some attempt'; a 'good attempt'; or 'no attempt' to establish the following:

(vi) the reliability of data collection tools;

(vii) the validity of data collection tools;

(viii) the reliability of the data analysis methods; and

(ix) the validity of data analysis methods.

The final three criteria related to the assessment of the *appropriateness* of the study methods for ensuring that findings about the barriers to, and facilitators of, healthy eating were rooted in children's own perspectives. In relation to this, reviewers were asked to judge studies according to whether they:

(x) used appropriate data collection methods for helping children to express their views;

(xi) used appropriate methods for ensuring the data analysis was grounded in the views of children; and

(xii) actively involved children in the design and conduct of the study.

Taken together, these 12 criteria provide a measure of the extent to which we can be confident that a particular study's findings can make a valuable contribution to this review.

Two researchers carried out all the procedures in this section independently, and then met to compare their assessments and resolve any differences.

2.6.3 Synthesis of findings

The findings and conclusions of each study were copied verbatim as reported by study authors into the review-specific data extraction tool described above. This tool asked reviewers to group findings according to their ability to illuminate the following questions:

(i) What are children's perceptions of and attitudes towards healthy eating?

(ii) What do children think stops them from eating healthily?

(iii) What do children think helps them to eat healthily?

(iv) What ideas do children have for what could or should be done to promote their healthy eating?

The study findings and conclusions within each of these groups were exported to NVivo (Version 2.0) from QSR Software, a specialist software package for undertaking qualitative analysis of textual data.

Three of the review authors (JT, AH and KS) carried out the synthesis, meeting on a total of six occasions (for periods of between two and five hours) over a three-week period. Synthesis methods broadly followed guidelines for thematic analysis of textual data collected in the context of primary research. In this case the textual data were study authors' descriptions of their findings. Further details on the methods for this synthesis can be found in appendix D.

2.7 Cross-study synthesis

A methodological and conceptual matrix developed in earlier reviews was used to juxtapose the findings of views studies against the findings of 'outcome' studies. Three questions guided the cross-study synthesis:

(i) Which interventions promoting an increase in children's consumption of fruit and vegetables match recommendations derived from children's views and experiences of healthy eating?

(ii) Do those interventions which match children's views show bigger effect sizes in their evaluations and/or explain heterogeneity between studies than those which do not?

(iii) Which recommendations derived from children's views have yet to be addressed by interventions evaluated by outcome studies?

The products of the synthesis of the findings of children's views studies (the implications for interventions organized by analytical theme and associated barriers and facilitators) were used as the starting point for the cross-study synthesis. These were listed in the left-hand column of the conceptual and methodological matrix. Three of the review authors (JT, AH and KS) took each intervention implication derived from children's views in turn and tried to match them to interventions evaluated by the outcome studies. Matching interventions were sought from our pool of high or medium quality outcome evaluations first of all. If no or few matches were found, matching interventions were sought from our pool of other outcome evaluations of a lower methodological quality. Matches and gaps were noted in the right hand columns of the matrix.

When a sufficient number of matches were found within a particular cell in the matrix, effect sizes of the outcome studies were combined statistically. The combined effect size was then compared to the effect sizes derived from the original statistical meta-analysis. These results are presented in both a statistical and narrative form.

It is worth noting that this might appear to run counter to the more orthodox philosophy which requires that statistical methods and choices of categorical variables should be stated well in advance of any analysis. On the other hand, a more interpretive, inductive approach demands that such categories cannot be pre-specified. The method used in this review combines the two approaches, stating that a limited number of issues would be explored statistically and that they would be derived from the results of the qualitative synthesis of the findings of children's views studies. Only once the results from the qualitative synthesis were complete and the categories set was the cross-study synthesis begun. Thus, at the commencement of the statistical component of the cross-study synthesis, the categorical codes that were to be used to create sub-sets for meta-analysis were already set and could not be changed once the cross-study synthesis was underway.

3. RESULTS: IDENTIFICATION AND DESCRIPTION OF STUDIES

Outline of Chapter

This chapter presents:

- *a description of the flow of studies through different stages of the review, including brief details of the studies eventually excluded from the in-depth review;*
- *a detailed description of the outcome evaluations that met our inclusion criteria for the in-depth review; and*
- *a detailed description of the studies of children's views that met our inclusion criteria for the in-depth review*

A searchable database of all the studies identified for this review is available on-line at http://eppi.ioe.ac.uk.

This chapter will be of interest to:

- ***researchers** or **commissioners of research** wishing to set an agenda for future inquiry, or considering conducting a similar mapping exercise.*
- ***practitioners, policy specialists** and **children/families** interested in the types of research conducted.*

Key Messages

- *One-hundred and ninety-three separate studies were identified for our mapping exercise. The majority of these were: outcome evaluations (n=141); focused on children in general (n=120) rather than more specific groups such as those from families on a low income or ethnic minorities; and focused on other aspects of healthy eating (n=138) rather than fruit and vegetables.*

- *Forty-one studies met the inclusion criteria for in-depth review: eight studies of children's or parent's views and 33 outcome evaluations.*

- *Across the 33 outcome evaluations, at least 23,720 children participated. The largest number of outcome evaluations were from the USA, although eight were from the UK.*

- *The majority of interventions evaluated by the outcome studies were school-based and delivered by teachers. Only three studies evaluated interventions which had been implemented as a result of consultation with children themselves.*

- *Across the eight studies of children's views, at least 1091 children and 92 mothers were surveyed in studies conducted in the North and South of England, the Midlands and Scotland. No studies conducted in Northern Ireland or Wales were identified.*

- *In reports of studies of children's views, the only characteristics of the participating children consistently reported were age; details of social class and sex were less commonly reported and ethnicity of the children is largely unknown.*

3.1 Overall flow of literature through the review

Figure 3.1 overleaf describes the flow of literature through each stage of the review. Our exhaustive searches of bibliographic databases identified a total of 9947 citations. After removing duplicates (n=1735), 7574 of these were excluded. The majority of these (n=4907) were excluded because their main focus was not healthy eating. A small number (n=19) were excluded because they were citations for reports not published in the English language. Together with reports identified through hand searching, scanning bibliographies and contacting authors, 710 reports had been identified as being potentially relevant for inclusion in the review. Full reports were obtained and processed for 660 (94 percent) of these within the time scale for this review. After screening of the full reports had taken place a further 392 were excluded from the review. At this stage, the major reasons for excluding full reports were because they did not focus on the right age group (n=111) or they did not describe a piece of primary research or a systematic review of primary research (n=134). A total of 272 reports of 193 separate studies were available for inclusion in the mapping exercise.

3.2 Characteristics of studies in the mapping exercise

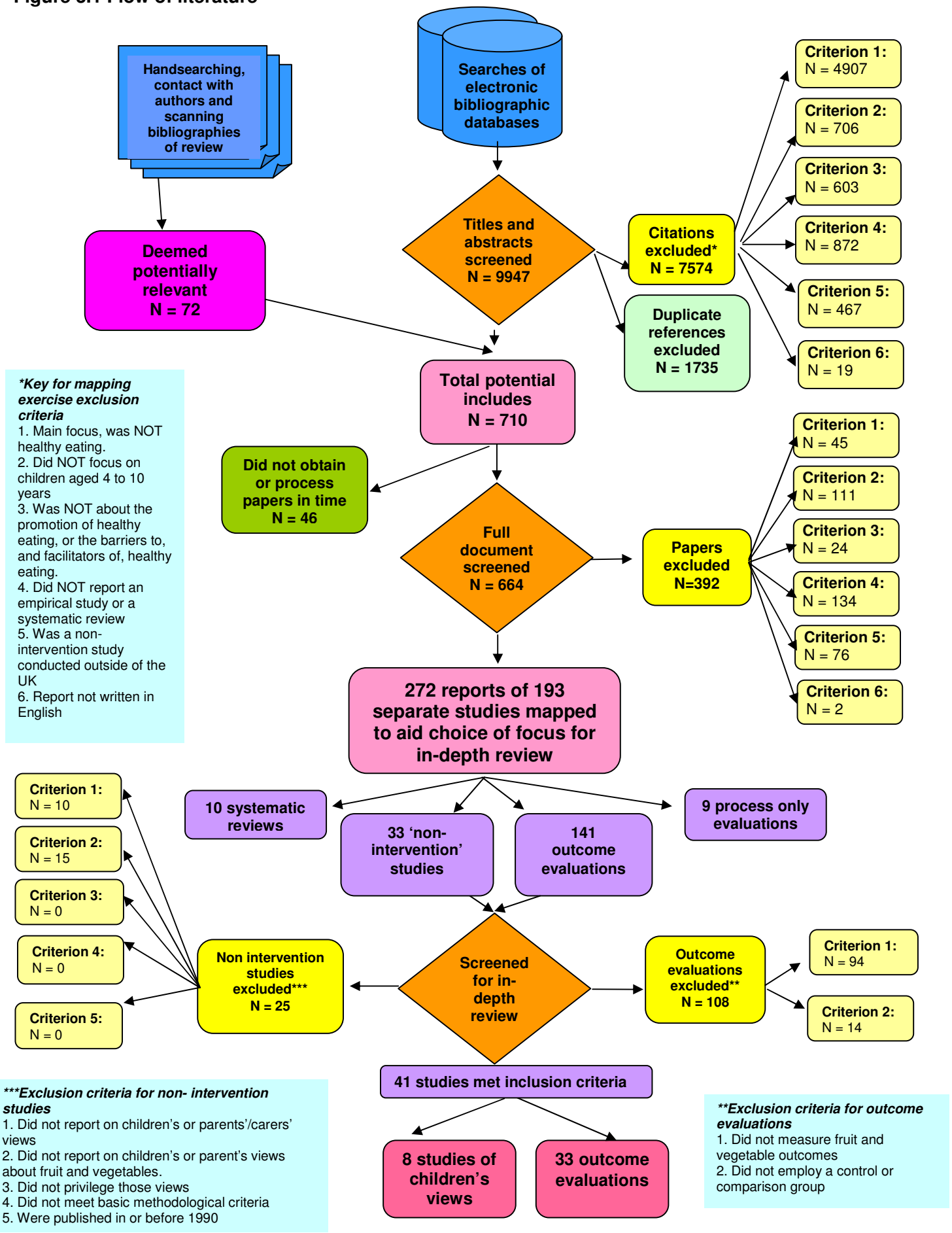
Of the 193 studies, 10 were potentially systematic reviews of a high quality; 141 were outcome evaluations; nine were process only evaluations; and 33 were UK non-intervention studies (Figure 3.1).

3.2.1 Systematic reviews

a) Scope of reviews

The reviews we identified did not have the same population and topic scope as this review. No review focused solely on children: seven reviews included studies focused on young people as well as children (Contento *et al.*, 1992; Fulton *et al.*, 2001; Glenny and O'Meara, 1997; Hursti and Sjödén, 1997; Lytle, 1994; McArthur, 1998; Resnicow and Robinson, 1997) and a further three also included studies focused on adults (Cliska *et al.,* 2000; Roe *et al.,* 1997; White *et al.,* 1998). There were several differences in topic scope across the reviews. Four authors located their reviews in the context of either obesity prevention (Fulton *et al.,* 2001; Glenny and O'Meara, 1997) or cardiovascular disease prevention (McArthur, 1998; Resnicow and Robinson, 1997). Five authors described their reviews as focused on interventions for either nutrition education (Contento *et al.,* 1992; Lytle, 1994) or healthy eating (Hursti and Sjoden, 1997; Roe *et al.,* 1997; White *et al., 1998)*. The authors of one review focused specifically on the effectiveness of interventions for promoting fruit and vegetables (Ciliska *et al.,* 2000). The population foci of this review were adults and young people as well as children.

Figure 3.1 Flow of literature



Key for mapping exercise exclusion criteria
1. Main focus, was NOT healthy eating.
2. Did NOT focus on children aged 4 to 10 years
3. Was NOT about the promotion of healthy eating, or the barriers to, and facilitators of, healthy eating.
4. Did NOT report an empirical study or a systematic review
5. Was a non-intervention study conducted outside of the UK
6. Report not written in English

Exclusion criteria for non- intervention studies
1. Did not report on children's or parents'/carers' views
2. Did not report on children's or parent's views about fruit and vegetables.
3. Did not privilege those views
4. Did not meet basic methodological criteria
5. Were published in or before 1990

****Exclusion criteria for outcome evaluations***
1. Did not measure fruit and vegetable outcomes
2. Did not employ a control or comparison group

b) Reporting quality and methods

Only half of the reviews (n=5) were judged as showing all four of the quality markers that they had been assessed against (clearly stated aims, inclusion criteria, search strategy, and quality assessment methods) (Ciliska *et al.,* 2000; Contento *et al.,* 1992; McArthur, 1998; Resnicow and Robinson, 1997; White *et al.,* 1998). Two reviews undertook statistical meta-analysis to pool the effect sizes from intervention studies (McArthur, 1998; Resnicow and Robinson, 1997). None of the reviews included 'qualitative' or other types of research.

3.2.2 Outcome evaluations

a) Country and children studied

The majority of outcome evaluations were conducted in the USA, although we did identify 15 studies conducted in the UK (table 3.1).

Table 3.1: Outcome evaluations in the mapping exercise (N=141) according to country

	N
Australia	8
Canada	3
Germany	2
Ireland	2
Italy	2
UK	15
USA	104
Other*	5
Total	141

*Greece; Israel; Pakistan; Spain; Taiwan

Table 3.2 shows the number of studies evaluating interventions targeted at different groups of children. The largest number of studies evaluated interventions targeted at children in general, although there were small numbers of studies with interventions targeted specifically at children from families on a low income (n=26) or those from ethnic minority groups (n=24). In thirteen of the studies, children from ethnic minority groups were also those from families on a low income (data not shown in table). The interventions in nine studies targeted children who were judged to show risk factors for disease.

Table 3.2: Groups of children targeted by interventions studied in the outcome evaluations in the mapping exercise (N=141)

	N
Children from families on a low income	26
Children from ethnic minority groups	24
Children from 'at risk' groups (e.g. overweight, elevated cholesterol level)	13
Children in general	93
Total*	156

**Total adds up to 156 rather than 141 as 15 studies evaluated interventions which targeted children belonging to more than one of the above groups.*

b) Outcomes measured and types of interventions

A broad range of outcomes was measured reflecting the breadth of 'healthy eating'. Table 3.3 shows these data. The most popular outcome measured across the studies was knowledge/ awareness relating to healthy eating (n=79). The next most popular outcomes were fat intake (n=53); attitudes//beliefs (n=50); fruit or vegetable intake (n=42); and physiological measures such as blood pressure or cholesterol level (n=48).

Table 3.3: Outcomes measured by outcome evaluations in the mapping exercise (N=141)

	N
Psycho-social outcomes	
Knowledge/awareness	79
Attitudes/beliefs	50
Intentions	9
Self-efficacy	20
Food intake	
Fat intake	53
Salt intake	21
Sugar intake	16
Fibre intake	12
Fruit or vegetable intake	42
Other intake	45

Table 3.3: Outcomes measured by outcome evaluations in the mapping exercise (N=141) (cont'd)

Other outcomes	**N**
Physiological measures	48
Structural outcome	5
Fiscal	0
Physical activity/sedentary behaviour	31
Other behaviours	11
Total*	442

**Total adds up to 442 rather than 141 as studies usually measured more than one outcome.*

The outcome studies evaluated a range of intervention types (table 3.4). Whilst nearly all the studies evaluated interventions which included an information giving or education component (n=135), it was rare for studies to evaluate interventions which relied solely on this intervention strategy (n=11, data not shown in table). Studies were more likely to evaluate interventions which combined information giving with one or more other components.

Table 3.4: Types of interventions evaluated by the outcome studies in the mapping exercise (N=141)

	N
Advice/counselling	14
Bio-feedback/screening	23
Environmental modification	37
Incentives	38
Information/education	135
Parent training	40
Physical activity	63
Professional training	36
Resource access	23
Service access	3
Skill development	58
Social support	3
Total*	473

**Total adds up to 473 rather than 141 as studies usually evaluated more than one intervention type*

c) Evaluation design

Table 3.5 shows the design of the outcome evaluations.

Table 3.5: The design of the outcome evaluations in the mapping exercise (N=141)

	N
Randomised controlled trial (RCT)	51
Controlled trial	52
Other design	37
Not stated	1
Total	141

One hundred and three studies employed a control group design; 51 of these were RCTs. Three of the 15 outcome evaluations carried out in the UK were RCTs and eight were controlled trials (data not shown in table). The design of one study was not stated, and the others employed one-group designs with post-test only or pre- and post-test assessment of outcomes.

3.2.3 Process evaluations

Twenty-eight of the 141 outcome evaluations also included an integral assessment of processes. Our mapping exercise identified an additional nine process only evaluations. All of these were conducted in the USA.

Without an assessment of outcomes, it is unclear what these studies are able to contribute to the evidence-base in the area of children and healthy eating.

3.2.4 UK non-intervention studies

a) Children studied

Table 3.6 shows the number of studies focused on different groups of children. In contrast to the outcome evaluations, nearly all studies focused on children in general rather than a more specific sub-group. While six studies focused on children from families on a low income, none focused specifically on children from ethnic minority groups.

Table 3.6: Groups of children focused on in the non-intervention studies in the mapping exercise (N=33)

	N
Children from families on a low income	6
Children from ethnic minority groups	0
Children from 'at risk' groups (e.g. overweight, elevated cholesterol level)	0
Children in general	27
Total	33

b) Focus

Studies focused on a number of different aspects of healthy eating (table 3.7). Thirteen studies had a specific focus on fruit and vegetables and smaller numbers of studies focused on salt, sugar or fat.

Table 3.7: Topic focus of non-intervention studies in the mapping exercise (N=33)

	N
Fruit and vegetables	13
Salt	2
Sugar	4
Fat	6
Other aspect of healthy eating	13
Healthy eating, not further specified	12
Total*	50

**Total adds up to 50 rather than 33 as 17 studies focused on more than one topic*

3.3 From mapping to in-depth review

Further details of all of the studies included in the map can be sought on-line at http:/eppi.ioe.ac.uk

The 141 outcome evaluations and the 33 UK non-intervention studies were screened for inclusion in the in-depth review (see figure 3.1).

The majority of the outcome evaluations (n=94) were excluded because they did not measure fruit and vegetable outcomes. A further 14 were excluded because they did not employ a control or comparison group as part of their evaluation design. Three of

these 14 were conducted in the UK (Edmunds, 2002; Lowe *et al.*, submitted for publication; Pearson *et al.*, 2002). The report by Lowe and colleagues (submitted for publication) described two separate studies. Only one of these was excluded from the in-depth review.

The non-intervention studies were also screened for inclusion in the in-depth review. Of these, 10 were excluded because they did not examine children's views or the views of their parents/carers. Examples of these 10 studies included a survey of teachers' views on school tuck shops (Curtis, 1988) and the influence of socio-demographic factors on the foods consumed by children at lunchtime and break-times at school (Bunting and Freeman, 1999). Another 15 were excluded because they did not include data concerning children's or parents' views on fruits and vegetables. Examples of these 16 studies included one focused on children's beliefs about fat in the diet (Turner *et al.*, 1997) and one focusing on food choice in general but not covering fruit and vegetables (Stratton and Bromley, 1999). No studies were excluded because they did not privilege children's or parents' views (e.g. collecting data on views solely for the purpose of generating variables to test in a causal model). No studies were excluded because they failed to meet basic methodological criteria (did not report at least some information on all of the following: the research question; procedures for collecting data; how these captured the phenomenon under study; sampling and recruitment; and at least two sample characteristics). All studies reported at least some information in these areas.

A total of 41 studies were included in the in-depth review.

3.4 Characteristics of studies in the in-depth review

Of the 41 studies included in the in-depth review, 33 were outcome evaluations and eight were studies of children's views or the views of their parents/carers. A high proportion of the outcome evaluations for this review were found solely through contact with authors (table 3.8).

Table 3.8: Source of studies in the in-depth review (N=41)

Source	Outcome evaluations N	Children's views studies N	All studies N
Major database only	6	4	10
Specialist register only	4	2	6
Contact with authors only	12	0	12
Handsearching only	0	0	0
Searching reference lists only	1	1	2
Found at more than one source	10	1	11
Total	33	8	41

A total of 16 of the 41 studies were carried out in the UK. These studies included eight outcome evaluations, and the eight views studies for which being UK-based was an inclusion criteria. The majority of the outcome evaluations were conducted in the USA (n=24), with just one conducted in Ireland.

3.5 Further details of outcome studies

3.5.1 Publication details and focus of studies

The results of most of the outcome evaluations were published in peer-refereed journals (n=27), whilst two were in publications in press obtained through contact with the authors, and four were unpublished project reports. Full project reports were also obtained for studies described in two of the published papers and three of the studies were reported in more than one journal article. One report contained details of implementing the same intervention with different sets of participants in two consecutive years (Auld *et al*., 1998). This report was therefore treated as containing two separate studies, which from this point on, will be referred to as Auld *et al.* (1998a) (the first study reported) and Auld *et al.* (1998b) (the second study).

Most of the reports were published between 1996 and 2000 (n=20). Five of the eight studies evaluating interventions in the UK were in press or unpublished, probably reflecting the country in which this review was written (UK) and the greater ease of obtaining unpublished material in the country where a review is carried out. Though unpublished reports obtained through author contact are likely to be more recent, they do not explain the apparent explosion of interest in this subject towards the end of the 1990s – an interest which would appear to be growing in the UK now, as well as the USA.

Most of the interventions in our review on children and physical activity were focused on both physical activity and healthy eating (Brunton *et al*., 2003, p. 42). This is not the case with the studies focused on fruit and vegetables. Seven of the outcome studies in this review contained a physical activity component too, with the focus for the rest being firmly on fruit and/or vegetable consumption. Obesity was the topic area for four of the studies with prevention of cancer (n=2) and cardiovascular disease (n=2) also being mentioned as being the primary reason for promoting fruit and vegetables in four other studies.

Only one study from the literature on eating disorders was included, suggesting that there is little crossover between research on eating fruit and vegetables for physiological reasons and those focused on mental health. This might be less apparent in a pool of studies on healthy eating in general rather than fruit and vegetables in particular.

Eight studies surveyed children in sites across the UK, one in Ireland, and the rest were based in the United States of America.

Some 23,720 children were reported to have taken part in 31 of the 33 studies (two studies did not provide numbers of individuals). Sample numbers of individuals ranged from 3793 (Resnicow and Robinson, 1997) to 30 Epstein *et al.,* 2001). Five

studies employed sample sizes of less than 50 (Epstein *et al.*, 2001; Fitzgibbon *et al.*, 1996; Georgiou, 1998; Wardle *et al.*, in press-a; Wardle *et al.*, in press-b). Nine studies involved over 1000 participants (Baranowski *et al.*, 2000; Foerster *et al.*, 1998; Moore, 2001; Perry *et al.*, 1998a; Perry *et al.*, 1998b; Resnicow and Robinson, 1997; Resnicow *et al.*, 1992; Reynolds *et al.*, 2000; Smith and Justice, 1979).

Ages ranged from four to 12 years old and all but one of the studies involved a mixed sex sample of children (the study by Cullen (1997) drew its sample from Girl Scout troops).

Information regarding socio-economic status of the children was often presented as the percentage of children receiving free school meals in the schools in which the interventions took place. Figures in studies that reported free school meal allocation ranged from 80 percent in the three studies by Auld *et al.* (1998a, 1998b, 1999), to a range of seven to 29 percent in the schools involved in the APPLES project (Sahota *et al.*, 2001). Fourteen of the studies indicated that the study population was predominantly of low socio-economic status. Thirteen studies provided no information on socio-economic status.

Some information about the ethnicity of the children in the studies was presented in 23 of the studies. Ten studies provided no information about the ethnicity of the participants, four of these studies were UK-based and one was the study based in Ireland. Of the remaining four UK studies, two reported that the sample of children was predominantly 'white' (Henry *et al.*, 2001; Wardle *et al.*, in press-b). Two UK studies reported the percentage of ethnic minorities, which was over eighty percent in one study (Lowe *et al.*, submitted for publication) and ranged from one to 42 percent in schools involved in the APPLES project (Sahota *et al.,* 2001). The studies based in the USA most commonly described samples of mixed ethnicity including African-American, Hispanic and Euro-American or 'Caucasian' children, although proportions varied. Seven studies reported that the study population was 60 percent 'Caucasian' or more (Baranowski *et al.*, 2000; Cullen *et al.*, 1997; Hendy, 1999; Parcel *et al.*, 1989; Perry *et al.*, 1998b; Reynolds *et al.*, 2000; Smolak *et al.*, 1998), four reported that their sample was predominantly African-American (Domel *et al.*, 1993; Gortmaker *et al.*, 1999; Liquori *et al.*, 1998; Resnicow *et al.*, 1998), and three studies reported a predominantly or exclusively Hispanic sample (Auld *et al.*, 1999; Fitzgibbon *et al.*, 1996; Resnicow *et al.*, 1992).

3.5.2 Methodological attributes of the studies

Table 3.9 shows the design of the outcome evaluations. All employed a control or comparison group as specified by our inclusion criteria.

Two issues regarding allocation are highlighted here. Firstly, the columns indicate the unit of allocation, whether or not study participants were allocated to control or intervention groups individually or by using pre-existing groups of people (for example, by school). Secondly, the rows indicate whether the method of allocation to the intervention or control arm(s) of the study was done in a random or non-random manner. Roughly half of the studies allocated their participants randomly (n=17) and all but six of the studies allocated using pre-existing groups. This reflects the types of interventions described earlier: many were whole school and community strategies necessitating the use of cluster (or group) allocation to be evaluated properly. Of

those that did allocate by group, the most popular unit of assignment was by school (n=17) with smaller units (for example, classes, Scout troops) being used in eight of the studies. One larger study used assignment by region (Foerster *et al.*, 1998).

Table 3.9: The design of outcome evaluations in the in-depth review (N=33)

	Allocation by individual / family	Allocation by group	Total
Randomised controlled trial	6	11	17
Controlled trial	0	16	16
Total	6	27	33

3.5.3 Development of interventions

The vast majority of studies evaluated interventions based on 'normative need' – i.e. initiated by experts (usually researchers) determining that there was a need which might be met by intervention.

Table 3.10 Type of needs assessment which initiated the interventions evaluated by the outcome studies in the in-depth review (N=33)

	N
Based on 'normative need' (what experts define as need)	31
Based on 'felt need' (what people say they want)	3
Based on 'expressed need' (what can be inferred by a community's use of its services)	2
Based on the needs assessment from another study	2
Not stated	1
Total*	39

**Total does not add up to the number of studies (n=33) because six studies evaluated an intervention initiated by more than one type of needs assessment.*

Though table 3.10 might suggest that participants and other stakeholders played a minimal role in the interventions evaluated by the majority of outcome evaluations, once 'expert opinion' had defined the need for intervention, 20 of the outcome evaluations were piloted and the study/target population was involved in developing the intervention in 10 studies. For example, when 'Gimme 5' (Baranowski *et al.,* 2000) was being developed, 'extensive' focus groups were conducted with children, parents, teachers and school food service workers in order to determine the barriers and facilitators to be addressed; the curriculum was revised after an initial study for evaluation in the trial in this review. Domel *et al.* (1993) and Gortmaker *et al.* (1999) also mention 'intensive formative research' in order to ensure that the intervention was acceptable and appropriate.

3.5.4 Details on integral process evaluations

Once implemented, nearly two out of every three outcome evaluations also included an integral process evaluation (n=21). Different processes were evaluated using a range of methods to collect such data (table 3.11).

Table 3.11: Processes evaluated and the data collection methods used in outcome studies with integral process evaluations in the in-depth review (N=21)

Processes evaluated	**N**
Perceptions, understanding or acceptability of the intervention	8
Consultation/collaboration/partnerships	2
Content of the intervention	15
Implementation/delivery of the intervention	19
Quality of the programme materials	4
Skills and training of the intervention providers	1
Other (design and development; potential of teachers to implement the intervention)	4
Total*	53
Methods used to collect data on the processes involved	
Not stated	1
Unclear	3
Documentation	4
Focus group	4
Interview	10
Observation	7
Self-completion report or diary/questionnaire	11
Other (point of purchase measures; participation rates)	3
Total**	43

**Total does not add up to the number of studies (n=21) because studies could evaluate more than one process.*
***Total does not add up to the number of studies (n=21) because studies could use more than one method to collect data on processes.*

Information on the implementation/delivery and content of the intervention was most often collected by the studies (n=19); studies less often addressed the perceptions, understanding, acceptability or quality of the intervention. Some of these data were used to evaluate the extent to which the intervention was implemented as intended and also to explore possible reasons for the results of the outcome evaluation. The content of the intervention was the aspect least often evaluated by the studies (n=15).

The results of the process evaluations for some studies were given as much importance as the outcome evaluation. Some chose to publish the results of the process evaluations in separate papers. Others, for example Sahota *et al.* (2001), Anderson *et al.* (2000) and Foerster *et al,* (1998) devote chapters in their final project reports to the findings of the process evaluations.

3.5.5 Intervention settings, providers and types

Table 3.12 shows the number of studies according to intervention setting

Table 3.12: Setting of interventions evaluated by outcome studies in the in-depth review (N=33)

	N
Community	6
Pre-school educational setting	2
Primary education	27
Health care unit	1
Home	13
Other (mass media)	1
Total*	50

**Total does not add up to the number of studies (n=33) because studies could evaluate interventions implemented in more than one setting*

Most of the studies evaluated interventions set in primary schools (n=27), though 12 of these studies also involved other settings; the most frequent addition being the home (n=13) and community (n=6). For example, whilst the 'California Children's 5 A Day Power Play! Campaign' (Foerster *et al.,* 1998) was centred on a school resource kit, the intervention also contained community elements, with participating schools being 'adopted' by local fruit and vegetable companies or community organisations. The APPLES project in Leeds (Sahota, *et al.,* 2001) was also based in primary schools, but encouraged schools to develop strategies to involve the whole school, family and community in their activities. Only four out of the 33 studies evaluated an intervention for which a researcher was the sole intervention provider (see table 3.13). Researchers were only part of the delivery of interventions evaluated by nine studies, and in five of these, the intervention was also delivered by other people (usually parents and teachers). This is characteristic of the types of initiative being

evaluated (see table 3.12): most of these were not small-scale 'laboratory' style psychological evaluations, but large, often multi-site interventions, designed for use in the 'real world'.

Two of the studies that evaluated interventions taking place in the home did not involve a school-based element. One study evaluated an intervention aimed at families with one obese parent with a six to 11 year old non-obese child (Epstein *et al*., 2001). The parents and children in this study attended sessions in a 'clinical setting' for six months and were given instructions regarding modifications they were to make to their home, and workbooks were taken away for completion between meetings. Dietary and physical activity goals were set on a case-by-case basis. Parents were also the focus of the home-based intervention without a school component evaluated by the other study. Wardle *et al.* (in press-b) evaluated an intervention that aimed to increase children's acceptance of a previously disliked vegetable through repeated exposure. Parents were asked to offer their children a taste of the target vegetable each day after first modelling their consumption of it. This exposure technique was compared with an 'information only' group who were given a '5 A Day' leaflet, and a control group.

Fifteen studies evaluated interventions that took place only in schools without any outside component. Moore (2001) describes a study that involved 43 schools in south-west England and south Wales. The intervention consisted of the provision of a fruit tuck shop in each school for the period of a year. Parents were sometimes involved in running these shops and local companies were employed to provide the fruit. Lowe *et al*. (2002) evaluated a school-based modelling and incentives-based programme that consisted of video adventurers featuring 'heroic peers' (the 'Food Dudes') who overcome the forces of evil by eating fruit and vegetables. In addition to watching the video, the children were given Food Dude merchandise (stickers, pencils, erasers) as rewards for eating targeted quantities of fruit and vegetables.

Baranowski *et al.* (2000) and Shannon *et al.* (1982) evaluated interventions which also made use of contemporary comic strip images. The intervention evaluated by Shannon *et al.* (1982) included posters on the walls in the lunchroom. One poster, positioned over the waste bin, depicted a 'grimacing garbage can imploring the children to put nutrients in themselves, not the can'. Other posters pictured popular characters from Marvel comic books with 'Iron Man' and 'Spider Man' being particularly popular. Boaz *et al*. (1998) evaluated the use of a fridge chart, other educational material, and counters with pictures of fruit and vegetable characters, in Lothian schools, Scotland. Whilst the intervention was initiated at the school level and included changes to the school lunch menu, a significant amount of the intervention took place at home using the 'five-a-day packs'. The comic strips used by the intervention evaluated by Baranowski *et al.* (2000) were part of a large intervention that also included the 'Gimme 5 rap' and MTV style videos. This intervention also contained exposure to food – in this case, taste testing snacks – as part of the programme.

Exposure to food was a technique employed to a greater or lesser degree within the interventions evaluated by many of the studies. Liquori *et al*. (1998) evaluated one example of an intervention in which children practiced cooking targeted foods in the classroom. The interventions evaluated in the studies by Auld and colleagues (Auld *et al*. (1998a, 1998b, 1999) also consisted of blending food preparation with an educational component. The intervention evaluated by Georgiou (1998) included an

education programme, sessions with a guest chef and a lesson with parental involvement.

The school-based interventions evaluated by nine of the studies (Anderson *et al.*, 2000; Boaz *et al.*, 1998; Domel *et al.*, 1993; Parcel *et al.*, 1989; Perry *et al.*, 1998a; Perry *et al.*, 1998b; Resnicow *et al.*, 1992; Reynolds *et al.*, 2000; Sahota *et al.*, 2001) necessitated modifications to the canteen menu in addition to additions to aspects of the school curriculum. Anderson *et al.* (2000) evaluated a multi-component intervention which included fruit being sold in the tuck shop, school lunches providing vegetable soup, choices of salads and vegetables, a weekly fruit based pudding and a daily choice of fruit as desert. Learning materials and hands-on experience in the classroom supplemented this.

Table 3.13: Number of outcome studies in the in-depth review according to the provider of the intervention evaluated (N=33)

	N
Community	2
Community worker	4
Health professional	2
Health promotion/education practitioner	3
Parent	7
Peer	1
Researcher	9
Teacher/lecturer	21
Other (catering staff, school nurses, dental team, local business)	10
Not stated / unspecified / not relevant	4
Total*	63

**Total does not add up to the total number of studies (n=33) because studies could evaluate interventions delivered by more than one provider*

Of the six studies evaluating an intervention within a community setting, four evaluated multi-component programmes which involved primary schools (Baranowski *et al.,* 2000; Foerster *et al.,* 1998; Resnicow *et al.,* 1998; Sahota *et al.,* 2001). The remaining two studies evaluated interventions for existing community groups: Girl Scouts in Texas (Cullen *et al.,* 1997) and a literacy training programme. The Girl Scout programme utilized the awards system in Girl Scouting by awarding a Girl Scout badge to those who completed the programme which included trying new foods, planning menus (at home and for a Girl Scout weekend), completing self-evaluation records and designing an advertising campaign for 5 A Day. (The use of peer teaching – of requiring children to communicate 5 A Day messages to their peers or parents was utilized in other interventions too.) Fitzgibbon *et al.* (1996)

evaluated a parental support programme amongst Hispanic families in Chicago. The programme contained activities for making changes to their diets and increasing their knowledge. This intervention was delivered through an existing literacy-training programme and was attended by both parents and children.

As might be expected with interventions implemented in multiple sites, many of the studies evaluated interventions with more than one provider (table 3.13).

Two studies attempted to evaluate whether the person providing the intervention made any difference to its effects. Auld *et al.* (1999) evaluated the same intervention as had been tested in previous years (weekly lessons, lunchroom activities and consumption of fruit and vegetables at lunchtime), but with a reduced number of lessons, some of which were taught by the normal classroom teacher instead of a special resource teacher. The other study, Resnicow *et al.* (1998), examined whether the provision of a 'teacher wellness' programme (educational materials and the offer of an exercise programme to teachers) made any difference to children's outcomes when receiving the 'Gimme 5' curriculum.

Table 3.14: Intervention types in all in-depth review outcome evaluations (N=33)

	N
Advice/counselling	1
Bio-feedback	2
Environmental modification	7
Increased access to resources	15
Information/education	31
Parent training	6
Professional training	8
Physical activity	9
Practical skill development	13
Social support	1
Total*	93

*Total does not add up to the total number of studies (n=33) because studies could evaluate interventions of more than one type.

As Table 3.14 shows, it was usual for studies to evaluate interventions using a number of different strategies. All but two of the studies evaluated an intervention which included an information/education component. One of the two studies that did not was the study in southwest England and south Wales which evaluated the provision of fruit tuck shops (Moore, 2001). The other (Wardle *et al.*, in press-a) was

a study in three London primary schools which attempted, through repeated exposure, to increase children's liking for, and consumption of, an unfamiliar vegetable (sweet red pepper).

3.5.6 Theoretical models

Data on the theoretical model underpinning each intervention were also gathered from each study (table 3.15). In nine studies, authors gave no information on any theoretical model used.

As table 3.15 shows, the theoretical models stated by study authors as underpinning the intervention they evaluated included traditional health promotion models such as social learning theory, and less widely articulated concepts such as neophobia (described below). The framework most often used in studies was social learning theory (n=15). Within this are interventions developed from the educational philosophies of Piaget and Dewey (Auld *et al.,* 1998a, 1998b, 1999) and those based on 'reciprocal determinism' (described below) (Auld *et al*., 1999; Baranowski *et al*., 2000; Domel *et al*., 1993; Foerster *et al*., 1998; Reynolds *et al*., 2000). For example, Auld *et al.* (1998a, 1998b: p. 269) state that key characteristics of the intervention they evaluated were informed by Piaget's cognitive development theory in particular: '(1) reliance on information from the senses, (2) need for hands-on manipulation, and (3) inability to understand abstract concepts and long-term causality'. These tenets were translated into: making (2) and eating food (1), emphasising particular foods rather than their nutritional value (3), and concentrating on 'eat more' messages rather than those which encouraged moderation in the eating of certain foods (3).

Table 3.15: Theoretical models as stated by the authors in all in-depth review outcome evaluations (N=33)

	N
Not stated	9
Unclear	3
Cognitive theory	1
Learning theory	1
Social Learning theory	15
Traditional Education/Reasoned Action Model	2
Other (behavioural choice theory, resiliency theory, 'reciprocal determinism', self-determination theory, 'neophobia')	7
Total*	38

**Total does not add up to the number of studies (n=33) because studies could evaluate interventions based on more than one theoretical model*

In accordance with the importance that 'reciprocal determinism' places on the interaction between personal and environmental factors in determining behaviour, all of the studies that evaluated interventions based on this model employed multi-component strategies in their attempts to promote fruit and vegetables. These initiatives included educational intervention, videotapes, newsletters, the involvement of local business and the inclusion of parents. Whilst not stated explicitly, the 'Health Promoting School' (HPS) philosophy used to underpin the intervention evaluated by Sahota and colleagues (Sahota *et al.,* 2001) with its emphasis on the whole school community would seem to fit into this category too.

Wardle *et al*. (in press-b) evaluated an intervention designed to increase children's acceptance and liking of an unfamiliar vegetable. The intervention consisted simply of children being offered, daily, some red pepper. Participants in one group were given rewards if they ate at least one piece. The rationale behind this intervention was 'food neophobia' – a theory attributed to Rozin, (1976) – which suggests that children's dislike of new foods is a natural reaction to protect them from the risk of poisoning. Repeated exposure, the intervention's mechanism, is said to overcome this initial distrust by demonstrating that no harm comes from eating the new food. Wardle *et al.* (in press-b) also cites 'Over Justification Theory' in suggesting that rewards are not an effective technique in the long term for promoting vegetable consumption.

3.5.7 Outcomes measured

Table 3.16 shows the number of studies according to the type of outcomes that they measured. The majority of studies evaluated consumption of vegetables (n=31), followed by consumption of fruit (n=25) and knowledge (n=21).

Of the two studies that did not report on vegetable consumption, one was the trial of fruit tuck shops in England (Moore, 2001) and the other was a study that compared five teacher 'actions' to encourage children's acceptance of new food (Hendy, 1999). In this study, the teachers employed different techniques including offering rewards, modelling their acceptance of the food, insisting the children try some and simply offering the food to the children.

Table 3.16: Types of outcomes measured by the outcome evaluations in the in-depth review (N=33)

	N
Vegetable consumption	31
Fruit consumption	25
Knowledge	21
Food preferences	12
Attitudes	13
Fat consumption	9
Physical activity	7
Salt consumption	4
BMI	4
Other (energy, fibre, vitamin, self efficacy, sedentary behaviour, healthy / unhealthy food, sweets, cholesterol, confectionary)	16
Total*	142

**Total does not add up to the number of studies (n=33) because studies could evaluate more than one outcome*

3.6 Further details of studies examining children's views

3.6.1 Publication details

The year of publication of the studies ranged from 1991 to 2002. Six studies were published in or after 1998. One of the studies was reported in two publications: in a stand alone report published by a research unit in the institution where the study authors were based at the time the study was undertaken (Mauthner *et al.*, 1993) and as an article in the *Health Education Journal* (Turner *et al.*, 1995). Hereafter, this study is referred to as Mauthner *et al*. (1993). One study was published in the *Journal of Sensory Studies* and the other studies were reported in nutrition or food related journals.

3.6.2 Focus and content of studies

Although all the studies focused on children's views about food, diet and nutrition, and all collected at least some data with regard to their views on fruits and vegetables, there were some differences in emphasis between them. Some studies focused explicitly on children's views regarding fruit and/or vegetables (Baxter *et al.*,

2000; Edwards and Hartwell, 2002; Gibson *et al.*, 1998; Neale *et al.*, 1998; Tilston *et al.*, 1991) with three studies focusing entirely on this (Baxter *et al.*, 2000; Edwards and Hartwell, 2002; Neale *et al.*, 1998). Three studies attempted to elicit children's views on 'healthy eating' in particular (Dixey *et al.*, 2001; Edwards and Hartwell, 2002; Hart *et al.*, 2002). The study by Mauthner and colleagues focused on children's views and attitudes about food in the school lunchroom setting (Mauthner *et al.,* 1993)

Authors offered a variety of reasons for the importance of examining children's views. Some identified it as useful for the development of healthy eating interventions for children (Baxter *et al.,* 2000; Dixey *et al.,* 2001). Authors of several studies (Dixey *et al.,* 2001; Hart *et al.,* 2002; Mauthner *et al.,* 1993; Neale *et al.,* 1998) reported that their studies had the specific aim of providing information for the development of future interventions aimed at changing children's consumption. Some studies cited the paucity of research amongst children in this topic area. In addition, several authors suggest that research with children was of particular importance as the development of healthy eating interventions for this age group could aim to ensure that good 'practice is ingrained as a habit early in life' (Tilston *et al.,* 1991: p. 26). Further still, many authors acknowledged the increasing health problems suffered by children as a result of poor diet.

Some study authors recorded as an explicit aim of their studies to explore differences amongst children according to their age (Hart *et al.,* 2002), socio-economic status (Baxter *et al.,* 2000; Gibson *et al.,* 1998; Hart *et al.,* 2002; Neale *et al.,* 1998), or gender (Baxter *et al.,* 2000; Hart *et al.,* 2002; Neale *et al.,* 1998).

3.6.3 Characteristics of children and/or parents included in the studies

The eight studies surveyed children in sites across southern England (Edwards and Hartwell, 2002; Gibson *et al.*, 1998; Hart *et al.*, 2002; Mauthner *et al.*, 1993), the Midlands (Neale *et al.,* 1998; Tilston *et al.,* 1991) and the north of England (Dixey *et al.,* 2000), and Scotland (Baxter *et al.,* 2000). No studies were identified from Wales or Northern Ireland. Sample numbers range from 300 (Dixey *et al.,* 2000) to 42 (Baxter *et al.,* 2000). Three studies employed sample sizes of less than 100 (Baxter *et al.*, 2000; Gibson *et al.*, 1998; Mauthner *et al.*, 1993), three had sample sizes between 100 and 200 (Hart *et al.*, 2002; Neale *et al.*, 1998; Tilston *et al.*, 1991) and two had sample sizes greater than 200 (Dixey *et al.*, 2001; Edwards and Hartwell, 2002).

The total number of participants for the eight studies is 1091 children and 92 mothers. All eight studies use a mixed sex sample. Four studies report numbers for children of each sex; totalling 298 male and 279 female (Baxter *et al.*, 2000; Dixey *et al.*, 2001; Gibson *et al.*, 1998; Hart *et al.*, 2002). The sex is not known for 514 children.

Information on indicators of socio-economic status is provided for over half the children (n=660). One-hundred-and-forty-one children are identified as coming from advantaged backgrounds and 104 are identified as being from disadvantaged backgrounds. A further 422 are identified as coming from schools with indicators of disadvantage, although specific details on the individual participants is not provided. The ethnicity of the children was largely unreported.

3.6.4 Study and design and types of data collected

All of the studies employed a cross-sectional design using either interviews or focus groups or self-completion questionnaires to collect data. Two studies collected solely 'quantitative' data, three studies collected solely 'qualitative' data and three studies collected both types of data.

4. RESULTS: METHODOLOGICAL QUALITY OF STUDIES

Outline of Chapter

This chapter presents the results of the procedures used to assess the quality of the 41 studies included in the in-depth review.

- *Section 4.1 focuses on the quality of the outcome evaluations.*
- *Section 4.2 focuses on the quality of the studies examining children's views.*

All readers who are interested in the methodological quality of studies and how these might be improved in the future should read this chapter, particularly ***researchers*** *or* ***research commissioners****.*

Key Messages

- *Fourteen outcome evaluations were regarded as having 'high methodological quality'.*
- *Fourteen outcome evaluations were regarded as having 'medium methodological quality'.*
- *Five outcome evaluations were judged to be 'not sound'.*
- *Six of the 28 outcome evaluations with high or medium methodological quality were excluded from the effectiveness synthesis, one because of reporting quality, and five because of design issues.*
- *Twenty-two studies went forward into the effectiveness synthesis and were considered for meta-analysis.*
- *None of the studies of children's views met all of the 12 quality criteria identified in this review as an approach to assessing the trustworthiness of findings generated from 'qualitative' and 'quantitative' studies. However, five studies met nine or more.*
- *Current strengths of studies of children's views in this topic area are:*
  - *reporting quality for study aims, context and data collection methods;*
  - *employment of strategies for enhancing the validity of data collection methods; and*
  - *using appropriate data collection methods for helping children to express their views*
- *Current weakness of studies of children's views in this topic area are:*
  - *reporting quality for study sample and data analysis methods;*
  - *employment of strategies for enhancing the reliability of data collection and data analysis and for enhancing the validity of the products of data analysis;*

- *using appropriate techniques for ensuring that products of data analysis were grounded in the views of children; and*
- *actively involving children in the design and conduct of the study*

4.1 Methodological quality of the outcome evaluations

All studies that were found to be within the scope for the in-depth review were examined for methodological characteristics and quality. A filter on study type had taken place earlier, allowing only those studies that controlled for bias in their evaluations by employing a control group to be considered for inclusion in the meta-analysis. Since we employed a statistical meta-analysis in this review to pool the results of the studies for the effectiveness synthesis, it was important to ensure that the quality assessment process did not bias the findings by excluding some studies from this pool unnecessarily. Statistical tests enabled us to check whether the results of certain studies were sensitive to differences in their methodological quality (sensitivity analyses reported in appendix G).

Assessment of quality for inclusion in the effectiveness synthesis and meta-analysis had three objectives: 1) to identify studies which the reviewers considered to be of high quality; 2) to identify studies which may have been high quality, but the lack of certain details in their reporting raised some doubts; and 3) to identify studies which had significant weaknesses in methodology or evaluation. Studies in 1) and 2) went forward into the meta-analysis, with the studies in category 2) listed for inclusion in a sensitivity analysis to establish whether findings differed significantly from the studies which did not have weaknesses in their reporting. Studies in category 3) were not included in the meta-analysis. These were usually exploratory studies or pilot evaluations in which the authors recognized that their results were provisional. The other group of studies that fell into this category were those that only allocated a single person or institution to control or comparison groups. This made it difficult to determine whether results were due to the effects of the intervention or to pre-existing differences between, for example, two schools. These studies were not combined with the other outcome evaluations but examined separately (see chapter five).

Studies were examined using the same four criteria for methodological soundness used in previous EPPI-Centre reviews (see e.g. Oakley *et al*., 1995c, Peersman *et al.,* 1996; Peersman *et al.,* 1998), with the amendment that studies which did not meet the four criteria because their reports lacked certain details were not excluded from the review at this stage, as explained above.

Eight studies met all of the first four criteria. An additional 20 were considered to be possibly sound but lacked some detail in reporting. The discrepancies in six ‘possibly sound’ studies were so minor (see table 4.2) that the studies were considered to be reliable and were therefore combined with the sound studies to form a group of 14 studies that were regarded as having ‘high methodological quality’. The other 14 were placed in a group labelled ‘medium’ and marked for testing in a sensitivity analysis before their findings could contribute to the effectiveness synthesis and meta-analysis.

Table 4.1: Methodological qualities of the outcome evaluations (N=33) meeting the four criteria for soundness (1-4) and the additional allocation criterion (5)

	N	%
1. Impact of intervention reported for all outcomes	32	97
2. Equivalent study groups at baseline	16	48
3. Pre-intervention data reported for all individuals / groups	17	52
4. Post-intervention data reported for all individuals / groups	28	85
5. Allocation of more than one individual / cluster into intervention / control group	27	82

Questions regarding equivalent groups at baseline and the presentation of pre-intervention data are somewhat interlinked, since unless the authors report on baseline equivalency, these data need to be reported in order for it to be assessed by reviewers. Almost all studies reported the impact of the intervention for all outcomes (n=32), though a smaller number (n=28) gave numeric data for all the outcomes they studied.

Table 4.2: Reasons for allowing the studies (N=20) which did not meet the 4 sound criteria to proceed into the meta-analysis

Baseline equivalency not established – authors took account of baseline differences in analysis	11
Pre-intervention data not given – authors state that there were no differences between the groups	7
Final data not reported – only change reported – however complete data on attrition were presented	11
Total*	29

** Total does not add up to 20 as there could be more than one reason for each study*

Six of these 28 studies were excluded from consideration for the meta-analysis: two from the group with high methodological quality and four from that of medium methodological quality. One study was excluded because it was not possible to calculate an effect size from the data presented. The other five were excluded because they allocated only one individual/group to control or intervention conditions. These six studies are described separately in section 5.2.5. Thus, 22 studies went forward into the effectiveness synthesis and were considered for statistical meta-analysis: 12 of 'high methodological quality and 10 for inclusion via the sensitivity analysis.

4.2 Methodological quality of studies of children's views

As stated in chapter two, studies of children's views were assessed according to 12 quality criteria covering three broad quality domains.

4.2.1 Quality of reporting

Five of these criteria were concerned with the quality of reporting of study methods. Study aims and details of data collection methods were reported clearly for all but one of the studies in each case and all but two study authors gave an adequate description of context (e.g. who funded the study, why the study was carried out) (table 4.3).

Reporting quality was most problematic with respect to presenting an adequate description of the sample and reporting data analysis methods adequately.

Three studies were judged by reviewers to have failed to give an adequate description of their sample (Edwards and Hartwell, 2002; Neale *et al.,* 1998; Tilston *et al.,* 1991). Describing a sample adequately should consist of describing the sampling frame used and indicating how children were selected from that sampling frame, as well as giving basic details about the socio-demographics of children. This helps the reader to understand whose voices are being heard in the study and, perhaps more importantly, whose are not. Three studies were judged to have failed to do this. As noted in chapter three, whilst reporting children's sex and age was generally good, details on children's socio-economic background were sketchy, and the ethnicity of children was largely not reported. Although all studies gave some indication as to how they identified and selected children, levels of detail were inconsistent. For example, some studies simply indicated that they had selected one or two classes from a school with no indication as to how this selection had been made. Other studies provided much higher levels of detail. Gibson *et al*. (1998) reported that all families in their sampling frame were invited to take part in the study and those who responded favourably then made up the sample. Hart *et al*. (2002: p. 131) reports that children were 'systematically sampled from each participating class using every third child on alphabetical, single gender class lists.' None of the studies reported the use of purposive sampling to build theory, even those that employed 'qualitative' methods.

Table 4.3: Quality of reporting of study methods in studies examining children's views (N=8)

	N
Aims and objectives were clearly reported	7
Adequate description of the context of the study	6
Adequate description of the sample	5
Adequate description of data collection methods	7
Adequate description of data analysis methods	3

Only three studies were judged to have reported their data analysis methods adequately (Baxter *et al*., 2000; Gibson *et al*., 1998; Hart *et al*., 2002). A lack of information on data analysis raises questions about the extent to which researchers have presented a full or partial view of their data. Of the five studies that reported

quantitative analysis, reviewers judged that there had been adequate reporting in only two of these (Baxter *et al.*, 2000; Gibson *et al.*, 1998). Of the five studies that used qualitative analysis, adequate reporting occurred even less often, with clear descriptions of the development of themes and allocation of data to codes and categories only provided by one study (Hart *et al.,* 2002). For other studies the reporting of qualitative analysis methods was limited (Edwards and Hartwell, 2002; Neale *et al.*, 1998) or non-existent (Dixey *et al.*, 2001; Tilston *et al.*, 1991).

Reports of all but one of the studies were only available as published journal articles. A short report of the study conducted by Mauthner and colleagues (Turner *et al.*, 1995) was published as journal article, but fuller details were available in a stand alone report of the study (Mauthner *et al.,* 1993)

4.2.2 Strategies for establishing reliability and validity

A further four of the 12 criteria used to assess the quality of the views studies were concerned with whether there had been adequate attempts to establish the reliability and validity of data collection tools or the results of the data analysis. The number of studies which had made either some attempt or a good attempt at establishing reliability are shown in table 4.4.

Authors of half the studies report making some attempt to establish the reliability of data collection tools (Baxter *et al.*, 2000; Edwards and Hartwell, 2002; Neale *et al.*, 1998; Tilston *et al.*, 1991) and authors of all the studies report this with respect to the validity of the data collection tools used. Authors of some studies reported using more than one strategy. Examples of strategies used in studies included: the use of tape recorders for accurate collection of interview data (Dixey *et al.*, 2001; Hart *et al.*, 2002; Mauthner *et al.*, 1993); using standardized protocols for focus groups and the same facilitator across groups (Dixey *et al.,* 2001); familiarising children with the data collection tools prior to administering them (Baxter *et al.*, 2000; Edwards and Hartwell, 2002); piloting self-completion questionnaires of focus group protocols (Dixey *et al.*, 2001; Edwards and Hartwell, 2002); and making data collection activities fun for children (Mauthner *et al.*, 1993; Neale *et al.*, 1998; Tilston *et al.*, 1991)

Table 4.4: Strategies for establishing reliability and validity in studies examining children's views (N=8)

'Some attempt' or a 'good attempt' made to establish the…	**N**
Reliability of data collection methods	4
Validity of data collection methods	8
Reliability of data analysis methods	5
Validity of the results of the data analysis	2

Reliability of methods for quantitative data analysis were ensured to some extent by the use of established statistical methods and packages (Baxter *et al.*, 2000; Edwards and Hartwell, 2002; Gibson *et al.*, 1998; Tilston *et al.*, 1991). The study by

Hart *et al*. (2002), which used only qualitative analysis, mentions explicitly the use of two independent raters to code the data as a way assuring reliability. In three studies the reviewers found no explicit or implicit mention of methods to ensure reliability of data analysis (Dixey *et al*., 2001; Mauthner *et al*., 1993; Neale *et al*., 1998). No other studies apart from Baxter *et al*. (2000) and Gibson *et al*. (1998) had made any attempt to assure the validity of their data analysis. Techniques such as 'negative case analysis', 'respondent validation' or 'triangulation', which are often advocated by qualitative researchers, were never mentioned in the studies.

4.2.3 Extent to which findings are rooted in children's own perspectives

The remaining three of the 12 criteria concerned the extent to which studies had used methods to ensure that their findings were rooted in the perspectives of the children themselves rather than the researcher (table 4.5).

Table 4.5: Appropriateness of study methods for ensuring that findings were rooted in the perspectives of children (N=8)

	N
Studies used appropriate data collection methods for helping children to express their views	8
Studies used appropriate methods for ensuring the data analysis was grounded in the views of children	5
Studies involved children in the design and conduct of the study	3

The reviewers found that all studies used appropriate methods for helping children to express their views. However, six studies were found to have used methods that were only 'partially' appropriate (Baxter *et al*., 2000; Edwards and Hartwell, 2002; Gibson *et al*., 1998; Hart *et al*., 2002; Neale *et al*., 1998; Tilston *et al*., 1991).

Most studies provided some detail on the structure and content of the interview sessions; some studies identified using pictures or photographs as prompts or activities for the children (Baxter *et al*., 2000; Edwards and Hartwell, 2002; Mauthner *et al*., 1993; Neale *et al*., 1998; Tilston *et al*., 1991). Other studies used other methods to assist children in expressing their views. Edwards and Hartwell (2002) describe using a 'faces scale' where children could indicate their liking of fruit and vegetables by indicating on a scale of faces ranging from 'smiley' to 'un-smiley'. Tilston *et al.* (1991) also report using a 'faces scale' in the form of a card game to elicit children's views. Neale *et al.* (1998) report novel methods for enabling children to express their views including 'illustrative material together with coloured stickers for answering some questions' (Neale *et al.,* 1998: p. 129). The study by Hart *et al.* (2002) described using a 'flip-chart' with questions to 'guide the groups' but stressed that these were used as prompts rather than stand-alone questions. The study by Mauthner *et al*. (1993) reports using a variety of activities aimed at enhancing children's ability to express their views, including drawing, writing, reading books, sorting cards showing pictures of food, and completing a 24-hour food recall chart.

Three studies were found *not* to have used appropriate methods for ensuring that the data analysis was grounded in children's views (Gibson *et al*., 1998; Neale *et al*.,

1998; Tilston *et al.*, 1991). The main purpose of the study by Gibson *et al.* (1998) was to use children's and mothers' attitudes to predict their consumption of fruits and vegetables. A complete lack of reporting on data analysis methods (clear or otherwise) in the other two studies made reviewers reluctant to judge these studies favourably on this criteria. The focus of these studies, which compared whether children thought people should eat more or less of different food types, was considered to represent a limited analysis of children's views. Of the five studies which were judged to have used appropriate data analysis methods, reviewers qualified this with 'partially' for four of them due to limited information on data analysis methods (Baxter *et al.*, 2000; Dixey *et al.*, 2001; Edwards and Hartwell, 2002; Mauthner *et al.*, 1993).

Three studies were judged to have involved children actively in the design and conduct of the studies (Dixey *et al.*, 2001; Edwards and Hartwell, 2002; Hart *et al.*, 2002; Mauthner *et al.*, 1993). Mauthner *et al.* (1993) report changing their research methods during the course of the project depending on how children responded to them. Dixey *et al.* (2001) and Edwards and Hartwell (2002) both report that children were given the opportunity to feed back to them on their research methods as a result of a piloting exercise.

4.4. Overall quality of studies

None of the studies met all 12 of the quality criteria. However one study did meet all but one criteria (Hart *et al.,* 2002); two studies met all but two (Baxter *et al.*, 2000; Gibson *et al.*, 1998); and two studies met all but three (Dixey *et al.*, 2001; Mauthner *et al.*, 1993). The remaining three studies appear to be of significantly poorer quality to the five studies already mentioned as they only met six (Edwards and Hartwell, 2002) or four of the quality criteria (Neale *et al.*, 1998; Tilston *et al.*, 1991).

5. RESULTS: EFFECTIVENESS SYNTHESIS

Outline of Chapter

This chapter presents the synthesis of findings from studies evaluating the impact of interventions on fruit and vegetable outcomes amongst children aged four to 10 years old.

This chapter should be read by:

- ***practitioners, policy specialists**, and others who are interested in whether, and what kind of, interventions are effective for increasing the fruit and vegetable intake of children; and*

- ***researchers** or **research commissioners** who are interested in the methodological issues concerning pooling the effect sizes from trials of social interventions.*

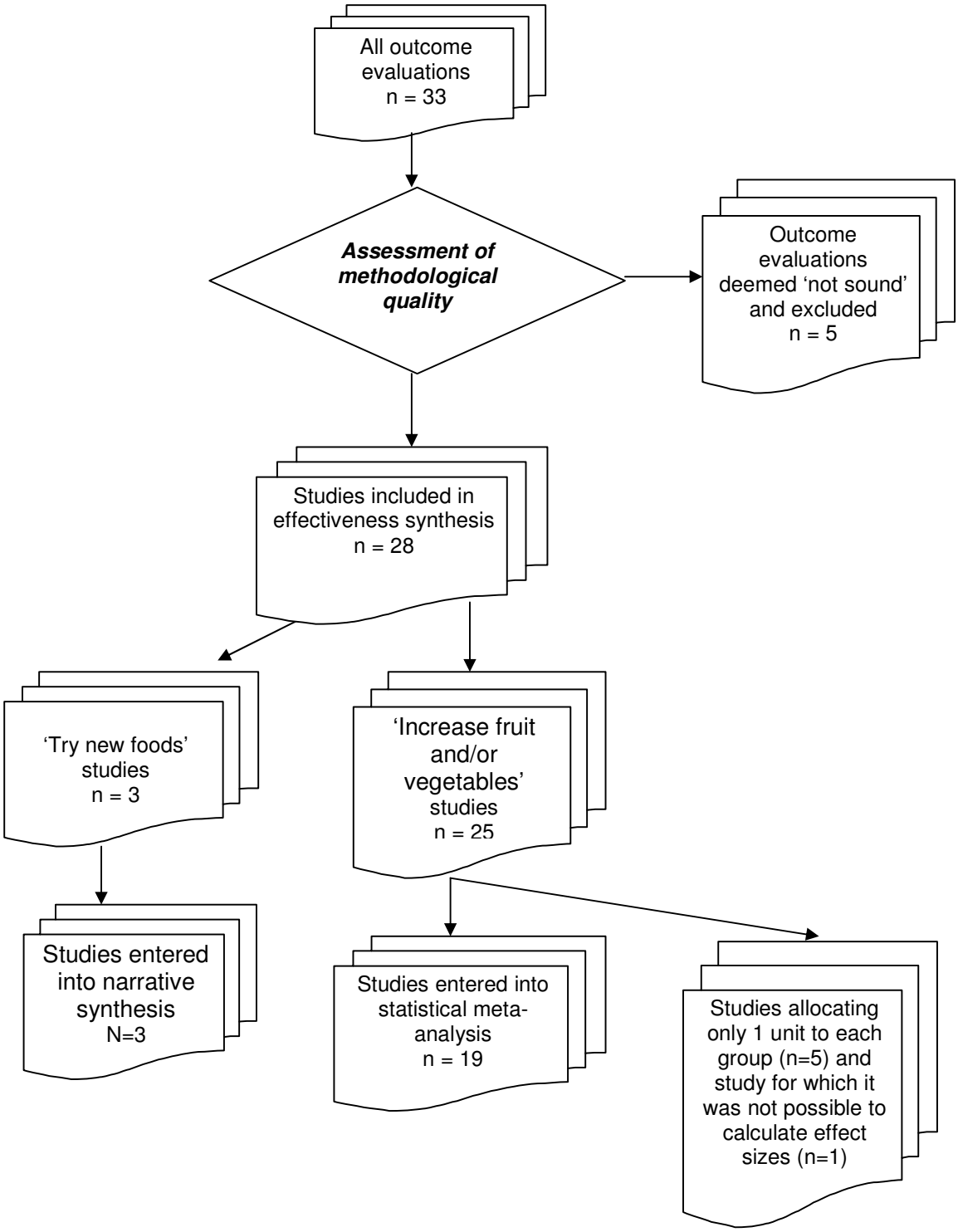
Key Messages

- *On average, children eat between one and three portions of fruit and vegetables a day*
- *Interventions addressing fruit increase consumption, on average, by one-fifth of a portion of fruit a day.*
- *Interventions addressing vegetables increase consumption, on average, by a little less than one-fifth of a portion a day.*
- *Interventions addressing fruit and vegetables together increase consumption, on average, by nearly half of a portion a day.*
- *Most effective was an intensive intervention targeting parents and children in high risk families.*
- *Less effective were interventions that did not focus solely on fruit and vegetables.*
- *Single component interventions (classroom lessons only, or fruit tuck shop only) were not effective.*
- *Children can be encouraged to try new foods, although allowing them a choice appears to be more effective than enforcing or rewarding this behaviour.*
- *Promoting healthy eating can be an integral and acceptable component of the school curriculum.*
- *Effective implementation in schools requires skills, time and support from a wide range of people.*

5.1 Flow of studies in the effectiveness synthesis

Thirty-three outcome evaluations met the inclusion criteria for the in-depth review and were assessed for their methodological quality as described in chapter four. Figure 5.1 shows the flow of studies through the quality assessment process and into the synthesis.

Figure 5.1: Flow of outcome evaluations to and through the effectiveness synthesis



Five outcome evaluations were excluded from the synthesis because they failed to meet basic quality criteria for this study type. The remaining 28 were split into two groups according to whether they evaluated interventions which a) aimed to increase children's consumption of fruit and/or vegetables in general or b) concentrated on trying to persuade children to eat new, or previously disliked, food. The studies in group (a) tended to have evaluated school-based interventions which, via curricula material and changes to school lunches, aimed to increase children's consumption of fruit and/or vegetables. The studies in group (b) were usually smaller-scale and aimed to persuade children to try unfamiliar food – often using modelling techniques. They were not focused on increasing consumption towards national '5 A Day' targets, aiming instead to increase the range of food children might be willing to eat. These two groups of studies were therefore considered to be sufficiently different from each other to merit separate syntheses.

The 25 studies that evaluated interventions aiming to increase children's consumption of fruit and/or vegetables were considered for entry into a statistical meta-analysis. Six studies were excluded from the meta-analysis at this stage either because they allocated only one group (for example, a school) to control or comparison groups or because it was not possible to calculate effect sizes from the data presented. The former studies present difficulties in the interpretation of their results. Because they allocate only one group it is hard to confident that the any observed effects are really due to the effects of the intervention rather than pre-existing differences between, for example, two schools. These studies are described in section 5.2.5.

The 19 remaining studies entered the meta-analysis and the results of pooling the effect sizes from these are presented in section 5.2. Descriptions of the evaluation methods used, and the interventions evaluated, by these studies can be found in Appendices E and F. Given the small numbers of the 'try new foods' studies, their findings on the effects of interventions are synthesised in narrative form in section 5.3. Descriptions of the evaluation methods used, and the interventions evaluated by these studies can also be found in appendix E.

5.2 Can interventions increase children's fruit and/or vegetable consumption?

5.2.1 Overall results

The 19 studies varied in terms of whether they measured fruit consumption (10 studies); vegetable consumption (12 studies); or fruit and vegetable consumption combined (13 studies). Some studies also measured knowledge about fruit and vegetables (n=7); preferences for fruit and vegetables (n=3) or self-efficacy regarding preparing or cooking fruit and vegetables (n=6).

As specified in the methods, the studies of medium trustworthiness were entered into a sensitivity analysis to ascertain whether or not any methodological characteristics might be responsible for a difference in results between these studies and those of high trustworthiness. This analysis was conducted on all outcomes and is described in appendix G. No significant differences were detected between the two groups of

studies (or between individual studies and the rest of the group) though there was a suggestion that the non-randomised studies tended to show higher effects for some outcomes than those which had employed random allocation.

Throughout this chapter, the relative impact of the studies on portions consumed have been standardised to that used in the Health Survey for England 2001 (Doyle and Hosfield, 2003). This enables comparisons to be drawn across studies.

a) Fruit consumption

Pooling the effect sizes from the 10 available studies revealed that overall, the evaluated interventions had a small but statistically significant positive effect on increasing fruit consumption (pooled effect size (standardised mean difference) of 0.10). This effect is equivalent to an increase of one-fifth of a portion of fruit per day. Effect sizes varied across individual studies with the highest effect size being equivalent to an increase of nearly two-thirds of a portion of fruit per day. Two studies however, showed no effect on fruit consumption. Despite this variation, these studies passed our prior tests which assessed whether or not it would be appropriate to combine their results in a statistical meta-analysis.

b) Vegetable consumption

Pooling the effect sizes from the 12 available studies revealed that overall, the evaluated interventions had a small but statistically significant positive effect for increasing vegetable consumption (pooled effect size of 0.23). This effect was equivalent to an increase of a little less than one-fifth of a portion of vegetables per day. Again, the effect size varied across studies with the highest effect size being equivalent to an increase of one-half portion of vegetables per day. One study however, showed a decrease in the number of portions of vegetables consumed. However, there were significant statistical differences between the studies, so the examination of individual interventions in this chapter is likely to be more illuminating than the summary statistic.

c) Fruit and vegetable consumption combined

Pooling the effect sizes from 13 studies examining this outcome revealed that overall, the evaluated interventions had a small but statistically significant positive effect on fruit and vegetable consumption combined (pooled effect size of 0.23). This effect was equivalent to an increase of nearly half of one-portion of fruit and vegetables per day. The effect sizes varied across studies with the highest effect size being equivalent to an increase of two portions of fruit and vegetables per day. One study however, showed a decrease in the number of portions of fruit and vegetables consumed per day.

The results of the meta-analysis for this outcome are difficult to interpret. These studies did not pass our prior tests to assess whether it would be appropriate to combine their results in a statistical meta-analysis. The variation in effect sizes between studies for fruit and vegetables combined was bigger than might be expected by chance alone. In these circumstances, some cautious hypothesising as to the cause of this is permissible: it is possible that the types of interventions being evaluated may explain the wide differences between the results of some of the studies.

One hypothesis, which was generated *a priori* for testing in the meta-analysis, was that the type of intervention – whether it concentrated on fruit and vegetables alone, or had other components – would affect its effect on fruit and vegetable consumption. This hypothesis was tested in the meta-analysis and its results do suggest that in some circumstances, observed variability in effect size between studies might be explained in part by whether or not the interventions promoted physical activity in addition to healthy eating. If this hypothesis is correct, interventions that concentrate on fruit and vegetables alone without promoting physical activity too are able to increase consumption by approximately half a portion per day. Those interventions that do contain physical activity components are only able to increase consumption by one-fifth of a portion. However, it is important to stress that this is only a hypothesis and that there could be other explanations to explain statistical differences between the studies.

d) Knowledge, attitudes and self-efficacy

Pooling the effect sizes from six studies which assessed the impact of their interventions on knowledge revealed that, overall, children's knowledge increased significantly (effect size 0.67). Their improvement in knowledge was estimated to be equivalent to an improvement of one GCSE grade in English compulsory subjects (Coe, 2000). Only three studies examined children's preferences for fruit and vegetables, but they also found a significant improvement. The effect was much more limited in the six studies reporting self-efficacy outcomes, though it is significant statistically.

5.2.1 What kinds of interventions are effective?

a) Interventions promoting an increase in fruit and vegetables

Figure 5.2 shows the relative increase in portions of fruit and vegetables consumed across all those studies which evaluated interventions promoting an increase in fruit and vegetables.

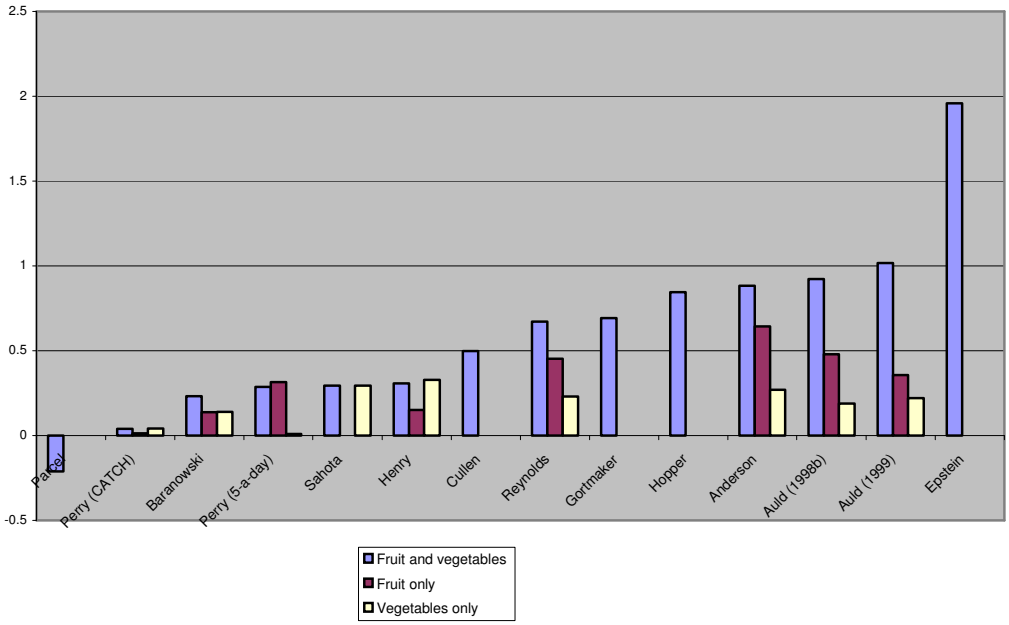
Some studies presented their results according to increases in fruit only and vegetables only, as well as for fruit and vegetables combined. Five studies did not do this (Cullen *et al.*, 1997; Epstein *et al.*, 2001; Gortmaker *et al.*, 1999; Hopper *et al.*, 1996; Parcel *et al.*, 1989). With three exceptions, increases in portions of fruit consumed were bigger than increases in portions of vegetables consumed (Baranowski *et al.*, 2000; Henry *et al.*, 2001; Sahota *et al.*, 2001). It appears that interventions targeting an increase in fruit and vegetables mainly increase the amount of fruit consumed – vegetable consumption does not increase by more than one third of a portion as a result of any of the interventions evaluated.

Considering increases in fruit and vegetables combined, the intervention evaluated by Epstein and colleagues stands out from the rest as it led to an increase of nearly two portions of fruit and vegetables per day. The interventions evaluated by Parcel (1999) and Perry (1998b) also stand out, but for different reasons – one led to a negligible increase in fruit and vegetable consumption (Perry, 1998b), the other led to a decrease in the number of portions of fruit and vegetables consumed (Parcel, 1999). The interventions in-between these two extremes lay along a continuum. For

convenience, the remainder of this section describes these interventions and their effects within the groups: (i) the two extremes, and the studies showing more moderate effects; (ii) those which detected an increase of between half a portion and one portion of fruit and vegetables per day; and (iii) those which detected an increase of less that half a portion of fruit and vegetables per day.

Figure 5.2: Increase in portions* of fruit and vegetables combined, fruit only, and vegetables only, as a result of interventions promoting an increase in fruit and vegetables (N=13).

* Portion sizes standardised using data from the Health Survey for England 2001 (Doyle and Hosfield, 2003)



The most successful and least successful interventions

The largest effect size for an intervention was revealed by the evaluation undertaken by **Epstein** and colleagues (2001). Thirty families residing in an unspecified location within the USA, with at least one obese parent and a six to 11-year-old non-obese child, were allocated randomly to one of two groups: the first received an intervention encouraging attainment of the five-a-day fruit and vegetable target (the intervention group); the second received an intervention targeting a decrease in the consumption of sugar and fat (the comparison group). A secondary goal within both groups was parental weight loss. Study authors presented no details on the ethnicity or socio-economic background of children taking part in the evaluation. Compared to the comparison group, the children in the intervention group increased their fruit and vegetable intake by nearly two portions per day at a 12-month follow-up.

There were several distinctive features of this intervention. It was community-based – one of only four in all 19 studies which entered the statistical meta-analysis. It also targeted parents as much as, if not more than, the children. The report of the evaluations describes the intervention as consisting of a 'Six month intensive treatment' (p.172) with eight weekly meetings to start with, followed by four biweekly and then two monthly meetings. The parental intervention contained education and bio-feedback components as well as 30 minute meetings with a therapist and 30

minutes as a group. Workbooks and other programme-related materials were taken home each week for the children. Two factors may have influenced the success of this intervention: 1) targeting parents rather than children alone; and 2) targeting the intervention at a group of parents likely to have been particularly motivated to change their dietary behaviour because at least one parent per family was obese and every family had at least one parent or grandparent with an obesity related risk factor. No other intervention targeted a population with known risk factors so it is not possible to speculate further than this.

The only evaluation to reveal a decline in fruit and vegetable consumption was undertaken by **Parcel** and colleagues (1999) within the USA who studied an intervention which aimed to promote a healthful diet and physical activity among elementary school children. Four schools within an urban district of Texas were allocated to either an intervention or a control group. The intervention, targeted at eight to 10-year-old children, consisted of three components: 1) changes to school lunches with the primary aim of providing meals lower in fat and sodium; 2) an enhanced PE curriculum; and 3) a health education curriculum which included two four-week healthy eating modules and one six-week physical activity module. The socio-economic background of the children taking part in the evaluation was not described, but 62 percent were described as 'Anglo', 21 percent as 'Mexican', and 15 percent as 'black'. Compared to the control group, children in the intervention group decreased their fruit and vegetable intake by one-quarter of a portion per day after the intervention had finished.

There are several plausible reasons why this intervention showed a negative effect. Firstly, it was one of the only two interventions not to include a parental component (the other was evaluated by Smolak). Secondly, only two of the three intervention components were focused on healthy eating. Moreover, the emphasis in both of these components was on a reduction in fat and sodium rather than increasing fruit and vegetable consumption. Whilst the intervention did not differ substantially in length to other interventions, the time dedicated to fruit and vegetables appears to be comparatively low. The inclusion of a physical activity component may have further reduced the intensity of the intervention for fruit and vegetables.

The intervention which led to a negligible (both in size of effect and statistical significance) increase in fruit and vegetable consumption was school-based and studied by **Perry** and colleagues (1998b) (the CATCH trial). It aimed to promote healthy eating (in particular eating less fat and more fruit and vegetables); increase physical activity; and prevent smoking. Fifty-six out of 96 schools from four states in the USA were selected randomly to receive the three-year long intervention which was initially targeted at children in their 3rd grade. The intervention consisted of the following components: 1) health education curricula focused on healthy eating (with some materials focused on fruit and vegetables) and physical activity taught by regular classroom teachers (fifteen 40 minute lessons in the first year, 24 in the second year and 16 in the third year); 2) take-home activity packs for children to complete with their parents and family fun nights (including taste testing and other activities); and 3) a food service intervention with the primary goal of lowering the fat and sodium content of school meals, although fruit and vegetables were promoted via, for example, taste testing in the school canteen. The socio-economic background of the children taking part in the evaluation was not described, but 835 children in the evaluation were described as 'white', 183 as 'Hispanic', 125 as 'African-American', and 40 as 'other'.

The most plausible reason for this intervention not showing any effect seems to be the fact that healthy eating was not its only focus and that the healthy eating component aimed to reduce fat consumption rather than to promote fruit and vegetables explicitly.

Interventions increasing fruit and vegetable intake by between one half to one whole portion per day

Seven studies revealed an increase of between one half to one whole portion of fruit and vegetables as a result of the interventions they evaluated. All involved parents in various ways, and all but one were school-based and were implemented in various parts of the USA. They are described in more detail below (in order of their size of effect – from the largest to the smallest).

The school-based intervention evaluated by **Auld** and colleagues (1998b) in an unspecified area of the USA aimed to promote healthy eating in general as well as increasing the consumption of fruit and vegetables in particular. Three schools receiving the intervention were matched with three others not receiving the intervention on indicators of low socio-economic status and ethnicity. The intervention was evaluated with seven to 11-year-olds and consisted of 24 weekly classroom activities (including preparing and eating food) delivered by specially recruited teachers trained in experiential learning; six weekly lunchroom activities delivered by parents; 12 bimonthly newsletters for parents; two family fun nights; and nutrition and food resource development work in the community. Authors describe the majority of children taking part in the evaluation as Hispanic, with over 80 percent being entitled to receive a free school lunch. Compared to those in the comparison group, children in the intervention group increased their fruit intake by nearly half a portion per day and their vegetable intake by nearly one-fifth of a portion per day. With fruits and vegetables combined, the children receiving this intervention increased their fruit and vegetable intake by nearly one portion per day.

In a further study with a similar sample of children (largely Hispanic from areas with indicators of socio-economic deprivation), **Auld** and colleagues (1999) found that the effectiveness of this intervention did not appear to be adversely affected by using the regular teachers of a school to deliver the intervention to avoid sole reliance on specially trained teachers. Children in the intervention group had increased their fruit intake by nearly a half of a portion per day and their vegetable intake by approximately one-fifth of a portion per day. With fruits and vegetables combined, the children receiving this intervention increased their fruit and vegetable intake by one portion. However, any differences between the results of this and the above study may be due to differences between populations rather that intervention providers.

The school-based intervention studied by **Anderson** and colleagues (2000) aimed to promote fruit and vegetable consumption via the five-a-day message to five to 10-year-olds from a city in Scotland in the UK. Two intervention schools were matched to two control schools on socio-economic status, religious status, school role and staff. Intervention components consisted of changes to school meals and food in the tuck shop; recruitment of parents to help in the tuck shop; whole school and classroom based educational activities; and parental newsletters. Intervention materials used cartoon characters (the 'Bash Street Kids') and intervention providers were school teachers, parents and researchers. Although authors provided some

indication of the socio-economic background of children – a small proportion of children within each school were entitled to free school meals – no details on ethnicity were presented. At four months' follow-up, children in the intervention schools had increased their fruit intake by two-thirds of a portion per day and their vegetable intake by a quarter of a portion per day. With fruits and vegetables combined, the children receiving this intervention increased their fruit and vegetable intake by approximately three-quarters of a portion per day.

The school- and home-based intervention studied by **Hopper** and colleagues (1996) aimed to promote physical activity as well as healthy eating. Four classes of seven to 10-year-old children within one school in a rural part of the USA were allocated randomly to either receive the usual nutrition and physical education curriculum provided by the school or an enhanced programme. The latter consisted of a twice weekly nutrition education class for 10 weeks emphasising a reduction of saturated fat in the diet but including activities such as preparing snacks using fruit and vegetables; a four-times-a-week physical education programme for 10 weeks (it was unclear who delivered the healthy eating and physical activity programmes); and a weekly pack to be taken home to families with instructions for preparing healthy foods and completing exercise activities as a family. Although the authors did not describe the ethnicity of children participating in the evaluation, they did specify that all children were from a rural area. Immediately after the 10-week intervention, children had increased their intake of fruit and vegetables by over three-quarters of a portion per day. This study did not measure fruit and vegetables separately.

The school- and home-based 'High-5' intervention studied by **Reynolds** and colleagues (2000) aimed to promote an increase in fruit and vegetable consumption via the five-a-day message. Twenty-eight schools in an unspecified area of the USA were paired on ethnic group and indicators of social disadvantage and then assigned randomly to either receive the usual nutrition education curriculum provided by the school or an enhanced programme. The latter consisted of three components: 1) food service personnel received a half-day of training on purchasing, preparing, and promoting fruit and vegetables; 2) a seven week curriculum delivered by project nutritionists and curriculum co-ordinators on three consecutive days every other week to eight- to nine-year-old children which aimed to build skills, self-efficacy and change preferences via colourful cartoon characters such as 'Indiana banana'; and 3) parents were asked to encourage and support their children's behaviour change and were encouraged to complete one homework assignment with their child each week. Children participating in the evaluation came from families with a median household income of $40,000 to $50,000 dollars and 83 percent were described as 'European-American', 16 per-cent as 'African-American' and one percent as 'other'. At one-year follow-up, children had increased their fruit intake by half a portion per day and their vegetable intake by one-fifth of a portion per day. With fruits and vegetables combined, the children receiving this intervention increased their fruit and vegetable intake by two-thirds of a portion per day.

The school-based intervention studied by **Gortmaker** and colleagues (1999) in Baltimore in the USA aimed to decrease consumption of foods high in fat; increase consumption of fruit and vegetables; decrease television viewing and increase physical activity. Six intervention schools were matched to eight control schools, chosen before the implementation of the intervention. Each of the two years involved thirteen 50-minute lessons on healthy eating and physical activity integrated into a range of curriculum areas, including mathematics, science, language and social

studies; a series of PE lessons focused on nutrition issues, using a 'safe workout' format, and classroom-taught lessons with a physical activity theme, involving students in movement; printed cards to introduce students to items on the menu of the school food service; training for the regular classroom teachers who delivered the intervention; take-home campaign activities for the children to involve family members (e.g. 'Get 3-at-school and 5 A Day'); and parent liaisons at schools linked with organisations providing low-cost nutrition and physical activity programmes to parents. Children receiving the two-year intervention were nine years old at its start and came from low-income families. Ninety-per-cent of the children were African American. At a follow-up length unspecified by the study authors, children had increased their intake of fruit and vegetables by over half-a-portion per day. This study did not measure fruit and vegetables separately.

The community-based 'Eat-5-Badge' intervention for Girl Scout troops studied by **Cullen** (1997) aimed to increase fruit and vegetable consumption. Twenty-two Girl Scout troops from Texas in the USA were allocated randomly to an intervention or control group. Nine to 12-year-old girls received the intervention which consisted of: four weekly educational and activity sessions of one to one-and-a-half hours duration which included opportunities to prepare and taste fruit and vegetables; parent information sheets sent home to enlist parental support for supplying fruit and vegetables for tasting and to encourage fruit and vegetable consumption at home; completion of food records each week with encouragement from a chosen 'buddy'; and completion of activities to receive an 'Eat-5-Badge' (e.g. preparing fruit and vegetables for families; designing an advertising campaign promoting fruit and vegetables). Troop leaders delivered the weekly sessions, with help from the researcher on the first. Although authors do not specify any indicators of social class, 75 percent of the girls participating in the evaluation were described as 'Caucasian', 11 percent 'Hispanic', three percent 'African-American' and eleven percent as from 'other groups'. Immediately after the intervention, children had increased their intake of fruit and vegetables by half-a-portion per day. This study did not measure fruit and vegetables separately

Interventions increasing fruit and vegetable intake by less than one-half of a portion per day

The interventions in three studies increased fruit and vegetable intake by less than half a portion per day. There does not appear to be any difference between these interventions (or their evaluations) compared to the seven interventions described above - all were based in primary schools and involved parents in various ways, and all but one were implemented in various parts of the USA.

The school- and home-based intervention studied by **Henry** and colleagues (2001) aimed to prevent obesity. Five to seven-year-old children from a city in the UK (Oxford) were assigned randomly to one of four programmes: 1) 'Eat Smart' which focused on the promotion of fruit and vegetables and 'power' ('high starch') foods; 2) 'Play Smart' which focused on the promotion of physical activity in daily life and a reduction in television viewing; 3) 'Eat Smart Play Smart' which was a combination of 1) and 2); and 4) 'Be Smart' which acted as a control group and did not give any guidance on physical activity or healthy eating. All four programmes were delivered by the researchers, were eight weeks in length and involved weekly or fortnightly 20-minute lessons using an interactive approach with an activity book to complete at home. Parents were asked to sign these books as their children completed the

activities. In programmes one, two and three, parents were also sent a weekly message about nutrition and/or physical activity. The children taking part in the evaluation were described as 88 percent 'white' and one in three parents had a degree. Immediately after the intervention, children had increased their fruit intake by just over one-fifth of a portion per day and their vegetable intake by nearly a third of a portion per day. With fruits and vegetables combined, the children receiving this intervention increased their consumption by one-third of a portion per day.

The school-based intervention, '5 A Day Power Plus', studied by **Perry** and colleagues (1998a) aimed to increase fruit and vegetable consumption. Twenty schools within an urban area of Minnesota in the USA were matched on the basis of size, ethnicity of student population, and percentage of free or reduced-price meals and were assigned randomly to an intervention or delayed intervention group. The intervention, delivered to nine to eleven year old children, consisted of the following components: 1) two eight week education programmes consisting of twice weekly lessons using materials illustrated with cartoon characters and focused on skill building, problem solving, snack preparation and taste testing (delivered by regular classroom teachers who received training); 2) take-home information and activity packs for children to complete with parents; 3) changes to school meal provision which involved a point-of-purchase promotion using characters from classroom curricula, enhancing the attractiveness and the variety of the fruit and vegetables served, and providing an additional fruit item on days when a baked desert was served; 4) food industries provided fruit and vegetables for tasting, home snack packs and school lunches and representatives gave presentations to children; and 5) team competitions to eat fruit and vegetables during lunch. Over 60 percent of the children taking part in the evaluation received free or reduced price school lunches and 47 percent were described as 'white', 25 percent as Asian American, 19 percent as 'African American', six percent as 'Hispanic', and one percent as 'Native American'. At one-year follow-up, children had increased their fruit intake by one-third of a portion per day, but not their vegetable intake. With fruits and vegetables combined, the children receiving this intervention increased their consumption by just over one-quarter of a portion per day.

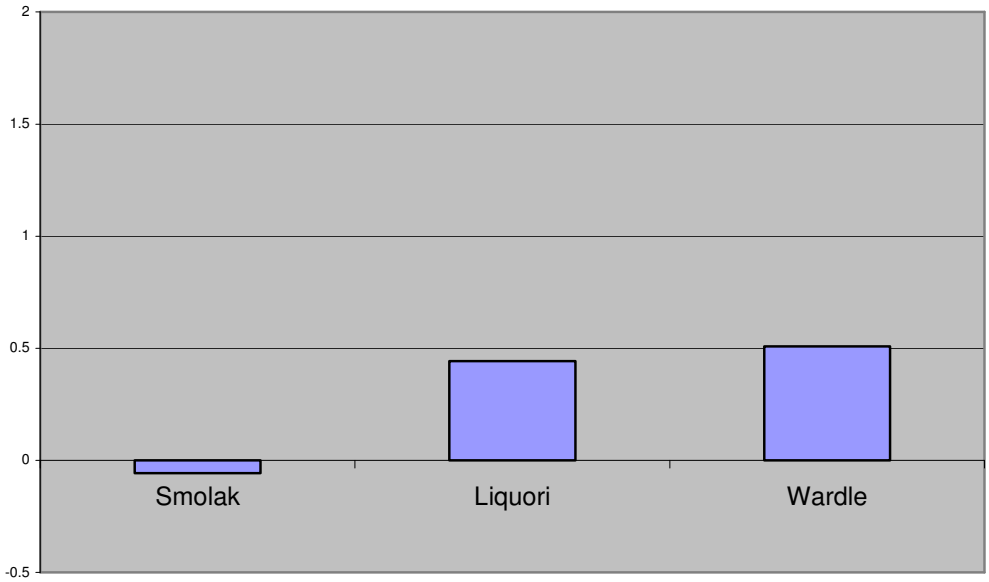
The school- and home-based intervention, 'Gimme 5', studied by **Baranowski** and colleagues (2000) aimed to increase fruit and vegetable consumption. Sixteen volunteer schools from an urban area of the USA were matched within school district (for size, percentage of students receiving free or reduced-price school meals, and percentage annual student turnover) and then assigned randomly to either receive the intervention or not. The intervention, which targeted children aged nine to eleven from two different year groups, consisted of the following components: 1) twelve 40 to 55 minute lessons, each with a specific behavioural objective, delivered over a six week period and including activities such as learning a 'Gimme 5' rap, setting dietary goals, taste testing and creating comic strips (delivered by regular classroom teachers); 2) materials sent home to children's parents (weekly newsletters to parents including suggestions and recipes for increasing fruit and vegetable intake and Music Television (MTV) style videos) and weekly home assignments for children to complete with families (e.g. preparing fruit and vegetable snacks, choosing fruit and vegetables at fast food restaurants); 3) prizes for the completion of six home assignments; and 4) two activities targeted directly at parents: point-of-purchase education at two grocery stores that parents most frequented; and a family fun-night hosted by produce managers who provided suggestions for selecting, storing, and preparing inexpensive fresh fruit and vegetables and taste testing. The socio-

economic background of the children taking part in the evaluation was not described, but 15 percent of the children were described as African American and 85 percent as Euro-American. At one-year follow-up, children had not increased their fruit intake significantly, but had increased their vegetable intake by one tenth of a portion per day. With fruits and vegetables combined, the children receiving this intervention increased their consumption by just under one-quarter of a portion per day.

b) Interventions promoting increased vegetable consumption only

Figure 5.3 shows the relative increase in portions of vegetables consumed across all those studies which evaluated interventions promoting an increase in vegetables only.

Figure 5.3: Increase in portions* of vegetables as a result of interventions promoting an increase in vegetables only (N=3)
* Portion sizes standardised using data from the Health Survey for England 2001 (Doyle and Hosfield, 2003)



The home-based intervention studied by **Wardle** and colleagues (Wardle *et al.*, in press-b) aimed to increase consumption of vegetables which children had previously identified as one they did not like. Children aged between two and six years old from London were allocated randomly to one of three groups: 1) an 'exposure' group in which parents delivered an intervention whereby children were offered their target vegetable every day for 14 consecutive days (parents were told not to offer rewards); 2) an intervention in which parents received information promoting increased consumption of vegetables; or 3) a control group. Sixty-eight percent of the parents of the children participating in the evaluation had left full-time education at the age of 21 or over and 74 percent of the children were described as 'white'. Immediately after the intervention, compared to the information only group and the control group, the children in the exposure group increased their intake of their target vegetable by half a portion per day.

The school-based intervention studied by **Liquori** and colleagues (1998) aimed to increase children's consumption of minimally processed whole grains and vegetables. Thirty-nine classes from four schools in an urban area of the USA were matched on teaching experience, reading level and grade and then allocated non-randomly to one of three intervention groups or a comparison group. These groups of children aged five to 11 years old received one or more of the following components: 1) provision of more minimally processed whole grains and vegetables for school lunches (13 were provided in total); 2) a series of ten classroom 'food and environment' lessons in which children learnt about the 13 different vegetables or whole grain foods; 3) a series of 'cookshop' lessons in which children learnt about these foods whilst cooking and/or tasting them; and 4) a newsletter sent to parents providing them with information on buying, storing, and preparing the whole grains and vegetables targeted. Regular classroom teachers and student nutritionists were involved in delivering the intervention. Although no explicit details are provided on the socio-economic background of children participating in the intervention, the authors do state that the schools taking part were selected as being representative of a 'relatively homogenous, urban, low-income' population. Eighty-five percent of the children were described as African American and 15 percent as Hispanic. The children who received all components of the intervention increased their vegetable intake by nearly a third of a portion per day.

The school-based intervention studied by **Smolak** and colleagues (1998) aimed to prevent eating disorders through the promotion of healthy eating (rather than dieting) and physical activity. Eight fifth-grade classrooms from six schools in a rural area of the USA received the intervention. A further three fifth-grade classrooms from the same six schools served as a comparison group. The intervention, named 'Eating Smart, Eating for Me' consisted of 10 lessons (with homework activities) focused on healthy eating and physical activity and covered issues such as 'Growth, change, and nutrition'; 'Myths about fat', 'Eating and exercising for you and your health', and 'Positive body image'. Regular classroom teachers were trained to deliver the intervention. The socio-economic background of the children taking part in the evaluation was not described, but all the children were described as 'white'. One month after the intervention, there was negligible decrease in portions of vegetables eaten per day. There are two plausible reasons for why this intervention might not have worked. Firstly, this was only one of two interventions that did not include a parental component. Secondly, it was one of only two interventions to rely on one component – a series of classroom lessons. Almost all other interventions were multi-component.

c) Interventions promoting increased fruit consumption only

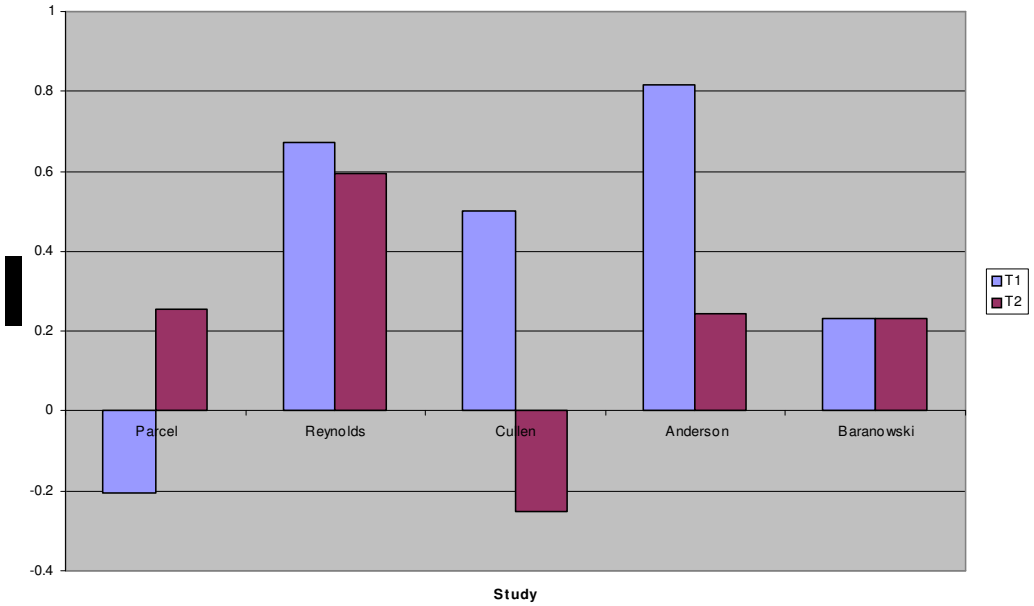
The one intervention that promoted fruit only was school-based and evaluated by **Moore** (2001). Forty-three schools from the South-west of England and Wales in the UK were allocated randomly to receive the intervention or to act as a control group. The intervention schools were provided with limited assistance in setting up and maintaining a fruit tuck shop. The main conditions that the schools were asked to abide by were (1) that there should always be a choice of fruits; (2) that fruits should be priced at 15 pence per portion; and (3) that sweets, crisps or other items should not be stocked as alternatives to the fruit. A project officer was available to visit each school to provide support and advice, and schools were put in contact with a local fruit supplier. The authors did not provide information on the ethnicity of the children participating in the intervention, but some indication of the socio-economic

background of the children was given – schools taking part in the evaluation had been sampled from a list of schools where the proportion of pupils entitled to free school meals was above the national average. Immediately after the intervention, children had not increased their intake of fruit.

5.2.3 What can be learnt from the studies with longer-term follow-ups?

The previous section reported outcomes measured immediately after interventions. Five studies reported the effects of their interventions both immediately after the intervention and after a follow-up period.

Figure 5.4: Fruit and vegetable intake: differences in effect (number of portions) between post-intervention (T1) and follow-up (T2) (N=5 studies)



In the case of Cullen (1997) the follow up period was only three months; Anderson *et al.* (2000) followed up after nine months and Parcel *et al.* (1999), Reynolds *et al.* (2000) and Baranowski *et al.* (2000) followed up after a year. Of the four studies which showed increased fruit and vegetable intake post-intervention, three were still showing increased consumption at follow-up. There are striking differences between studies however, and there is no clear relationship between length of follow-up and difference in consumption. Two of the studies with the longest follow-up period show a small, or no decline in consumption (Reynolds *et al.,* 2000; Baranowski *et al.*), whereas the study with the shortest follow-up period (Cullen, 1997) shows a decline of two-thirds of a portion.

Both Reynolds *et al.* (2000) and Baranowski *et al.* (2000) were large trials (28 and 16 schools respectively) and both were multi-component interventions that focused on fruit and vegetable consumption specifically, without facets including physical activity or other aspects of healthy eating. Both featured materials designed to make the subject interesting to children (Baranowski *et al.,* (2000): 'Gimme 5 rap', MTV style

videos; Reynolds *et al.*, (2000): 'Freggie', 'Indiana Banana' and other characters, fridge magnets) and included taste testing and parental involvement with homework assignments.

Whilst the intervention for Girl Scouts described in Cullen (1997) had some initial impact, this disappeared quickly. This intervention was much shorter than those described above (four weeks) and this may account for the negative effects detected at the longer term follow-up.

5.2.4 What did the studies which compared different intensities / types of intervention find?

Three studies compared the impact of different interventions or interventions containing different components with one another.

The study described in **Henry *et al.*** (2001) compared four groups. One received an intervention aimed at improving nutrition; another focused on physical education; a third group received both nutrition and physical activity – but only half of each – and the fourth acted as a control. Though the aim of the study was obesity prevention, the nutrition programme aimed to promote fruit and vegetables and high starch foods rather than discouraging the consumption of high-fat food. The study found that there was a modest rise in consumption in both groups that received the nutrition component and that there was a small difference in favour of the group that concentrated on nutrition without physical activity.

Liquori *et al.* (1998) also compared four groups, though in this study all four groups aimed to increase the consumption of whole grains and vegetables. One component of the intervention was termed 'cookshops'. Children in the cookshops participated in activities related to cooking or tasting one of the selected whole grains or vegetables. The second intervention component consisted of 'food and environment lessons' which, whilst being 'highly participatory' and included education relating to the health benefits of the targeted foods, did not involve tasting or preparing food. One group of children acted as controls whilst the others received either one, or both, of the intervention conditions. The study found that the children who received the cookshops component ate more (or left less) of the targeted foods and that the effect was greatest among those children who received both aspects of the intervention. The children who had received the food and environment lessons alone, did not differ significantly in their food intake from those in the control group.

All the children in the **Resnicow *et al.*** (1998) study were receiving the 'Gimme 5' (Baranowski *et al.*, 2000) intervention. Resnicow evaluated whether providing the teachers with a wellness programme would impact on the way in which they taught the Gimme 5 curriculum and thus have an effect on the children's outcomes. The teachers were offered 36 health workshops, an exercise programme and health risk appraisals. The study found no measurable impact of the programme, though noted that poor uptake of the wellness programme and low levels of Gimme 5 implementation may have affected the outcome. Classroom observations indicated that TeachWell teachers did not deliver the Gimme-5 program with greater fidelity than comparison teachers. Teachers selectively under-implemented key elements of the curriculum, particularly activities that included goal setting and rewards.

5.2.5 Details of the studies not included in the meta-analysis

This primary school-based intervention by **Auld** and colleagues (1998b) aimed to increase the consumption of whole grains, fruits and vegetables in children through nutrition education and local partnerships. The 449 children in 23 classes in four schools were allocated either to receiving the intervention (3 schools) or acting as controls (1 school). The schools were all located in Denver, USA and were attended predominantly by Hispanic and African-American children. The intervention group received 24 classroom activity lessons which included food preparation and eating; teacher training through after school classes and classroom role modelling from a special resource teacher; parent education via newsletters, nutrition classes and 'family fun nights' at the school; and community nutrition / food resource development. Whilst it is not possible to be sure, given only one school was allocated to the comparison condition, there appear to have been some increases in fruit, but not vegetable, consumption.

Domel and colleagues (1993) describe the pilot evaluation of the 'Gimme 5' intervention described earlier in this chapter by Baranowski *et al*. (2000). This preliminary evaluation took place in two elementary schools in Richmond County, Georgia. The schools were assigned randomly either to receive the intervention or to act as controls. As a result of this pilot study, the intervention was revised before being implemented in the study described by Baranowski *et al*. (2000).

The community-based intervention, 'California Children's 5 A Day Power Play!' campaign reported by **Foerster** and colleagues (1998), aimed to increase children's fruit and vegetable consumption via a large-scale 'social-marketing' initiative. Forty-eight schools in three different regions in California, USA were allocated by region to receive either school, or school and community interventions. The school-based intervention involved classroom work, families, the school cafeteria, the school environment and the local community. In addition, in one region, this programme was supplemented by initiatives involving local farmers and supermarkets, the media and community organisations. Ethnicity was not measured specifically, but the percent of Hispanic children in the school districts ranged from 30 percent to over 90 percent. Compared with the control region, the belief of children that they should eat five or more servings of fruit and vegetables increased in both intervention regions. They also increased their consumption of fruit and vegetables by 0.4 (school + community) and 0.2 (school only) servings. However, given that the schools were allocated by region and that the authors also note that environmental and economic factors could have influenced their findings, the results must be treated with caution.

'Little Red Riding Hood: a tale of crunchy munchy vegetables' featured in the pre-school intervention described by **Lawatsch** (1990). This intervention aimed to increase the knowledge, attitudes and behaviour of children attending four pre-school facilities in Northern New Jersey, USA. The children were allocated randomly, by class, to receive one of two interventions or to act as controls. The first intervention – 'benefit appeal' – consisted of fairy tales being re-told with accompanying visuals to give an emphasis on vegetables in a positive way. The second intervention – 'threat appeal' – contained the same fairy tales with a vegetable content, but this time containing darker, more threatening visual materials. The children were predominantly 'white', though no information is given regarding their socio-economic status. Compared with the control group, the class in the

benefit appeal group increased in its knowledge, attitudes and vegetable intake. Results from the threat appeal group were less clear.

The 'Food Dudes' triumph over 'General Junk' and his 'Junk Punks' in the intervention described by **Lowe** and colleagues (submitted for publication). This initiative aims to increase children's consumption of fruit and vegetables through a peer-modelling intervention containing videos of cartoon characters and associated merchandise (stickers, pencils, erasers) which act as rewards. Children in one London primary school received the intervention whilst another acted as a control. Both schools had high percentages of children from ethnic minorities (80 percent and 85 percent) and both had high proportions of children receiving free school meals (67 percent and 46 percent). The study found that the intervention had a highly significant effect, which was sustained over time. However, given that only two schools were involved which were not equivalent on all baseline measures, we recommend that this intervention should be evaluated on a larger scale before conclusions regarding the magnitude of effect can be drawn.

The school-based 'Know Your Body' intervention described by **Resnicow** and colleagues (1992) aimed to 'facilitate positive health choices' among primary school children in New York. Three schools in New York received the programme whilst a fifth, along with a school in Texas, served as controls. The schools in the intervention group received a multi-component intervention consisting of: classroom materials; teacher support and in-service training; changes to the menu of the school cafeteria; peer leader training; student health committees; food tasting parties; and student aerobics. The children were predominantly (60 percent) Hispanic with lower proportions described as being 'black' (23 percent), and 'white' (11 percent). The results are presented in three strata depending on the level of intervention received. It is hoped that contact with authors will enable the data from this study to be included in a future update of this review.

5.3 Can interventions persuade children to try new fruit or vegetables?

Three studies evaluated the success of interventions in attempting to persuade children to try new fruit and/or vegetables: Hendy (1999), Shannon *et al.* (1982) and Wardle *et al*. (in press-a). The interventions in both Hendy (1999) and Wardle *et al.* (in press-a) contained elements of modelling – of children observing an adult eating the targeted foods before consuming it themselves. Both studies also compared different types of intervention: in Hendy's case the comparison was between different teacher actions – simple exposure, modelling, rewards, insisting that children try one bite and choice-offering. Wardle *et al.* (in press-a) compared two of the same techniques: reward and exposure. Both reports cite 'Over Justification Theory' in suggesting that, in the longer term, rewards are counter productive and devalue the food in the eyes of the child (though there might be some short-term effect).

Hendy (1999) and Wardle *et al.* (in press-a) come to similar conclusions, both finding evidence to support their hypotheses. In the **Hendy** (1999) study, 'insist', 'reward' and 'choice-offering' were more effective than simple exposure in encouraging the children to try a range of new foods. Teacher modelling without some kind of encouragement was not found to be effective on its own. Whilst the results of the

'reward' group appear to be strongest in terms of the number of different foods tasted, when the number of bites was assessed, the 'choice' ('Do you want any of this?') group appears to have the strongest results. The exposure group in the **Wardle *et al.*** (in press-a) study is similar to the choice group. In this study, children were invited to eat as many pieces of red pepper as they chose, or were told that they could eat as much as they liked and that they could choose a sticker if they ate at least one piece. Again, reward proved to be an effective strategy for persuading the children to eat some red pepper, but when the number of pieces consumed was examined, the group that was offered no rewards was found to have eaten more.

The paper by **Shannon *et al.*** was published in 1982 – some 20 years before some of the other papers in this review. Its intervention shows signs of coming from a different era with an educational programme emphasising a 'balanced' diet and the concept of food being a source of nutrients. Posters depicting characters from Marvel Comics were displayed around the lunchroom including a grimacing garbage can, which implored the children 'to put nutrients in themselves, not the can'. No specific mention is made of fruit and vegetables when describing the intervention, though the outcome measures do include the consumption of raw carrot and broccoli sticks along with peanuts, pumpkin bread, corn, green beans, mashed potatoes, spinach salad, stewed tomatoes and milk. These foods were offered to the kindergarten children as snacks and the study attempted to evaluate the impact a nutrition education programme might have on their acceptance. It appears that the programme did affect children's knowledge and attitudes, but impact on behaviour was less clear. Feedback from parents suggested that their children were more likely to ask for foods of 'high nutrient density' as a result of the intervention, but the measures of observed behaviour showed no appreciable difference between the intervention and control groups.

5.4 What can we learn about the acceptability, content and implementation interventions?

Fourteen of the 19 studies in the meta-analysis also conducted process evaluations. Table 5.5 shows the range of processes evaluated by this pool of studies. Some of the main messages and lessons learned from these process evaluations are summarised in this section.

Table 5.5: Processes evaluated by the 19 studies in the meta-analysis

	N
Content of the intervention	11
Quality of the programme materials	3
Perceptions, understanding or acceptability of the intervention	7
Implementation/delivery of the intervention	13
Skills and training of the intervention providers	1
Consultation/collaboration/partnerships	2
Other (design and development; participation and response rates)	2
Total*	39

** Total adds up to more that 19 because each study could examine more than one process*

5.4.1 Content and quality of the intervention

An important component of many intervention strategies was giving children hands on experience of preparing and tasting food. This aspect of the Girl Scouts' intervention (Cullen, 1997) was the most popular activity. The teachers in Anderson *et al.* (2000) also thought that the children had enjoyed preparing and tasting food – a view supported by the children themselves. The parents involved in persuading their children to try a new vegetable (Wardle *et al.,* in press-b) reported that their children had enjoyed the daily tasting session and that this had increased their willingness to try other foods. In light of the number of interventions which employed child-friendly strategies to make fruit and vegetables appealing (cartoon characters, videos, raps, stickers, etc.) there is little process data regarding this strategy. Anderson *et al.* (2000) report that children liked the 'Bash Street Kids' material and considered it to be both appropriate and memorable. The Girl Scouts (Cullen, 1997) considered that there was too much paperwork/homework in their programme.

Two studies examined interventions that concerned the provision of fruit to children via tuck shops. Anderson *et al.* (2000) reported that the schools considered the tuck shop to be the strongest component of the intervention, with children preferring soft fruits – such as strawberries and grapes – and mixed selections. Parental involvement appears to have been important at tasting sessions with a 'very talented' parent being involved in food presentation. In this intervention, fruit competed with other food at the shop, and the observation from staff was that children chose fruit initially because of its novelty value. As this wore off though, fruit was bought less unless something new was introduced or there was a shortage of other items. Special offers and sales promotions were used in some of the fruit tuck shops in Moore's study (2001) as part of a strategy to maintain interest. Some schools also maintained a high profile for their fruit tuck shops by mentioning them regularly in assemblies and newsletters and by ensuring the shop was located in an advantageous position. Some of the fruit tuck shops managed to make a profit and the authors report that links were strengthened between parents and schools as a result of the co-ordination necessary to run them.

5.4.2 Perceptions, understanding or acceptability of the intervention

Adding health promotion to a crowded school curriculum may not be acceptable to teachers, children or their parents. However, nutrition education has the potential to link to other areas of the school curriculum. Some interventions designed their programmes with this in mind, whilst others found unintended benefits arising from their implementation. Moore (2001) found that the mental arithmetic of the children helping in fruit tuck shops was being tested daily and that they were also gaining experience in handling money. This experience of dealing with money on a practical level also extended to the children buying fruit at the tuck shop in that they were 'grasping the concept of a money transaction, and mentally working out the amount of change' (appendix 3, p. 9). English and art were also said to have benefited from the presence of the tuck shops via the production of posters to advertise the shops or the development of questionnaires relating to the fruit tuck shop. The teachers involved in Auld *et al.* (1998b) support this, stating that other subjects were supported by the nutrition lessons – in particular maths (measuring, fractions, graphing activities) and literacy (reading recipes, following directions, worksheets). Henry *et al.* (2001) record that the teachers involved in the 'Be Smart' obesity

prevention programme felt that some of the materials could be incorporated into other curricula, e.g. into Personal Social Health Education (PSHE).

5.4.3 Implementation

Teacher workload is an issue that arises in many studies. Anderson *et al.* (2000) found that teachers were unlikely to use programme materials if too much preparation time was required. Auld *et al.* (1998b) also found that the preparation work involved and managing the class meant that some teachers were unlikely to repeat their lessons. A 'perceived lack of resources: time (to plan and prepare), money (for food and materials), equipment, and help in the classroom' (p. 276) were identified as primary barriers to using the curriculum. Teachers in this study were also concerned about health and safety regulations on food within schools and the amount of classroom time which was taken up teaching the programme. Parcel *et al.* (1999) found that teachers commented most frequently on a perceived lack of time to teach the modules in the programme adequately. They also identified the strong emphasis on academic subjects as being the 'greatest barrier to full implementation of the modules' (p. 197).

However, the CATCH study (Perry *et al.*, 1998b) did not experience this problem. They found that both the teachers and school food service staff were very supportive of the aims of the intervention and also that they were confident in their ability to implement their respective components effectively. When levels of implementation were examined, they found that more than 86 percent of the lessons were being taught without modification. The CATCH intervention appears to have made fewer demands on teachers' time and was more acceptable to them because of this. However, this needs to be set aside the study's findings – in which no appreciable effect was found on children's consumption of fruit and vegetables.

An increase in workload as a result of these programmes was not only felt by teachers. Catering staff in school canteens were often expected to attend training sessions and to alter the range food on offer. Not many process evaluations report data on this, though Anderson *et al.* (2000) did find that more work was involved in meal preparation due to their intervention. The staff at one school noticed an increase in preparing salads but made the comment that 'much got thrown away'.

5.4.4 Skills and training of the intervention providers

The skills, training and support for the person providing the intervention emerged as a concern in many studies, but it received little research attention. Mainstream classroom teachers provided the intervention in some of the programmes, whilst in others, specialists in nutrition taught the lessons. The difference between these two types of providers was one of the subjects under investigation by Auld *et al.* (1998b, 1999). The teachers in the first study, in which most of the intervention was delivered by an external resource teacher, stated that there were significant barriers to them engaging in substantial nutrition education without support, but were more confident after observing a specialist resource teacher and attending training. Teachers in the second study (Auld *et al.*, 1999) carried more responsibility for teaching the curriculum and appear to have been less comfortable, expressing doubt that they would be able to teach nutrition to the same level (as frequently or elaborately) as

the resource teacher due to a lack of preparation time, resources and classroom support. This was also raised as an issue by the teachers in Anderson *et al.* (2000) in which a project worker delivered much of the practical work. Teachers reported that without this extra help, the activities would either have been much more difficult to implement or would not have happened at all.

Teachers' lack of confidence in their ability to deliver nutrition education was also found by Sahota *et al*. (2001). Only 52 percent of the teachers in this study felt that they had the skills to teach health education effectively and 63 percent stated that they had not received any training in health education prior to the intervention. Sixty-two percent of the teachers had not heard of the health promoting schools philosophy.

Some of the studies that used mainstream teachers to deliver the intervention in preference to an external teacher found that, for a variety of reasons, this resulted in low levels of implementation of the programme. Baranowski *et al.* (2000) reported that teachers appeared to be uncomfortable when teaching 'behaviour change-oriented practices' (p. 107) when, nationally, nutrition knowledge is more commonly targeted. Implementation figures suggested that 47 percent of intervention activities were performed, but this figure dropped to 22 percent for some activities 'identified as crucial to achieving behaviour change'. Smolak *et al.* (1998) had a similar experience, finding that even though instructions to teachers were 'quite specific' (p. 343), teachers changed and/or left out significant parts of the curriculum. They reported that this degree of flexibility was necessary in order to gain the support of the school board and teachers.

5.4.5 Partnerships for intervention

Whilst passive support for an intervention might have been achieved (above) by a flexible approach to programme implementation, some interventions depended on the active support of the school community. Some of the fruit tuck shops (Moore, 2001) in this review depended on the goodwill of parents, teachers or other school staff in order to operate: 'As a rule, if the adult-in-charge was doing so unwillingly or without enthusiasm, the fruit tuck shop did not thrive.' (appendix 3, p. 8) This was sometimes resolved by the recruitment of another adult. However, the authors report that some of the shops were 'limping along' (appendix 3, p. 8) due to a lack of enthusiasm on the part of those running them. Both teachers and office staff were also unwilling to administer the money associated with the fruit tuck shops – either in terms of running the shops' finances or in ensuring the security of the money brought into school by children (appendix 3, pp. 7-8). Anderson *et al.* (2000) also found that the degree to which their programme was implemented was limited by the priority it was given by the schools and their staff. One school did not want the intervention to disrupt existing activities and did not enlist the support of parents to the extent necessary. They conclude, 'getting busy school staff more involved in nutrition is a challenge with no easy solution.' (p. 38)

6. RESULTS: SYNTHESIS OF CHILDREN'S VIEWS

Outline of Chapter

This chapter presents the synthesis of the findings of the eight studies we identified which examined the views of children in the UK concerning healthy eating in general or eating fruits and vegetables in particular. It describes:

- *the descriptive themes which emerged from looking for similarities and differences across the findings of each individual study;*
- *the analytical themes and associated barriers to, and facilitators of, healthy eating derived from these descriptive themes; and*
- *the implications for interventions to promote fruit and vegetables to children.*

Appendices H and I contain more systematically ordered information on the characteristics of the studies, their methodological quality, and their findings.

All types of readers are likely to be interested in this chapter

Key Messages

- *Thirteen descriptive themes emerged across the study findings, grouped according to 'understandings of healthy eating' and 'influences on food eaten'.*

- *Identifying barriers and facilitators led to the emergence of a further six analytic themes:*
  - *Children do not see it as their role to be interested in health.*
  - *Children do not see messages about future health as personally relevant or credible.*
  - *Fruit, vegetables and confectionery have very different meanings for children.*
  - *Children actively seek ways to exercise their own choices with regard to food.*
  - *Children value eating as a social occasion.*
  - *Children see the contradiction between what is promoted in theory and what adults provide in practice.*

- *Nine implications for appropriate interventions for promoting fruit and vegetables to children were identified. These ranged from simple strategies such as 'branding fruit and vegetables as tasty rather healthy' or 'do not promote fruit and vegetables in the same way' to more challenging strategies such as ' make health messages relevant and credible to children' and 'create situations for children to have ownership over their food choices'.*

- *These findings were generated from studies involving 1091children (aged five to 11 years old) and 92 mothers living in Scotland or England. Children from both lower and higher socio-economic status families were represented, but the inclusion of children from ethnic minority groups was unclear.*

The synthesis of findings presented in this chapter was generated from studies involving 1091 children and 92 mothers living in Scotland or England. Although reporting limitations makes it difficult to establish precisely, these findings appear to have been derived from children from both lower and higher socio-economic status families. Due to a near complete lack of reporting on ethnicity, it is not clear to what extent the findings reported here were derived from, or are applicable to, children from ethnic minority groups.

Whilst we did not exclude any studies on the grounds of quality, the reader should be aware that not all studies contributing findings to the synthesis were of the same methodological standard. In particular, three studies were judged to be of a poorer quality, meeting six or less of the 12 criteria we use to assess the quality of these studies (Edwards and Hartwell, 2002; Neale *et al.,* 1998; Tilston *et al.,* 1991). The results of our quality assessment would have provided a good rationale for not allowing the findings of these three studies to contribute their findings to our overall synthesis of children's views. We decided not to exclude these studies, however. When we checked, their findings did not contradict those from studies of a higher quality. In fact, these studies had very little to contribute to the synthesis. The scope of their findings was very narrow, limited mainly to revealing whether children could identify commonly available fruits and vegetables (Edwards and Hartwell, 2002) and whether children agreed with statements about whether people should eat more or less of different types of food (Neale *et al.*, 1998; Tilston *et al.*, 1991).

Descriptive themes derived from looking across findings of the eight studies are presented first. We then present details of the analytical themes that emerged from our synthesis and the associated barriers to, and facilitators of, fruit and vegetable consumption or healthy eating in general.

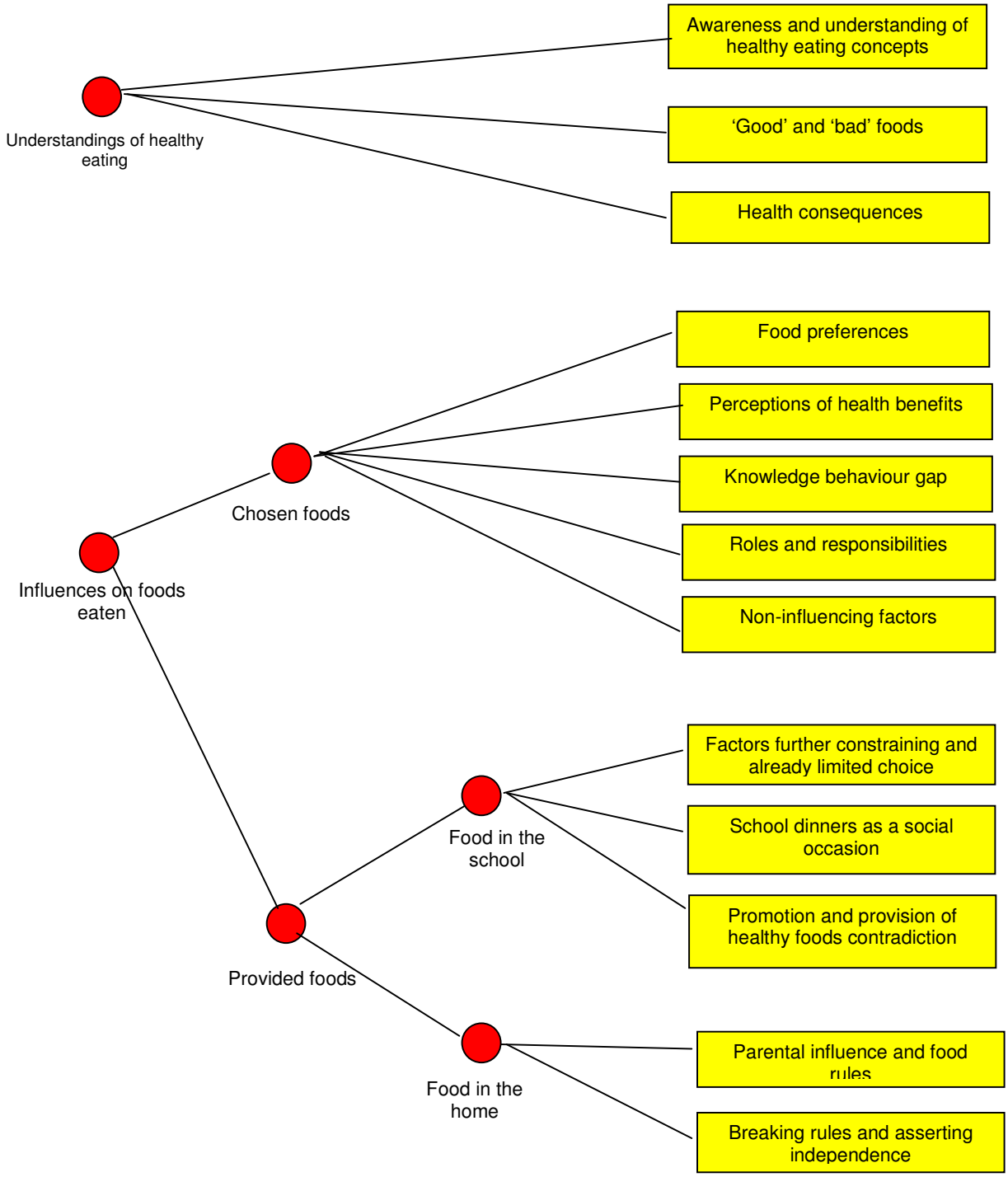
6.1 Descriptive themes

Qualitative analysis of the findings of each study resulted in 13 main descriptive themes which were related either to children's understandings of healthy eating, or to different routes for potentially influencing children's eating (see figure 6.1).

6.1.1 Children's understandings of healthy eating

All but one of the studies examined children's understandings of healthy eating. These found that children have considerable knowledge about healthy eating; they can distinguish between healthy and unhealthy foods; and they can identify the health consequences of eating or not eating healthily. However, children dismiss health consequences and prioritise their taste preferences. It is worth noting that authors of three of the seven studies reported that they were carried out in schools which had already taught children about nutrition and/or had implemented school policies on healthy eating (e.g. discouraging fizzy drinks, encouraging children to bring fruit into school).

Figure 6.1 Interrelated descriptive themes identified across studies of children's views (N=8)



Awareness and understanding of healthy eating concepts

Children were familiar with the term 'healthy eating' and revealed a basic understanding of the concept of a balanced diet (e.g. 'a good balance of sugar, fruit and veg') and its associated concepts such as variation (e.g. 'eating a bit of everything from different categories') and moderation (e.g. 'you need a bit of fat') (Dixey *et al.,* 2001; Edwards and Hartwell, 2002; Hart *et al.,* 2002). Although the idea of balance did feature in some children's description of a healthy diet, other descriptions were more focused on just one element of diet; one study noted that a healthy diet was most often described as one which did not include too much fat (Dixey *et al.,* 2001). Another study noted that illustrations of concepts such as moderation and variation came mainly from the older children in their sample (aged 10 to 11 years) and those who came from schools in socially and economically deprived areas (Hart *et al.,* 2002). This same study also reports that although children from schools in such areas cited food health links more frequently than others, they were less accurate when describing the links between health and foods.

'Good' and 'bad' foods

Three studies asked children to name 'good' and 'bad' food and their reasons for these classifications (Edwards and Hartwell, 2003; Hart *et al.,* 2002; Mauthner *et al.,* 1993). Children in all these studies readily used the 'food-health' or 'food-nutrition' links described by Hart *et al*. (2002) as reasons for labelling foods good and bad (e.g. fat is bad because it causes heart disease; vegetables are good because they provide vitamins). Examples of bad food included: cereals with sugar in them; sweets and chocolates; junk food; and 'fattening food'. Examples of good food included: fruit; vegetables; nuts; and milk.

Children also labelled food as good or bad on the grounds that they liked or disliked it. For example, Mauthner *et al*. (1993: p. 26) provides an illustration of a sugary food being labelled as good by the children in their sample ('Jam. Good for you. If you put it on toast. That's good for me.' and 'Um coke. Good for you'). In this same study a sour taste was used as an explanation for why vegetables like carrots are 'good for you' whereas a sweet taste was used as the explanation for why fruit is good for you (e.g. fruit is good for you 'cos it tastes sweet'; carrots are good for you 'because they're sour' p. 27). It appears that foods labelled by children as 'good' for taste reasons hold more appeal than those labelled as 'good' for health reasons.

Health consequences

Children identified both future and immediate health consequences of either eating healthily or not eating healthily (figure 6.2). (Dixey *et al*., 2001; Edwards and Hartwell, 2002; Hart *et al*., 2002; Mauthner *et al*., 1993; Tilston *et al*., 1991). One study noted that immediate health consequences of eating healthily were mentioned less often (Mauthner *et al*., 1993).

Figure 6.2: Future and immediate health consequences of healthy eating identified by children

Consequences of eating healthily	Consequences of not eating healthily
Immediate	***Immediate***
'You keep energy inside' 'You go to the toilet regularly'	Sweet things make you feel sick Fat makes you feel fat
Future	***Future***
Benefits for skin, hair, teeth and eyes Avoid diseases and dying Keeps blood and bones strong	Too much fat causes heart disease Sweet things make you fat Sweet things rot your teeth

Despite a basic understanding of current recommendations for healthy eating, and an awareness of the negative health effects of eating unhealthily and the positive effects of eating healthily, children were not concerned about negative health effects and prioritised their taste preferences. As discussed above, children's descriptions revealed that they labelled the same type of foods as both good and bad for different reasons. These apparently contradictory views were particularly highlighted in relation to sugary food such as sweets and biscuits. However, children easily managed such contradictions – they prioritised taste preferences and dismissed health concerns (Tilston *et al*., 1991; Mauthner *et al*., 1993). Tilston *et al*. (1991) found that although children understood that 'too many sweets rots your teeth' they felt that any denial of sweets was very unfair because they liked them and were not concerned about the consequences. Mauthner *et al.* (1993) report that the older children (aged seven to nine) in their study often added that they 'didn't care' when describing foods that were bad for them. In this same study, children also provided examples of eating sugary foods that they had labelled 'bad' or 'not good for you' with no ill effects ('I like sweets. When I eat it doesn't wobble my teeth because I like sweets… I eat chocolate sweets because my teeth won't wobble' p. 28). It is not clear from studies whether children's dismissal of health consequences applies to both immediate and future health.

6.1.2 Influences on foods eaten by children

The fact that children do not usually have a choice about the foods that they eat was well recognised by the children studied. They valued choice and had developed strategies for exercising that choice whenever possible. This section is therefore divided into two parts. The first presents children's ideas about what factors influence (or do not influence) their choice of foods in situations where they can choose food for themselves. The second presents children's views about eating foods in those situations in which the foods are provided for them.

a) Chosen foods

Food preferences

Children say that food preferences play a primary role in determining their choice of food. That is, they choose foods on the basis of whether they like them or not. Gibson *et al*. (1998) found that children aged nine to 11 years old rated taste as the most important factor in choosing food for themselves, although healthiness was

rated second. Food that is 'quick and easy to eat' and 'eating the same as others' were rated as less important.

Favourite foods identified by children aged five to nine were sweets, cakes, puddings, custard and cream; chips and potatoes; sausages and other meat dishes; and baked beans (Mauthner *et al*., 1993; Tilston *et al*., 1991). Children also indicated that they liked fruit. For example, Gibson *et al*. (1998) found that nine to 11-year-old children rated their liking for fruit nearly as high as their liking for confectionary. Liking for vegetables was rated much lower than fruit and confectionary. Similarly, Edwards and Hartwell (2002) found that fruits were rated as more acceptable than vegetables by the eight to 11-year-olds in their sample. Two studies examined fruit preferences amongst eight to 11-year-olds (Edwards and Hartwell, 2002; Neale *et al*., 1998). The most popular fruits were apples, strawberries, oranges, pears, grapes and bananas. Fruits not liked by most children were dates, rhubarb, grapefruit, plums and figs.

One study examined vegetable preferences amongst eight to 10-year-old children from advantaged and disadvantaged areas in Glasgow (Baxter *et al*., 2000). This study asked children to rate their preference for eight vegetables and examined the characteristics the children assigned to different vegetables in order to build up a picture of why children liked and disliked different vegetables. Colour, taste, texture and size were important. Large, hard and leafy vegetables were not well liked and vegetables with pips in them were also disliked (turnip, cauliflower, cabbage and tomatoes). On the other hand, brightly coloured, small, soft, juicy and sweet vegetables were liked by children (peas, sweet corn and carrots). Those which could be served with a sauce, were also popular (baked beans). Baxter *et al*. (2000) noted that vegetable preferences did not vary according to age, gender or social class.

Perceptions of health benefits

Although Gibson *et al*. (1998) found that children aged nine to 11 years old rated the healthiness of food as the second most important factor in choosing food, evidence from other studies suggested that children would actively reject foods if these were perceived as healthy. This is expressed through an association of healthy foods with foods that do not taste very nice. For example the nine to 10-year-old boys in the study by Dixey *et al*. (2001: p. 73) reported that 'All the things that are bad for you are nice and all the things that are good for you are awful'. In the same study, some children reported throwing away foods they knew had been put in their packed lunches because they were 'good for you' and only ate the crisps and chocolate. Tilston *et al*. (1991: p. 27) report a similar viewpoint from the five to seven-year-old children in their sample ('I don't like them so they must be healthy'). In addition, the leafy green vegetables disliked by eight to 10-year-old children in the study by Baxter *et al*. (2000) where seen as being full of vitamins.

Knowledge behaviour gap

The finding noted above that children describe dismissing health concerns in favour of choosing foods based on their taste preferences, despite an awareness of the importance of eating healthily, suggests the classic 'knowledge-behaviour gap' is operating. Moreover, children in one study explicitly used the 'knowledge-behaviour gap' idea to express their views on healthy eating. The nine to 10-year-old boys in Dixey *et al*. (2001: p. 74) described how their resolve to eat more healthy foods,

fostered as a result of receiving an intervention to promote healthy eating, broke down in the face of temptation or easy access to unhealthy foods ('When they [the APPLES project] come round, you think right, I'm going to get healthy now, but when you get home, you get something out of the fridge or something' and 'At home I just nip into the biscuit tin').

Roles and responsibilities

In the only study to raise the issue of whether children used their own money to buy food, Dixey *et al*. (2001) reported that children said they used their pocket money to buy sweets. They did not see the use of this money to buy healthy foods as legitimate and thought that it was their parents' role to buy healthy food.

Factors children describe as not influencing them

Again Dixey *et al*. (2001) was the only study to reveal factors which children described as not influencing their choice of foods. These were advertising and friends. Children felt that they were not personally influenced by advertising and felt that advertisers were 'just after your money'. However, children did talk about other children being influenced by advertising. For example, girls talked about how their brothers were influenced by an advert for a burger bar which featured a footballer ('My brother says we have to go to there [to the burger bar] because Alan Shearer has been there' p 75). The authors of this study also note that children admitted that adverts made them feel hungry and they enjoyed the foods that were advertised (and their adverts). Similarly, friends were not identified as an influence. Children said that they did not talk about healthy eating with their friends. However they did talk about sharing sweets with friends. Although children did not identify friends as being a direct influence, they did highlight eating as a social occasion and valued being able to eat with friends. This is discussed below in more detail.

b) Provided foods in the school

Two studies had findings concerning children's views about foods provided or eaten at school (Dixey *et al*., 2001; Mauthner *et al*., 1993). In brief, children: described how their choices were constrained by the availability of food for school dinners and pressures to choose and eat food quickly; highlighted how important it was to them to be able to enjoy school dinners as a social occasion in which they could spend time with friends; and recognised a contradiction between the teaching of healthy eating in the classroom and the temptation of unhealthy foods in the school dining room.

Factors further constraining a limited choice

In one culturally diverse primary school in the south of England (with a high proportion of its children entitled to receive a free school meal), Mauthner *et al.* (1993) identified a range of factors that influenced the quality and quantity of the food provided for school dinners. Budgetary constraints meant that the school was often not able to provide the foods that children said they preferred (e.g. pizza, pasta, samosas). Food shortages were also a daily problem and catering staff were always trying to make the food go further. The fruit tended to run out, but so did main meals. Salads were presented first on the counter, but puddings and cakes were displayed before the fruit. Interviews and informal conversations with children revealed that

lunchtime was generally seen as 'one big rush'. This meant that children were often under pressure to choose and eat food quickly. This was especially difficult for the younger children as they tended to be slower to make a choice and could end up receiving food that they did not really want. Children were either rushed along and given foods before they could refuse, or they did not manage to make their preference heard ('Why did you ask for it [jelly]?…I didn't…Why don't you go back and get some fruit? …How shall I?' p. 17). Children, did however, reveal strategies for expanding their choice in creative ways. For example non-vegetarians opted for the vegetarian dish when the main meal looked unappetising, explaining 'Sometimes I'm vegetarian, sometimes I'm not' (p. 16).

School dinners as a social occasion

All the children were keen to sit with their friends during school lunch. Children who had school dinners could not choose where to sit, but were sat with friends if they were with them in the dinner queue. Those children who brought in packed lunches had more freedom to sit where they wanted to. Interestingly, quite a few children aspired to have packed lunch. The ability to choose to sit with friends may have been one factor in this. However, another factor mentioned by the children was financial. Some said that having packed lunch was something to look forward to when their family could afford it. The decision about whether children had packed lunch or school dinner appeared to be made by parents. Children who had packed lunch did not always have more choice in what food they ate at school. Some children told parents what they wanted and this was what they were given; but many children had little say in what went into their lunchboxes.

Contradiction between promotion and provision of healthy foods

Some of the boys in the study by Dixey *et al*. (2001) highlighted a contradiction between the teaching of healthy eating in the classroom and the temptation of unhealthy foods in the school dining room ('But once you go down for the school dinners it's a different story, because you've got all your fattening foods' p. 74). This was one of the main conclusions that Mauthner and colleagues came to in their study. They also concluded that the provision of school dinners is not 'child-centred' (reported in the linked report by Turner *et al*., 1995: p.25).

c) Provided foods in the home

Three studies had findings concerning children's views about food provided at home (Dixey *et al*., 2000; Hart *et al*., 2002; Mauthner *et al*., 1993) and one study examined the views of mothers on the factors determining the food that they chose for their children (Gibson *et al*., 1998). This latter study found that in contrast to their children, the mothers included in this study rated concerns for their children's health as the most important factor in choosing foods for their children (children rated taste as the most important factor).

Parental influence and food rules

This conflict of views between parents and children was reflected in other studies in which children described various 'food rules' employed by parents (Dixey *et al.,* 2001; Hart *et al.,* 2002). Sometimes these were used to encourage children to eat more vegetables and fewer sweets. Hart *et al.* (2002) found that children described

seven parental food rule categories: 'food prescription' in which there was an obligation to eat a specific food item (e.g. you must eat fruit everyday?); 'food restriction' whereby some foods were simply not allowed (e.g. fizzy drinks); 'timing restrictions' whereby children were not allowed to eat at certain times (e.g. not before bed); 'food deals', for example not allowing children to have a pudding unless they finish their main course; rules about table manners; obligation to finish food; and 'no rules' or 'free choice'. Sometimes this latter category seemed to occur to ensure that children did eat something (e.g. 'My mum doesn't care what I eat…as long as I eat something' p. 133). Some of the children in Dixey *et al*. (2001) reported that their parents also influenced them to eat healthier foods in a more positive way by virtue of making healthier choices themselves.

It is a shame that neither of these two studies report children's views of the relative appropriateness or effectiveness of these different 'food rules'. However, Hart *et al*. (2002) do report some differences in the citing of these strategies according to sex, age and socio-economic status. Boys were more likely than girls to cite rulings over food manners and to finish food; girls were more likely to cite food prescriptions or food deals. Older children (10 to 11-year-olds) were more likely to report timing restrictions and obligations to finish their dinner and a free choice; younger children (aged seven to eight years old) were more likely to report food deals. Children from schools serving a disadvantaged area were more likely to report free choice or absence of rules in the home; children from schools serving an advantaged area were more likely to report food prescriptions and timing restrictions. The study by Dixey *et al*. (2001) reports that children also described how their parents would encourage them in a more positive way to eat healthy food.

Breaking rules and asserting independence

Despite a climate of food rules in the home, children described breaking these rules with regard to eating sweets. Mauthner *et al.* (1993: p. 28) provide the example of five-year-old Meena explaining how she and her sisters eat sweets when their mother is out ('When my mum goes out we quickly eat them…When she comes back we put them away'). Eating sweets is clearly an act which is thoroughly enjoyed by children. The reasons for this appear to go beyond simply enjoying the taste of sweets. This is particularly interesting when considered in the light of children's preference for fruit over vegetables because they taste sweet. Children like the taste of fruit but do not speak about eating fruit with the same enthusiasm as eating sweets.

Choosing to eat sweets despite the 'rules' seems to be a way for children to assert their independence. Interestingly, this appears to extend to healthy food too, at least for girls. During a discussion about parental influence on food choice, some of the girls in Dixey *et al*. (2001) were keen to point out that they did not need encouragement from parents because they liked 'healthy stuff' and would choose to eat it anyway. Other girls in this study expressed their preference for packed lunches because they could exercise choice: 'I pack my own lunch and always put fruit into it' (Dixey *et al*., 2001: p. 74).

6.1.3 Differences amongst children

A number of studies indicated differences in children's views about healthy eating and fruit and vegetables, according to various characteristics. In particular, age, gender and socio-economic status were highlighted but also, to a lesser extent, ethnicity. Most of the evidence of such differences is provided by those studies that stated this as an aim (Baxter *et al.,* 2000; Gibson *et al*., 1998; Hart *et al.,* 2002; Neale *et al.,* 1998). Two other studies did explore variations in the results according to the characteristics of the children although they did not present this as a particular aim of the study (Tilston *et al.,* 1991; Edwards and Hartwell, 2002).

The most commonly reported difference was in relation to the age of the children, with older children cited as having better recognition of vegetables (Edwards and Hartwell, 2002), and some indication of higher awareness of the health consequences of not eating healthily (Hart *et al.,* 2002; Tilston *et al*., 1991). This is in contrast to younger children who were cited as being more likely to advocate increasing sugar consumption (Tilston *et al.,* 1991) whilst also being more likely to have higher levels of vegetable intake (Baxter *et al.,* 2000). Other differences between older and younger children relate to choice with older children being more likely to cite that they had a level of freedom in choosing food (Hart *et al.,* 2002), whilst younger children were observed to be less able to make quick food choices in the school dinner line, their choices often being over ridden by adults keen to keep the dinner line flowing.

The influence of gender was found not to have a significant impact on either preferences (Baxter *et al.,* 2000), or attitudes towards increased fruit consumption (Neale *et al.,* 1998). The study by Hart *et al.* (2002), as mentioned earlier, did find gender differences according to the types of parental rules or restrictions the children said they encountered (Hart *et al.,* 2002). In addition, the study by Edwards and Hartwell (2002) cited differences in fruit and vegetable preferences according to gender and age, finding that there were significant variations according to both of these variables.

Two studies found that the socio-economic status (SES) of the children did not have an impact on children's attitudes or preferences (Neale *et al.*1998; Baxter *et al.,* 2000). However, significant correlations were found between SES and intake, with children in families with indicators of lower SES being less likely to consume fruit juice and fruit. The study by Hart *et al.* (2002) also found that SES was correlated with the types of parental rules enforced in a home, lower SES being correlated with absence of rules, or free choice.

The issue of ethnicity was only touched upon in the Turner *et al.* (1995) study, which found that the requirements of Asian children's religious practices were often not catered for in the school canteen and so these children were given a packed lunch.

The differences seem to highlight that although gender and SES were unlikely to affect attitudes and preferences, they were likely to affect practices; and that ethnicity could also affect practice, whilst age could affect both attitudes and practices.

6.2 Analytical themes and barriers and facilitators

As noted in chapter two, the barriers and facilitators framework of our review did not appear to match the way children included in the studies talked about healthy eating. Children did not readily identify (and do not appear to have been directly asked about) things that helped them to eat or stopped them from eating healthily. It was, however, possible for reviewers to interpret, from the perspectives that children did express, the issues articulated by children that might act as barriers or facilitators for healthy eating and for increasing their consumption of fruit and vegetables in particular.

The methods we used to infer these barriers and facilitators are described in full in chapter two and appendix D. Table 6.1 below shows the results of this process.

6.2.1 Children do not see it as their role to be interested in health (theme 1)

Children identified readily that taste was the major concern for them when selecting food, and that health was either a secondary factor or, in some cases, a reason for rejecting food. This idea that it is not children's role to be interested in health was further exemplified when children stated that they did not see buying healthy food as being a legitimate use of their money.

The reviewers felt these barriers could be addressed by a shift in emphasis for the presentation of healthy foods. As one child noted astutely, 'All adverts for healthy stuff go on about healthy things. The adverts for unhealthy things tell you how nice they taste.' (Dixey *et al.* 2001: p. 75) This idea, coupled with children's identification of taste as the most important factor for them when choosing food, indicates that branding fruit and vegetables as a 'tasty' and 'exciting' or child-relevant product could be far more effective in increasing consumption than a focus on health messages.

The issue of presentation seemed to be a salient one for children. One recommendation that came directly from a child was the suggestion that fresh fruit could be advertised with a famous celebrity. The children in the study by Dixey *et al.* (2001) discussed food and advertising and acknowledged that they liked the adverts involving football celebrities, although these adverts involved unhealthy food. The child's recommendation and the views on advertising suggest that children would be receptive to advertising linking fruit with their interests.

Furthermore, although the children in the study by Gibson *et al.* rated health as the second most important factor in choosing food, it was reported by other children that they actively avoided foods they knew to be healthy (Dixey *et al.,* 2001). The views presented thus indicate that health promotion drives would do well to promote 'tastiness' as the primary appeal of fruit and vegetables with nutrition as a secondary, if not invisible, factor.

Table 6.1: Barriers, facilitators and implications for interventions to promote increased fruit and vegetable intake amongst children

Themes from children's views	Barriers	Facilitators	Implications for intervention development
Children do not see it as their role to be interested in health.	Children dismiss the health consequences of eating or not eating healthily and prioritise taste preferences. They consider taste, not health, to be a key influence on food choice. Food labelled as healthy may lead children to reject them ('I don't like them so they must be healthy') Children do not see buying healthy foods as a legitimate use of their money		Brand fruit and vegetables as a 'tasty' rather than 'healthy'. Promote children's favourite fruit and vegetables or target the ones they do not like
Children do not see future health consequences as personally relevant or credible.	Children dismiss possible health consequences of not eating healthily for them personally ('don't care') Children feel that health messages (e.g. 'sweets rot your teeth') do not match their actual experience	Immediate health consequences may be more relevant to children (e.g. effects on skin; energy to move around)	Reduce emphasis on health messages, particularly those that concern future health. Make health messages credible and relevant for children
Fruit, vegetables and confectionary have very different meanings for children.	Children do not like (some) vegetables because they taste sour ('yucky'). Children do not like large and hard vegetables. Eating sweets is a social and 'exciting' activity to be shared with friends and siblings	Children like fruit because it is sweet Fruit is preferred to vegetables and is liked almost as much as confectionary Children prefer brightly coloured, small, soft, juicy and sweet vegetables.	Do not promote fruit and vegetables in the same way: Do not promote fruit and vegetables within the same intervention; or if fruit and vegetables are promoted in the same intervention treat them differently Brand fruit and vegetables as an 'exciting' or child-relevant product, as well as a 'tasty' one.
Children actively seek ways to exercise their own choices with regard to foods.	Eating sweets, despite parental rules, is a way for children to assert their own independence Children can feel under pressure to choose and eat food quickly in school	For girls, choosing healthy foods appears to be a way for them to exercise their own choice	Create situations for children to have ownership over their food choices.
Children value eating as a social occasion.	Eating sweets is a social and 'exciting' activity to be shared with friends and siblings	Children like to sit with their friends at school	Brand fruit and vegetables as an 'exciting' or child-relevant product, as well as a 'tasty' one. Create situations for children to have ownership over the social context in which they eat their food
Children recognise the contradiction between what 'adults' promote in theory and what is provided in practice.	Easy access to tempting (unhealthy) foods Contradiction between the promotion of healthy foods in the classroom and the provision of unhealthy foods in the school dining hall.		Ensure that messages promoting fruit and vegetables are supported by appropriate access to fruit and vegetables

A second recommendation for future practice also stemmed from children's views about taste. Children indicated that certain vegetables were preferable to others. Larger vegetables such as cauliflower, cabbage, turnip, and vegetables with a sour taste were identified as being not very appealing to children. Smaller, sweeter vegetables, such as peas, sweet corn and baked beans were reported to be much more appealing. Therefore, it would seem appropriate for products and interventions to link in to what children are saying about the vegetables they prefer.

6.3.2 Future health consequences (theme 2)

Data from a number of studies indicated that health messages about the future consequences of not eating healthily are not important for children. Indeed children suggest these messages are being received yet they are unconcerned about such issues.

Furthermore children found that the health messages they were receiving did not stand up to their scrutiny. Children demonstrated an awareness of health messages but their own experience told them that not eating healthily did not seem to have a negative impact on them, thereby negating the credibility of the messages they are receiving. For example, the article by Mauthner *et al.* (1993; p. 28) cites a child whose experience tells her that 'I like sweets. When I eat it doesn't wobble my teeth'.

Furthermore, messages about cancer or heart disease are even less likely than tooth decay to match a child's personal health experiences, and are, therefore, even less suitable as messages for children.

Health messages linked to healthy eating could be geared towards more immediate consequences of not eating healthily, with a focus on issues relevant to children's experiences, such as benefits for skin and hair, growth and strength, rather than focusing on problems they would be unlikely to face until adulthood, such as cancer or heart disease.

Children's discussion of their understanding of healthy diets revealed a further issue regarding health messages. In children's accounts of what constitutes a healthy diet, the focus was overwhelmingly on not having too much fat in the diet, and to a lesser extent the impact of sugar on dental health. Some children in the Tilston study (Tilston *et al*. 1991: p. 28) even indicated an awareness of the link between salt and blood pressure. Although some children indicated an understanding of balance, they did not highlight fruit and vegetables as constituting part of a healthy diet. Therefore, it would seem that children are able to take health messages on board and it may be worth giving some clear messages about fruit and vegetable intake to counterbalance the overwhelming viewpoint that health messages are primarily about fat. However, as noted earlier children's views indicated that health messages are not of interest to them, therefore if health messages are to be conveyed the children's views presented here suggested that these messages should be child relevant and given less importance than messages about taste.

6.3.3 Fruit, vegetables and confectionary (theme 3)

Children view fruit and vegetables as very different in nature. The children in several studies indicated that they liked fruit (e.g. Gibson *et al*., 1998; Neale *et al*., 1998; Turner *et al.,* 1995). The children in the Gibson *et al.* study (1998) rated fruit nearly as highly as confectionery, whilst in the study by Mauthner *et al.* (1993) children said that they like fruit because it 'tastes sweet'. No children in any study indicated that they disliked fruit. However, there was much evidence to suggest that vegetables were less well liked. In the study by Gibson *et al.* the children's rated liking for vegetables was significantly lower than their rating for fruit. The Edwards and Hartwell (2002) study also found that children rated acceptability of fruit higher than acceptability of vegetables. This would suggest that fruit and vegetables should not be promoted in the same way.

Such findings must be considered in association with the above findings on barriers and facilitators, i.e. that sweet taste is an important facilitator for children and that links to health benefits can be a barrier; 'everything that is healthy tastes awful'. Therefore, presenting a health message linking vegetables and fruit may in fact be detrimental to fruit consumption, as fruit would move from a category associated with 'tasty' food to a category associated with 'healthy', and by definition 'awful' food.

6.3.4 Children exercise choices (theme 4)

Children often expressed views about the importance, for them, of exercising choice. For example, eating sweets, despite parental rules, is a way for children to assert their own independence. Some children in the study by Mauthner *et al.* (1993) emphasised that they felt unhappy when they were not able to exercise their choice fully, such as feeling under pressure to choose and eat food quickly in school. Other children, girls, stated that choosing healthy foods was a way for them to exercise their own choice.

These findings point to the importance of healthy eating interventions enabling children to make healthy choices and to have ownership over their food choices. For example, interventions could involve children in the planning of healthy school menus.

6.3.5 Eating as a social occasion (theme 5)

Many comments made by children showed that they valued eating for its social aspect. This is relevant to the development of appropriate interventions. Some children suggested that eating sweets is a social and 'exciting' activity to be shared with friends and siblings. If fruit products could be branded and presented as something child relevant they would have the potential for being valued as part of a similarly exciting activity. Other children discussed the context in which they eat in terms of the social aspect of the school lunch. The fact that children said that they like to sit with their friends at school suggests that healthy eating interventions should foster the social side of lunchtime to fuse healthy eating with an enjoyable occasion.

6.3.6 Contradictions in theory and practice (theme 6)

The children themselves provided three recommendations for the promotion of fruit and vegetable consumption. The recommendations came from the study by Dixey *et al.* (2001) in which children had been exposed to the 'APPLES Project' intervention. One recommendation was that the fruit tuck shops, which were part of the 'APPLES Project', would be worth running permanently. This suggestion ties in with their views about having access to healthy foods being a facilitator, and being able to exercise choice. It may also be worth involving children in the choice of selection of fruits available.

Some children observed that even when they did take the health promotion messages on board, good intentions were often scuppered by the provision of unhealthy foods by others, or ease of access to unhealthy foods which tempted them when making their own choice. To this end it would be important for interventions to ensure that messages promoting fruit and vegetables are supported by appropriate access to them.

7. SYNTHESIS ACROSS STUDY TYPES

Outline of Chapter

This chapter synthesises the findings from the different sections of the report. This is a particularly challenging exercise in view of the different types of research included. Specifically, the chapter looks at:

- *the ways in which the barriers to eating fruit and vegetables identified from children's views are similar to, or different from, the barriers addressed in intervention studies;*

- *the extent to which the facilitators as inferred from children's views have been used as the basis of evaluated interventions.*

*This chapter will be useful to all audiences. In particular **practitioners**, **policy specialists**, **children and their families** are likely to find useful the examples of matches, mismatches and gaps between what children say are influences for healthy eating and interventions for healthy eating. Matches highlight interventions that resonate with children's views. Mismatches highlight interventions that could match with children's views but have not been evaluated in a sufficiently rigorous way to enable reliable conclusions to be drawn, or interventions targeting aspects of healthy eating that were not identified in children's views studies, such as studies with a focus on parental involvement. Gaps highlight areas where no interventions were located that matched children's views. These suggest promising interventions to build on for future development and evaluation.*

Key messages

- *Some interventions matching children's views were clearly effective*
- *Some interventions matching children's views were unclear in their effects*
- *Some children's views may provide guidance for the design of innovative interventions*
- *No interventions matching children's views were clearly harmful or ineffective*

Components of effective interventions include:

- *Encouraging children to accept or like the taste of fruit or vegetables, rather than highlighting the health benefits*
- *Minimal emphasis on the benefits for future health*
- *Treating fruit and vegetables differently*

The effectiveness of the following components is unclear, and further evaluation is required:

- *Branding fruit and vegetables as exciting or child-relevant products, as well as tasty*
- *Encouraging situations for children to express choice*
- *Appropriate access to fruit and vegetables in school*

Opportunities for developing and evaluating innovative interventions based on children's views include:

- *Branding fruit and vegetables as 'tasty' rather than 'healthy'*
- *Creating opportunities for children to influence the social context in which they eat*

- *Making health messages credible for children*

Six themes were identified in the synthesis of children's views; these themes are highlighted in chapter six and appendix I, along with nine implications for future interventions derived from these themes. This chapter will assess the extent to which the interventions in the outcome evaluations assessed for this review address each of the nine implications.

Table 7.1 illustrates which interventions, if any, were found to have addressed the implications highlighted by children's views.

Table 7.1: Reliable and other outcome evaluations addressing implications for interventions identified from children's views

Implication	Reliable outcome evaluations addressing implication	Other outcome evaluations addressing implication
(1) Brand fruit and vegetables as a 'tasty' rather than a 'healthy' product.	None identified	None identified
(2) Promote children's favourite fruit and vegetables or target the ones they do not like	Hendy (1999) Wardle *et al.* (in press-a) Wardle *et al.* (in press-b)	None identified
(3) Reduce emphasis on health messages particularly those which concern future health	Hendy (1999) Liquori *et al.* (1998) Smolak *et al.* (1998) Wardle *et al.* (in press-a) Wardle *et al.* (in press-b)	Domel *et al.* (1993)
(4) Make health messages credible and relevant for children	None identified	None identified
(5a) Do not promote fruit and vegetables in the same intervention	Liquori *et al.* (1998) Moore (2001) Wardle *et al.* (in press-a) Wardle *et al.* (in press-b)	Smith and Justice (1979)
(5b) If promoting fruit and vegetables in the same intervention treat them differently	Baranowski *et al.* (2000)	None identified
(6) Brand fruit and vegetables as an 'exciting' or child-relevant product, as well as a tasty one	Anderson *et al.* (2000) Baranowski *et al.* (2000) Hopper *et al.* (1996) Perry *et al.* (1998a) Reynolds *et al.* (2000) Shannon *et al.* (1982)	Boaz *et al.* (1998) Domel *et al.* (1993) Foerster *et al.* (1998) Friel *et al.* (1998) Lawatsch (1990) Lowe *et al.* (submitted for publication)
(7) Create situations for children to have ownership over their food choices	Moore (2001)	Foerster *et al.* (1998)
(8) Create opportunities for children to have ownership over the social context in which they eat their food	None identified	None identified
(9) Ensure that messages promoting fruit and vegetables are supported by appropriate access to fruit and vegetables	Anderson *et al.* (2000) Parcel *et al.* (1999) Perry *et al.* (1998a) Perry *et al.* (1998b) Reynolds *et al.* (2000)	Resnicow *et al.* (1992)

A more detailed version of this table displaying both the themes and implications derived from children's views can be found in appendix J.

Several cells in table 7.1 demonstrate that no matching studies were identified for some the implications identified by children. However, there were sufficient numbers of studies for other implications (3, 6 and 9) to conduct meta-analyses in order to explore whether the subgroups of studies addressing these implications had different levels of effect from those that did not. (This was specified in advance in our methods and does not represent an attempt to 'dredge' the data for significant results; it is our chosen technique of combining qualitative and quantitative methods for synthesis.) The other implications, where a smaller number of matches were found, are explored narratively.

7.1 Matching children's views to evaluated interventions: Children do not see it as their role to be healthy

The first of the six analytical themes to emerge from the children's views synthesis revealed that children do not see it as their role to be healthy or to be interested in health. In the context of encouraging children to eat more fruit and vegetables, this led to two implications for interventions: to brand fruit and vegetables as being a 'tasty' rather than a 'healthy' product and; to promote children's favourite fruit and vegetables or to target the ones that they do not like.

7.1.1 Brand fruit and vegetables as being a 'tasty' rather than a 'healthy' product

With regard to this implication, no interventions reliably evaluated or otherwise, were found to have branded fruit and vegetables as being tasty, or to have used the taste appeal of fruit and vegetables as a particular focus. In fact, many interventions targeted that which children views suggested could be a barrier - emphasising the health benefits of eating fruit and vegetables. For example, within interventions to promote the 'five-a-day' message, health reasons were emphasised in their catchy slogans such as '5 A Day Power Plus' (Perry *et al*., 1998a) or 'Gimme 5 fruit, juice, and vegetables for fun and health' (Baranowski *et al*., 2000). As children do not see it as their role to be interested in health, the health messages are unlikely to capture children's interest. Indeed, children argued that if food is labelled as healthy they were more likely to reject it. Thus the focus on health issues within interventions for children may, in fact, be detrimental to increasing their consumption of fruit and vegetables.

7.1.2 Promote children's favourite fruit and vegetables or target the ones they do not like

Children argued that taste, rather than health, is the key influence on their choice of food for themselves. The implication for interventions to flow from this is that they should focus on increasing the consumption of fruits and vegetables that children identify as tasty or on changing children's preferences. Unlike the first implication described above, this one was found to have some matches amongst the interventions.

Three reliably evaluated interventions attempted to encourage children to try unfamiliar, or previously disliked, fruits and vegetables (Hendy, 1999; Wardle *et al*., in press-a; Wardle *et al*., in press-b). These interventions were informed by the observation that we are all reluctant to try unfamiliar foods, with children showing a particular reluctance to try new vegetables between the ages of two and six (Wardle *et al.,* 1998a: p. 4). Simple exposure was used as the basic mechanism for change, whereby disliked or unusual foods were presented regularly for the participants to try.

The intervention evaluated by Wardle *et al*. (in press-a) involved a researcher encouraging children to eat red pepper with eight daily tasting sessions; two levels of intervention were compared: exposure only and exposure plus rewards (stickers) for eating at least one bite.

Hendy (1999) evaluated an intervention to encourage children to try four new fruits and vegetables during a school lunchtime and compared exposure only to exposure plus a) teacher modelling; b) rewards for trying one or two bites; c) a teacher insisting that children try at least one bite of each of the four foods; and d) a teacher offering the children a choice of whether or not to eat the new foods. Hendy (1999) found that exposure combined with insisting, rewards, or choice was more effective in increasing the number of bites that children took of the new foods than simple exposure alone. These findings would appear to be consistent with other issues which children have raised, such as parental rules (which could be construed as being similar to insisting), the importance of choosing their own food, and their enjoyment of sweets (the reward intervention of this study consisted of receiving dessert). These are discussed in sections 7.4 and 7.5 below.

The two evaluations discussed so far showed effects limited to the testing environment. However, the second study by Wardle *et al.* (1998a) provided some evidence that exposure to new and disliked vegetables can increase consumption of these foods within children's everyday lives. Wardle *et al*., (in press-b) evaluated a parent-delivered intervention in which children were offered their target vegetable every day for 14 consecutive days. Parents were told not to offer rewards. Compared to an information only group and a control group, the number of children in the exposure group who ate some of their target vegetable voluntarily increased significantly from 47 percent to 77 percent.

These interventions focused on increasing children's consumption of vegetables by encouraging them to accept or like the taste of them, rather than linking these items with their health benefits.

7.2 Matching children's views to evaluated interventions: Future health consequences

In addition to the theme outlined in 7.1 – that children do not see the promotion of their health as their responsibility – children not only disregard the future consequences of their current actions on their future health, but see any future health consequences related to healthy eating as applying to other people rather than themselves. They also feel that health messages (e.g. 'sweets rot your teeth') are not credible because they do not reflect their personal experience. The third and fourth implications for interventions emerged from these views: that the current emphasis

on health messages – particularly those concerning future consequences – should be reduced; and that any health messages that are conveyed should be credible and relevant to children.

7.2.1 Reduce health emphasis in messages to promote fruit and vegetables particularly those which concern future health

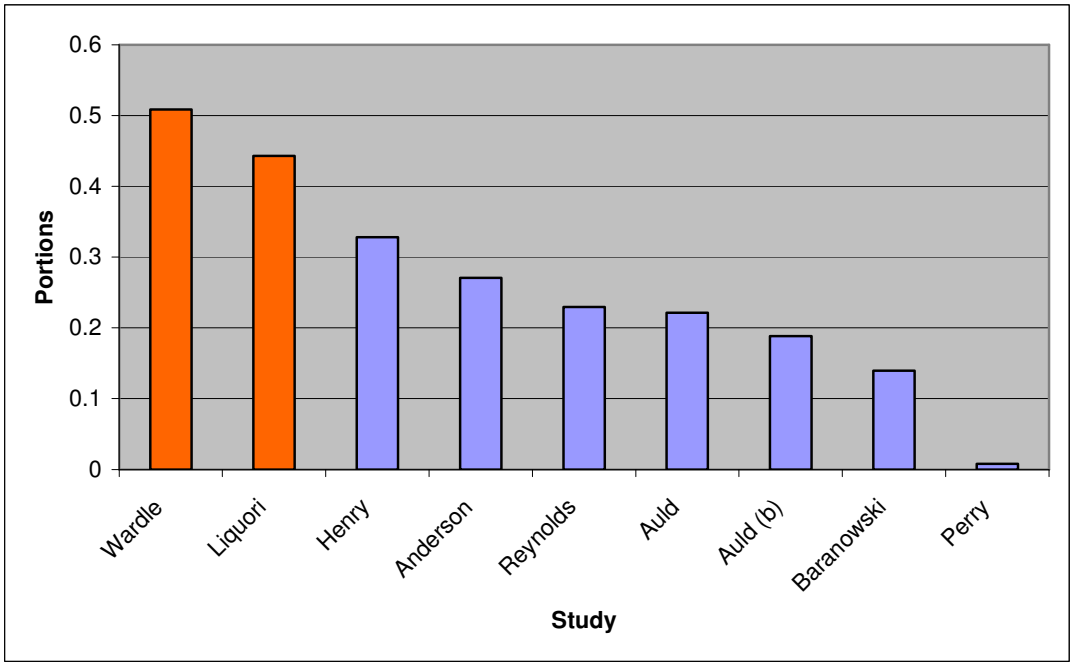
Five reliably evaluated interventions aimed to increase children's fruit and vegetable consumption without placing a great deal of emphasis on health messages: Liquori *et al.* (1998), Smolak *et al.* (1998), Wardle *et al.* (in press-a), Wardle *et al.* (in press-b) and Hendy (1999). Two of these interventions attempted to persuade children to 'try new foods' and are described in section 7.1. The remaining three contributed to a sub-group meta-analysis.

A sub-group analysis was conducted which compared the results of Liquori *et al.* (1998), Smolak *et al.* (1998) and Wardle *et al.* (in press-b) with the other outcome evaluations on increase in vegetable consumption (neither Liquori *et al.* (1998) nor Wardle *et al.* (in press-b) targeted fruit). Since the synthesis of outcome evaluations suggested that interventions targeting physical activity as well as healthy eating were qualitatively different to those that did not, the sub-group analysis excluded the interventions with a physical activity component; thus Smolak *et al.* (1998) was removed from this analysis. (There is also justification for excluding Smolak *et al.* (1998) on the grounds that the study was examining different concepts to the other two.)

As figure 7.1 shows, the two studies which did not focus on the health benefits of eating fruit and vegetables showed the two highest effect sizes and were the only two studies to increase vegetable consumption by a standardised measure of more than 0.4 portions per day. The p value for this is significant ($p=0.003$) but only a small number of studies was involved. The results do show though, that health messages are not essential components of interventions which aim to increase children's vegetable consumption.

One further study was found to have minimal emphasis on the health aspects of eating fruit and vegetables, but assigned only one cluster to each arm of the trial, and therefore was not used in the meta-analysis. The study by Domel *et al.* (1993) evaluated an intervention designed to enhance students' abilities to ask for, and prepare, fruit and vegetables, to enhance students' liking for fruit and vegetables and to modify students' behavioural change techniques - goal setting, self-monitoring and problem solving. Thus here the focus was on working with, tasting and eating fruit and vegetables rather than learning about the health issues around fruit and vegetables. The study was found to increase preferences for fruit and fruit and vegetable snacks significantly, but not for vegetables. The results regarding consumption were very unclear however, with no differences found between the experimental or control group with regard to total daily servings of fruit and vegetables. The authors concluded that the weak results on both preferences and consumption might be explained partially by the vegetable consumption results; the authors suggest that more emphasis needs to be placed on exposure to vegetables in order to increase preferences: a finding which is in tune with children's views.

Figure 7.1: Increase in vegetable intake (standardised portions per day) among studies which did not have a physical activity component in their intervention



7.2.2 Make health messages credible and relevant for children

There were no matching studies for the other implication for interventions – that health messages should be relevant and credible for children. Children have demonstrated that they examine health messages that are presented to them critically and make their own 'evidence-informed' decisions about whether or not a particular message applies to them personally. If they had been informed that eating certain sweets would make their teeth 'wobble', but after eating the sweets no effect was noticed, this warning lost its credibility. In the same way, cardiovascular disease and cancer may be beyond many children's experience and knowledge. Therefore, invoking images of specific diseases as warnings to children may lack impact because, being beyond their experience, these diseases do not pose an identifiable threat. Developing health messages that convey the health benefits of eating fruit and vegetables in a way that is credible, relevant and comprehensible to children is a challenge for future programme development.

7.3 Matching children's views to evaluated interventions: Fruit, vegetables and confectionery

7.3.1. Do not promote fruit and vegetables in the same way

The fifth implication, that fruit and vegetables should not be promoted in the same way, can be dealt with in two ways. Firstly, not promoting fruit and vegetables in the same intervention could solve this problem (implication (5a)), and secondly, if fruit and vegetables are promoted together, children's views suggest they should still be treated differently (implication (5b)). The justification for this implication is that children have stated that they like fruit, but that vegetables are something they like much less; therefore, interventions that promote fruit and vegetables together, particularly as healthy foods, are likely to damage the status of fruit as being perceived as something tasty for children. However, nine of the reports of evaluations indicate that the focus is very much on 'fruit and vegetables', for example, the title of the report by Anderson *et al.* (2000) was: 'The development and evaluation of a novel school based intervention to increase fruit and vegetable intake in children'. Furthermore, at least eight interventions involved a slogan focusing on eating five portions of fruit and vegetables a day. In fact one study coined a new term 'freggies' to describe both fruit and vegetables as one item (Reynolds *et al.,* 1998). Whilst the simplicity of such messages are their strength, children suggest that the association of tasty fruit with disliked vegetables and health messages might not be right for them.

Five interventions did, however, match the implication that fruit and vegetables should not be promoted in the same intervention. Two reliably evaluated interventions that aimed to increase intake focused only on vegetables and not fruit. The study by Liquori *et al*. (1998) focused on whole-grains and vegetables, and the study by Wardle *et al* (in press-b) focused on increasing intake of unfamiliar or disliked vegetables. Both studies were included in the meta-analysis, and of the thirteen meta-analysed studies that measured vegetable intake, these two studies had the largest effect sizes. Furthermore, although the study with the smallest reduction in effect size after a long-term follow-up (Baranowski *et al.,* 2000) did focus on fruit and vegetables (including a 5 A Day message), this study did treat fruit and vegetables differently: two different curricula were implemented in each of the two years of the study. For the whole of the first year the focus was on 'veggies' and the larger part of the second year emphasised fruit. Six sessions at the end of the second year returned to a focus on vegetables – but fruit or vegetables were always examined and promoted separately.

A third study was identified that focused only on vegetables, however a lack of information on the evaluation in the report meant that it could not be judged as reliable. This study, by Smith and Justice (1979), focused on nutrition programmes for third graders. Two interventions, parent education and student education, were compared with a combined student and parent education group and a control group. The findings of this study are in line with the findings of the above studies: significant increases in the reported consumption of vegetables by children in the parent education and the combined groups, but these results should be accepted with caution because of the lack of information about the evaluation. One further study, by Wardle *et al*. (in press-a), had a vegetable only focus, however red pepper (the

vegetable classified by parents as being unfamiliar to children) was the only vegetable studied and the outcome measure was whether children had tried this new food, rather than whether there were general increases in vegetable consumption. The findings of this study were positive however, as both intervention groups showed significant increases in their consumption of red pepper.

The fifth study, which did not link fruit and vegetables, was the study by Moore (2001), and focused on fruit only, via the establishment of fruit tuck-shops in schools. Unlike the other interventions that did not combine fruit and vegetables, the results of this study showed that the tuck shops had no measurable effect on children's consumption of fruit or other snacks. Although the study was evaluated soundly, the authors suggest that the time lapse between implementation of the tuck-shops and the collection of post-intervention data meant that interest had waned and thus the results were equivocal.

Despite a lack of evidence from the Moore (2001) study, the results from the majority of studies without a combined fruit and vegetable focus, do support the message from children: that fruit and vegetables are different, and that interventions which promote them should be cognisant of this.

7.3.2 Brand fruit and vegetables as an 'exciting' or child-relevant product, as well as a tasty one

As described in section 6.2, children have observed that advertising techniques differ depending on whether a healthy or unhealthy product is being promoted. Companies which are advertising sweets or fast food to children describe how tasty their products are and often use famous celebrities to make their products appear to be more attractive and acceptable; materials which promote fruit and vegetables tend to extol their health benefits without using some of the advertising images and techniques used widely elsewhere. Eating sweets is a social and 'exciting' activity that is shared with friends and siblings. Fruit might be seen in the same light if it were promoted as an exciting product in a child-friendly way. Specifically, the use of celebrities is a technique identified by children.

Five reliably evaluated studies and seven other studies used child-relevant techniques to promote the consumption of fruit and/or vegetables to children. Baranowski *et al*. (2000) used MTV style videos and a rap to make fruit and vegetables exciting to the children in their study whilst Hopper *et al*. (1996) included storybooks describing a family's journey to the 'Land of Health' to be read by parents and children together. Comic strips were used by Perry *et al*. (1998a) and 'memorable characters' employed by Reynolds *et al*. (2000) – including 'Indiana Banana' and Freggies (fruit and vegetables). '5 A Day the Bash Street way', described by Anderson *et al*. (2000), was a whole school intervention involving posters, quizzes, story books and videos. Finally, Shannon *et al*. (1982) also employed cartoon characters – this time from Marvel Comics – to persuade children to eat, rather than throw away, nutritious food.

However, it is not clear whether dividing the studies measuring fruit and vegetable intake between those which used child-friendly techniques (Anderson *et al*., 2000; Baranowski *et al*., 2000; Hopper *et al*., 1996; Perry *et al*., 1998a and Reynolds *et al*., 2000) against those which did not (Auld *et al*., 1998b; Auld *et al*., 1999; Cullen. 1997;

Epstein *et al*., 2001; Gortmaker *et al*., 2000; Henry *et al*., 2001; Parcel *et al*., 1999; Perry *et al*., 1998b) was the deciding factor in the success, or otherwise, of the interventions. Significant heterogeneity is explained by dividing the studies in this way (p=0.01) with those studies using child-friendly techniques increasing fruit and vegetable consumption by half a portion compared with only a fifth of a portion in the other studies. The heterogeneity remaining in the group which did not use child-friendly techniques is also significant though and four out of the eight studies in this group increased consumption by more than half a portion.

As mentioned in chapter five, the two studies that had the longest sustained impact were Baranowski *et al*. (2000) and Reynolds *et al*. (2000) – both of which attempted to promote fruit and vegetables as being fun and exciting as well as being healthy.

Six other studies used child-friendly techniques in their interventions. Lowe *et al*. (submitted for publication) developed the 'Food Dudes' – heroic teenage characters that defeat their enemies by eating fruit and vegetables – and accompanying merchandise for use in their intervention. Friel *et al*. (1999) adopted a similar technique in the use of the cartoon characters 'Hearty Heart and Friends'. Lawatsch (1990) (described in chapter three) re-wrote well-known fairy stories and the 'California Children's 5 A Day Power Play!' campaign (Perry *et al*., 1998a) was promoted in the local media and featured celebrities, games and prizes. (Domel *et al*. (1993) described a pilot study for Gimme 5 described above by Baranowski *et al*. (2000)).

7.4 Matching children's views to evaluated interventions: Children exercise choices

7.4.1 Create situations for children to have ownership over their food choices

The seventh implication for interventions is that providers should create situations for children to have ownership over their food choices. Children pointed out that being able to exercise choice was important to them. The fact that children suggested that eating sweets was a way to assert their own independence as they were circumventing adult rules indicates that an element of independence and choice could be an effective ingredient to incorporate into interventions. Two interventions were identified that incorporated such an element. The study by Moore (2001), a reliably evaluated intervention, involved the setting up of fruit tuck shops in 23 schools. The authors highlight the fact that 'Schools were given great flexibility in how they chose to run the tuck shops' (Moore, 2001: p. 10) and that either children or adults could be in charge of running the tuck shop. The level at which children were involved in deciding the types of fruit they would purchase is unclear, but it is possible that involvement in the setting up and running of tuck shops could instil a sense of ownership for children. There is a suggestion that the intervention was effective as pupils in schools with a fruit tuck shop were 1.55 times more likely to report that they often ate fruit as a snack at school, when compared to their control school counterparts. However, the author also states that 'the tuck shops appeared to have little or no impact on the children's reported liking of fruit, on their willingness to perceive fruit as being 'cool' (Moore, 2001: p. 14), or on their overall consumption of fruit. The author did not explore any correlations of these findings with how the

tuck shops were implemented, and so no indication of whether higher involvement of children in setting up and running the tuck shops impacted on their perception of fruit as being 'cool' or tasty.

The second study that involved creating situations for children to have ownership over their food was the study by Foerster *et al*. (1998). Although the evaluation of this was judged to have been reliable, it was not included in the meta-analysis as the allocation to condition was done by region, with only one area allocated to each condition. In this study, schools in different areas were assigned either to a condition in which activities were conducted in the school, a condition where activities were conducted in the school and in community channels, or a control condition. In the school and community condition, teams of children in each school taste-tested and selected a 'school recipe' which was then prepared in quantity by an adult sponsor. The children also designed an exhibit booth using principles of advertising and promotion, and then staffed the exhibit for families attending the event. These types of activities can be seen to provide children with a level of ownership over the intervention, and with the recipe activity, over the choice of food eaten.

The study found that consumption rose in both intervention conditions whilst dropping 12 percent in the control conditions. However, consumption rose by 14 percent in the school and community condition, compared to a seven percent increase in the school only condition. It is impossible to judge whether the encouragement of a sense of ownership in the children was a significant factor in these findings, yet these creative activities, that encourage children to exercise independence and choice, were suggested by children themselves as being useful ideas for future interventions.

7.5 Matching children's views to evaluated interventions: Eating as a social occasion

7.5.1 Create opportunities for children to have ownership over the social context in which they eat their food

A number of ideas put forward by children indicated that they valued meals and eating for being social events. Several children indicated that eating sweets is a social and exciting activity to be shared with friends and siblings; other children discussed how much they enjoyed and valued sitting and eating with their friends at school. These ideas suggested the eighth implication: that intervention providers should allow children to have a degree of ownership of the social context in which they eat their food. Programmes could foster this idea by involving children in the creation of a positive social context in which to eat healthy food. For example, interventions involving a food service component to increase provision of healthy food could also ask for, and incorporate, children's own suggestions about how to lay out the eating area.

Creating a child-friendly, positive eating environment at the same time as providing healthy food, can be seen as addressing another implication that emerged from children's views: that fruit and vegetables should be branded as being 'exciting' or child-relevant products. As indicated above, 12 interventions were found to have included child-centred and exciting elements. Furthermore, these interventions

included components which took place in the lunchroom setting, parents providing workshops in the lunchroom and posters of cartoon characters being displayed. However, no interventions were found to have incorporated either ideas about creating a positive child-friendly eating environment, or allowing children to have a sense of ownership over their eating environment.

7.6 Matching children's views to evaluated interventions: Contradictions in theory and practice

7.6.1 Ensure that messages promoting fruit and vegetables are supported by appropriate access to fruit and vegetables

Although there were no interventions that focused on the lunchroom as a setting, five interventions made changes to the foods provided at school. Such interventions fit with the ninth implication, that interventions should ensure that health promotion messages about fruit and vegetables are supported by appropriate access to them. This implication was borne out of two ideas expressed by children; firstly there was a recognised contradiction that classroom health messages did not tally with dining hall provision; secondly, that easy access to unhealthy food is a barrier to healthy eating: it is too tempting. Therefore the five interventions highlighted above can be seen as attending to these identified barriers.

A sub-group analysis was conducted which compared fruit and vegetable consumption between those interventions that included changes to the lunchroom menu and those that did not. No clear result emerged. Repeating this analysis excluding the interventions with a physical activity component increased the pooled effect sizes but produced no clear difference between the two sets of studies.

However, further investigation of the nature of the food service interventions suggests that the goals of the food service interventions may be crucial to their success. Studies with relatively high effect sizes, Anderson *et al*. (2000) and Reynolds *et al*. (2000), both contained food service interventions aimed at increasing fruit and vegetable servings. The food service intervention in the study by Reynolds *et al*. (2000) consisted of food service staff receiving a half-day of training on purchasing, preparing, and promoting fruit and vegetables that met 'High 5' guidelines (Reynolds *et al*., 2000), whereas those studies finding negligible effect sizes, Perry *et al*. (1998b) and Parcel *et al*. (1999), focused on lowering fat and sodium levels. The primary goal of the CATCH food service intervention, Eat Smart, was to lower fat, saturated fat, and sodium in the school lunches and only two of the 30 food service guidelines promoted fruits and vegetables (Perry *et al*., 1988b). Therefore, there is some evidence within the outcome evaluations to support this finding from the views studies.

The 'Know Your Body intervention', evaluated by Resnicow *et al*. (1992), also instituted changes to the food service. However, the overall goal of these changes was to increase fibre and decrease fat content of the foods served; therefore it is not surprising that the changes made did not result in increased fruit or vegetable consumption.

The description of the intervention in Gortmaker *et al*. (2000) does not suggest that changes were made to the lunchroom menus; rather, that special cards were given to children in order to introduce them to the fruit and vegetables that were going to be available on a given day. Whilst this does not address the contradiction (identified above) directly, it did provide a link between the classroom and the lunchroom and attempted to influence children's choices when they selected their lunches.

8. DISCUSSION

Outline of Chapter

This section summarises and discusses the main findings from each stage of this review - the mapping exercise, the review of outcome evaluations, the studies of children's views and the cross-study synthesis.

This chapter should be read by ***practitioners, policy specialists and researchers*** *wishing to implement interventions or design new interventions*

Key Messages

- *There is a large evidence base for informing practice in the area of children and healthy eating, particularly randomised controlled trials to evaluate interventions, but fewer studies of children's views and experiences.*
- *Differences in the findings between this and other reviews may simply be due to the differing scopes in terms of high risk or general populations, and different age ranges.*
- *This review appears to be unique in synthesising findings from studies of children's views; and consequently it differs in highlighting factors identified as important to children, rather than other factors such as parental or family involvement.*
- *This review includes only 'views' studies as non-intervention research but, judging by the citations in reports of trials, other non-intervention research has informed the development and evaluation of interventions more than studies of children's views.*
- *The small but statistically significant effects of intervention are typical of psychological, educational and behavioural studies, and may well have real consequences for long-term health, especially when these effects are maintained over time.*
- *The quantitative data from cluster randomised controlled trials are not always analysed appropriately, but appropriate methods are available in this field.*
- *Research 'with' children rather than research 'on' children calls for more appropriate methods to elicit and analyse their views.*
- *Pooling of studies according to the implications arising from children's views is more informative for sub-group analysis than adopting more conventional* a priori *frameworks such as study design, choice of outcomes, types of intervention, provider, length of follow up, or theories of health promotion*

8.1 Summary of principal findings

This is the first review of which we are aware which attempts to analyse and synthesise, in a systematic way, the findings from studies of children's views and experiences of food and healthy eating, and tries to integrate these findings with those derived from effectiveness studies.

8.1.1 Mapping exercise

The results of our mapping exercise revealed a reasonably large evidence base for informing policy and practice in the area of children and healthy eating. The research activity we uncovered has very similar features to that which has been undertaken in other areas of health promotion with children and young people (Brunton *et al.*, 2003; Shepherd *et al.*, 2002). Firstly, there are many more evaluations of interventions implemented in the USA than elsewhere in the world. The randomised controlled trial appears to be the most popular evaluation design, and this is apparent in the UK as much as it is in the USA. This is encouraging given the fierce debates which have taken place sometimes about the appropriateness of this method for evaluating public health in the UK (Oakley, 2000; Speller *et al.*, 1997). Secondly, a relatively small proportion of the non-intervention research conducted in the UK has attempted to examine children's own understandings of food and healthy eating. This may reflect a long-standing tradition of doing research 'on' children rather than 'with' children and a reluctance to consider and value children's views and experience as a valuable resource (Alderson, 2003).

8.1.2 Effectiveness synthesis

Pooling the findings of 19 studies revealed that, on average, interventions are able to increase children's fruit intake by one fifth of a portion a day and their vegetable intake by a little less than one fifth of a portion a day. However, further analysis revealed the effects of interventions which focused more specifically on healthy eating were nearly three times greater than those which tried to target healthy eating alongside physical activity and/or smoking. These increases look negligible, and we discuss the potential health gain and reduction in use of health resources which might be associated with these increases in section 8.3 below.

An interesting finding of the effectiveness synthesis was that that it appears to be easier to increase children's consumption of fruit than vegetables. A small number of studies attempted to address children's apparent greater dislike for vegetables by 'exposing them' to new or previously disliked vegetables. Their results revealed that it is possible to get children to try these vegetables, but it is unclear whether such strategies would lead to increases in children's everyday consumption.

We identified 10 other systematic reviews which included studies evaluating interventions for promoting healthy eating amongst children, although none of these had exactly the same scope or population focus of this review. These reviews also found small effects of interventions. For example, McArthur (1998) entered 12 studies of interventions to encourage 'heart healthy' eating behaviours of children

aged nine to 11 years old into a meta-analysis and found a pooled effect size of 0.24. Hursti and Sjödén (1997: p. 110) concluded that 'Most of the reported changes in dietary behaviour were modest' in their review of interventions to change food habits amongst children. Similarly Contento and colleagues (1992: p. 257) concluded that the impact of general nutrition education on behaviour was 'minimal in their review of programmes amongst school-aged children.

Two reviews had different findings to ours regarding the lesser effectiveness of interventions targeting physical activity as well as healthy eating for increasing children's fruit and vegetable intake. A key conclusion from the review undertaken by the Centre for Reviews and Dissemination (NHS Centre for Reviews and Dissemination, 2002) was that programmes that 'promote physical activity, the modification of dietary intake and the targeting of sedentary behaviours' have been found to be effective. Resnicow and Robinson (1997) drew similar conclusions in their review. These apparently contradictory conclusions may simply be due to the differing scope of these reviews from ours: obesity prevention and treatment (NHS Centre for Reviews and Dissemination, 1997) and cardiovascular disease prevention (Resnicow and Robinson, 1997). Both of these reviews also extended beyond studies with children. The review by Ciliska and colleagues (2000) found that the most effective interventions in their review on promoting fruit and vegetable consumption gave clear and undiluted messages about fruit and vegetables – a finding which is supported by this review.

8.1.3 Synthesis of findings from studies of children's views

The views from children provided valuable insights into their experiences of food and healthy eating. Our synthesis revealed a number of contextual issues which any programmes to promote healthy eating amongst children need to consider. For example, children do not see it as their role to be interested in health and they do not see messages regarding possible future health consequences as being relevant or credible. Promoting fruits and vegetables on health grounds therefore, may have little currency amongst children. Children identified the 'here-and-now' aspects of eating food as important (e.g. children valued eating as a social occasion), and different foods had different meanings for them. Eating certain foods such as confectionary was seen as risky, exciting and as a way of breaking adult rules and asserting independence. Given that it is not usual for children to have a choice about what they eat, they talked of seeking ways actively to exercise their own choices (e.g. throwing away the 'healthy foods' that parents had provided for them). Children recognised readily the contradiction between what 'adults' promote in theory and what is provided in practice. For instance, the school canteen often came under fire for not providing the kinds of healthy foods that adults promote.

The synthesis of children's views studies was able to develop a broad picture of the issues children from diverse backgrounds regard as important. Some differences between children were found in several studies in relation to socio-demographic factors, such as sex, age and socio-economic status. However, the differences explored in the studies tended to be studied solely in relation to knowledge and behaviours rather than children's understandings and experiences. This represents a gap for future research.

We are aware of no other systematic review that has attempted to synthesise the findings of this type of study. The picture that emerges from our review highlights a number of deeper issues concerning the construction of children and childhood which resonate with other primary research attempting to understand health and social issues from children's perspectives (Mayall *et al*., 1996; O'Brien *et al*., 2000; Scott, 2000). Many of the children's insights into food and healthy eating may not be too dissimilar to those that might be found amongst adults. Our review has found, however, that professionals who design and evaluate interventions do not always take these insights on board.

8.1.4 Integrating the findings of children's views with findings on intervention effects

The findings of our views synthesis suggested ten implications for the development of appropriate interventions. Comparison of evaluated interventions to these implications in our cross-study synthesis revealed matches, mismatches and gaps. Furthermore, we found evidence to suggest that some interventions that matched the implications derived from children's views led to bigger effects than those which did not. Interventions which did the following led to bigger increases in fruit and/or vegetables consumed: promoted fruit and vegetables separately or indifferent ways: reduced or removed any emphasis on health messages; and supported the promotion of fruit and vegetables in educational materials with access to fruit and vegetables. However, we found no difference in effects when comparisons were made between interventions that promoted fruit and vegetables in exciting and child-relevant ways and those that did not. It was not clear why this might be so and further research is warranted to examine children's views on whether/how fruit and vegetables could be made to be exciting to them. Other gaps for intervention development are summarised in chapter nine.

8.2 Strengths and weaknesses of this review

As argued earlier (section 8.1), many other reviews stressed that, although positive behaviour changes were found, such changes were modest. This review has been able to take these findings one stage further by exploring which components of interventions might make them more successful. Furthermore, the implications derived from children's views have enabled this review to examine components that have never emerged before as relevant or important, but that have been found to be significant such as reduced emphasis on health messages, or the differential treatment of fruit and vegetables.

As mentioned earlier, this review goes beyond existing systematic reviews in this and other areas by combining diverse study types – in this case studies of children's views and evaluations of interventions. Other reviews may contain recommendations advocating that we take into account the perspectives of the intended recipients of interventions (e.g. Ciliska *et al*., 2000: p. 341), but they do not go that one step further to integrate studies assessing these perspectives into the review in a formal and systematic way.

The methods used for this review differ from all other reviews found on this subject, specifically with respect to comparing interventions with children's views on healthy eating. Many other reviews have tended to highlight factors not presented as important by children as their key messages, for example, parental or family involvement (Ciliska *et al*., 2000, p. 341; Contento *et al*., 1992, p. 247; NHS Centre for Reviews and Dissemination, 2002, p. 1). The greater depth of analysis that this approach brings demonstrates the added value of this approach (for example, the findings from the cross-study synthesis, suggesting that fruit and vegetables should be promoted differently or separately, are very different from recommendations made in other reviews).

The review by Ciliska *et al*. (2000) acknowledges as a weakness its inability to draw conclusions regarding the relative impact of interventions on different target groups. The present review is focused very specifically on children, and whilst some other reviews focus on children and young people, no other reviews were found that focus on young children aged four to ten alone. However, we are unable to draw conclusions on the relative impact of interventions on different groups according to ethnicity (as argued for in the review for the Health Education Authority (White *et al*., 1998)), or socio-economic status because this information was rarely reported in the primary studies.

A further weakness acknowledged in the review by Ciliska *et al*. (2000) was that as they only had studies from the US, the generalisability of the results was limited. The present review is slightly broader, including studies from the UK and one from Ireland, and is therefore able to conclude that intervention effects can be replicated outside the US. However, many other countries face similar concerns about nutrition-related diseases and levels of fruit and vegetable consumption, so the generalisability of study findings across countries is an area that needs more attention (Strategic Inter-Governmental Nutrition Alliance, 2001).

A clear gap in this review is that it does not include non-intervention studies other than of children's views. It was acknowledged that this body of literature would not be represented from the outset and it could be a valuable addition to any future updates of the review. However, the knowledge gained from other epidemiological work in this area is not altogether absent, since it informs many of the experimental studies in this review (as their literature reviews testify).

Given that all the 'views' studies were from the UK, there is some question regarding the international applicability of the findings of this review. One way of assessing this would be to conduct syntheses of children's views in a variety of countries and examine their commonalities and differences.

As with all secondary research, it is possible that this review has missed some relevant literature and it is impossible to gauge the impact that its absence may have had. Though the searches were as extensive as possible and a large number of authors were contacted personally, there was no extensive search of grey literature and no specific inclusion of studies that examined children's views of interventions they have received. It could be worth targeting this latter category in any future update of this review. Since most of the outcome evaluations are in broad agreement as to the direction and general size of effect, we can be reasonably confident that any studies that were missed would not have changed the findings of the review. However, publication bias (the tendency for studies with exciting results to be

published in preference to those showing no effect) could be a source of error, since it is possible that more studies showing smaller effects have been conducted than are present in our meta-analysis. However, the way in which the synthesis was conducted– validating the results of trials with children's own views – should go some way to mitigating any effects of this.

Our quality assessment criteria (providing pre-intervention and post-intervention data for all participants, equivalent study groups, reporting findings for all outcome measures) reflect what we consider to be the minimum standard for ensuring a study's internal validity. However, study bias can result from other aspects such as outcome measurement (Kristal *et al.*, 1998; Oppenheim, 1992; Thompson and Byers, 1994). Data were collected on these aspects but were not used to make a judgement on a study's overall quality. There is an ongoing debate regarding the appropriate means of measuring children's food intake and some writers have cast doubt on, for example, children's ability to recall the content and quantity of what they have eaten (Livingstone and Robson, 2000). Whilst many of the authors of studies in this review took steps to validate their measurement tools, there is a clear lack of consensus in this area with some studies using direct observation and others 24-hour recalls and food diaries. The extent to which these differing methods produce different results is not clear, but they are a feature of, and a potential weakness in, the underlying dataset used in this review.

The participants in most of the studies in the review were in the upper age range: aged seven upwards rather than aged six and below. The extent to which the findings of the review are more representative of slightly older children is a potential but unquantifiable limitation. Livingstone and Robson (2000) have suggested that children below the age of eight years cannot recall accurately what they have eaten. Whilst most of the studies in our review collected data from children over the age of eight years, the possibility that children under the age of eight may have provided inaccurate information must also be considered as a potential limitation. Lack of complete information regarding portion sizes may also have influenced the results of the studies.

Finally, there is a growing body of literature that supports the inclusion of those people who will be 'users' of the research findings in guiding the research process (Beresford and Evans, 1999; Boote *et al.*, 2002; Grant-Pearce *et al.*, 1998; Hanley *et al.*, 2001; Hanley *et al.*, 2000; Macaulay *et al.*, 1999; Sakala *et al.*, 2001), particularly in considering the interventions and outcomes for evaluative studies (Oliver, 1997; Oliver, 1999; Oliver, 2001; Oliver *et al.*, 2001a; Oliver *et al.*, 2001b; Oliver *et al.*, 2001c) and developing services (Crawford *et al.*, 2002; Simpson and House, 2002). Whilst the conduct of this review and its priorities was informed by one group of its users – policy makers – other possible users specifically teachers, health promotion practitioners, parents and children were not consulted at any point during the review process. This may reduce the wider relevance and utility of the review and is an issue we are addressing in our next review.

8.3 Implications for policy and practice

From the Health Survey for England 2001 (Doyle and Hosfield, 2003) undertaken on behalf of the Department of Health, we know that children consume, on average, between 2.5 and 2.8 portions of fruit and vegetables per day. Only one study in the

present review (Epstein *et al*., 2001) was able to increase fruit and vegetable consumption by enough to approach the recommended daily consumption of five portions. Only one of the other interventions was able to increase daily intake by as much as one portion. The standardised effect size necessary to increase consumption from 2.5 to five is approximately equal to 1.2. In their study of 302 psychological, educational and behavioural treatment studies, Lipsey and Wilson (2001) found that the median effect size was 0.47 and mean equal to 0.5. In our review, the median effect size for fruit and vegetable consumption was 0.35 with a mean of 0.32. This suggests that the studies included in this review are doing, in general, not quite as well as in other fields.

Thus, judging from the experience of a large number of other studies, only an exceptionally successful intervention would be able to increase fruit and vegetable consumption to the nationally recommended 5 A Day. Interventions which produce effects of this magnitude are rare – only two percent of all the interventions in Lipsey and Wilson's study (2001) achieved this effect size. The identification of successful interventions, together with insights into which intervention components might be attended to in the future, should enable future interventions to concentrate on approaches which work (or might work). The evidence-base does suggest that it is possible to increase fruit and vegetable consumption towards recommended levels, but also that existing strategies will need some development if this goal is to be achieved.

In an earlier review (discussed above), Hursti and Sjödén (1997) note that, as even modest effects may be beneficial for cardiovascular disease if maintained over long periods, research should concentrate on how the effects on an intervention programme might be maintained. In this regard, even the small effect sizes found in most of the studies may have a clinical significance which is not apparent at first glance. Indeed, the way in which two of the interventions (Baranowski *et al*., 2000; Reynolds *et al*., 2000) succeeded in sustaining their increased consumption over a year could be worthy of further examination. It is worth noting here, that some of the strategies employed in these interventions were supported by the findings of the children's views synthesis too.

The evidence from the cross study synthesis, that higher effect sizes were correlated with some of the implications from children's views, further supports the need to explore areas that children suggest are important but that have not been researched extensively. Interventions that matched two of the implications derived from children's views (to reduce the emphasis on health messages, or to promote fruit and vegetables differently, or separately) had higher effect sizes than studies that did not. This finding suggests key messages for future policy, practice and research. For policy and practice it is evident that current messages that promote fruit and vegetables together, such as the 'five-a-day' messages promoted by organisations including the Department of Health, may not be suitable for children, and that practitioners should be focusing on promoting fruit and vegetables separately, or differently, as in the government's proposed National School Fruit Scheme rolled out in 2004.

A second message for policy would be that in order to increase fruit and vegetable intake among children, a move away from current health messages about fruit and vegetables might be necessary. Again one of the two key aims of the Department of Health's 5 A Day initiative is to raise awareness of health benefits, which may be

suitable for adults, but further work may have to be undertaken in order for this to be successful with children.

The implications for research are, firstly, to ensure that all the implications arising from children's views are considered for their potential for informing intervention design; secondly, that children's views should be incorporated in the development and evaluation of any future healthy eating initiatives. For instance, there is an opportunity for intervention design to address the creation of situations that allow children to have ownership over their food choices and over the social context in which they eat their food. As Roberts (2000) discusses, the involvement of the recipients of interventions in their development is a matter of research ethics; it is not sufficient simply to listen to children, it is also important to act upon their views. However, the findings of our review suggest that incorporating children's views into the development of interventions is not only desirable from an ethical viewpoint but is also necessary in order to develop effective interventions.

Another area for development suggested by the cross study synthesis are the implications that we did not find to have any impact on the outcome of interventions. In particular, the sixth implication, that fruit and vegetables should be branded as an exciting or child-relevant product, may need further unpacking. Although several studies addressed this issue, they may not have done so in 'exciting' or relevant ways. For example, interventions using cartoon characters, stickers and games were classified for this review as using methods to make fruit and vegetables 'exciting' and relevant, whereas children suggested using television advertising campaigns featuring famous 'celebrities' such as football stars. Current interventions, such as the 'Food Dudes' intervention being rolled out in Scotland (Forth Valley NHS Board, 2003) using 'cartoon' techniques similar to those in the studies included in the sub group analysis in the cross study synthesis, suggest that further research with children into the intervention components that they would find 'exciting' or relevant could be valuable.

The principle that practice should involve children and focus on what they are saying is an important one. But it must be recognised that not all of the implications will be easy to incorporate into practice. For example, if children are using their own experience of being healthy despite eating unhealthily, and choosing to disregard messages about long-term health, it may not be possible to develop messages that are credible or relevant for them. Practitioners might choose to prioritise those messages from children which are less problematic, for example, promoting fruit and vegetables as being 'tasty' rather than healthy (an implication for which no matching interventions were found).

8.4 Building the evidence base: lessons for the future

8.4.1 Evaluating effectiveness

Our review of effectiveness included controlled trials that allocated individuals to different interventions. The review also included controlled trials which, in order to avoid individuals sharing information about what intervention they received, allocated entire groups of individuals to different interventions. The latter included groups such as whole schools, classes or other groups such as Girl Scout troops. This is a very

strong design in many ways since it avoids the possibility of 'contamination' between groups that is present, for example, when allocating individuals from the same school. However, individuals in the same cluster are more likely to be similar to one another than if they had been sampled randomly from the population at large. As a consequence of this, 'selecting an additional member from the same cluster adds less new information than would a completely independent selection, and the clustered sample thus achieves less precision… than a simple random sample' (Health Survey for England 95-97 Section 13.10 (Prescott-Clarke and Primatesta, 1998)). Thus, any analysis needs to take account of this and must not treat the individuals as though they were not assigned by cluster. This can be done in a number of ways and methods for the analysis of these studies are still being developed (see e.g. Donner and Klar, 2000; and Murray, 1998).

The APPLES evaluation took account of its cluster allocation firstly by computing results within schools and then calculating a weighted difference between them. Moore (2001), in their evaluation of fruit tuck shops, also analysed on the basis of school rather than individual – though since there were 43 schools involved they had rather more statistical power.

The evaluation of the CATCH intervention used a different approach. Rather than using the school as the unit of analysis (and suffering a large loss of statistical power), it analysed on the basis of individuals whilst taking account of the fact that they were similar to one another. (The degree of similarity can be estimated and used as an adjustment in the analysis.) The CATCH trial is cited widely as having employed a strong method of analysis for these study designs.

In contrast to these studies, some evaluations did not take account of their cluster allocation. This can lead to claims of large, statistically significant findings that are not justified by the study design. It is for this reason that studies that only allocated one school to control or comparison conditions were excluded from the meta-analysis. None of these studies took account of their cluster allocation and there are concerns in some quarters regarding their reliability. In the opinion of Kirkwood and Morrow, the allocation of only one cluster to an intervention/comparison group 'is analogous to conducting a clinical trial with just two patients, one receiving the drug and the other the placebo' (quoted in Donner and Klar, 2002: p. 2974). (It is for this reason that the 'Food Dudes' are not present in the meta-analysis.)

Taken together, the above studies show how trials can be conducted in this area, and the cluster designs and analyses that could be employed to evaluate Food Dudes, Sustain and the Community 5 A Day pilots rigorously.

Studies that employ cluster-allocated designs can be combined in statistical meta-analysis, though care must be taken when calculating effect sizes since this also needs to take account of the method of allocation. In order for accurate effect sizes of these trials to be calculated, the degree of similarity between individuals in the clusters needs to be presented in the reports. This information was only given in two of the studies in this review and was imputed in the other studies. We have been in communication with one of the developers of the CONSORT guidelines for cluster randomised trials (Diana Elbourne) and they are being revised to take account of the need for these data to be presented in future.

8.4.2 Research with children

This review has demonstrated that children's views could be a valuable tool for the development of future interventions. However several factors identified in this review exemplify how this idea is not widely accepted. The cross study synthesis revealed many gaps in research when contrasted with children's views of important issues, suggesting that children have had little involvement thus far in the design and conduct of interventions and evaluations. Far more studies were found evaluating children's experiences of receiving particular interventions than exploring their views on the subject of healthy eating.

There were a number of concerns about the way in which the studies of children's views were carried out. Less than half the studies involved children in the design and conduct of the study. None of the studies stated that the children had given formal consent to take part in the study. A majority of the studies involved the use of highly structured questionnaires or interviews, for example, asking children whether we ought to eat more, less or the same of a prepared list of foods. Such methods may not ensure that children's own views will emerge; children may manipulate their views to fit adult constructs. Furthermore, only one study stated that the facilitators actively tried to encourage children to express themselves freely. One other study stated that the researcher had spent time with the children prior to interviews or focus groups in order to get to know them and attempted to ensure the most natural setting for the children to talk. The facilitation methods of the researcher to achieve rapport and to encourage children to express their views may be a crucial element in ensuring that the findings are rooted in children's views (Harden *et al.*, 2000). The data analysis methods, when described at all, were often based on constructs predetermined by adults, with only one study stating that the themes emerged from the transcripts provided by children.

These shortcomings are particularly surprising in the light of the arguments commonly put about the superiority of 'qualitative' over 'quantitative' research in privileging the subjectivity of research participants (Morse, 1994). They repeat themes identified by others about the treatment of children in research as a marginal group incapable of providing valid and reliable data (Mayall, 2002) There is currently much interest in developing better methods for researching children's perspectives (e.g. Christensen and James, 2000; Roberts, 2000). Roberts (2000) discusses how it is not sufficient simply to listen to young people; it is also important to hear and act on their views.

There were similar misgivings about the nature of children's involvement in the design and conduct of the outcome evaluations. Again very few studies stated that children had been asked for their active consent. Only a very small percentage of the outcome evaluations involved children in the development of the intervention, and only one study stated explicitly the aim to develop a 'child driven, user friendly' intervention. Only about one fifth of the outcome evaluations stated that children had been asked formally for their views on the intervention after receiving it.

8.5 Methodological issues in conducting this systematic review

This review builds on a series of systematic reviews conducted by the EPPI-Centre on the barriers to, and facilitators of, mental health, physical activity and healthy eating among young people. The framework for this series of reviews has allowed the development of methods for synthesising both 'qualitative' and 'quantitative' studies within a systematic review. This developmental work has continued in this review through the synthesis of the results of statistical meta-analysis with the views of children. Statistical meta-analysis has not been used in previous EPPI-Centre systematic reviews and the standardization of results into comparable effect sizes has enabled us to hypothesise which different components of interventions might be related to effectiveness. Therefore, this review has been able to make recommendations focused on specific design issues rather than simply advising the replication of certain interventions.

The pooling of studies about healthy eating in previous systematic reviews has been based around either the study design and choice of outcomes (Pirozzo *et al.*, 2003), types of intervention (Pirozzo *et al.*, 2003), intervention provider (Thompson *et al.*, 2003), length of follow up (Campbell *et al.*, 2003), or theories of health promotion (Shepherd, 2001). The pooling of studies in the present review is a departure from such *a priori* models. The most significant influence on pooling for meta-analysis was the thematic analysis of children's views from non-intervention studies.

The significance of this method of pooling became apparent after we explored the outcome evaluations through the variables that we had identified as possibly being significant and contrasted this approach with utilising the views synthesis. The first method, which explored the effect that *a priori* categories might have had on intervention effect though the meta-analysis, did not yield very illuminating results (chapter five and appendix G). The pooling of studies in relation to the results of the cross-study synthesis was much more focused, giving us a rationale to explore heterogeneity without being in danger of 'dredging' the data for significant results.

9. CONCLUSIONS AND RECOMMENDATIONS

The aim of the systematic review described in this report was to survey what is known about the barriers to, and facilitators of, healthy eating amongst children. The review mapped and quality screened the research in this area, and brought together the findings from evaluations of interventions promoting fruit and/or vegetables with studies of children's own perspectives on healthy eating.

The first major finding is that there is a reasonable amount of good quality international research evaluating interventions to promote fruit and/or vegetables. This is complemented by a growing body of research based in the UK. Interventions ranged from those targeting people with specific risk factors to large-scale initiatives which involved children, parents, schools and local communities more broadly. Most interventions were aimed at primary schools, though some used community organisations such as Girl Scout Troops and adult evening classes. A common approach was to combine learning about the health benefits of fruit and vegetables with 'hands-on' experience in the form of food preparation and taste-testing. Most were 'multi-component' programmes involving more than one approach and often targeting more than one outcome (for example, fruit and vegetable consumption, knowledge, self-efficacy, BMI and physical activity).

Secondly, this research reveals that these kinds of interventions have a small, but significant positive effect. Pooled estimates suggest that implementation of these interventions will, on average, increase children's fruit intake by one fifth of a portion per day and their vegetable intake by a little less than one fifth of a portion per day. Bigger effects (by almost two portions) are associated with targeted interventions for parents with risk factors for cardiovascular disease. Increased effects were also found for interventions which do not 'dilute' their focus on fruit and vegetables by trying to promote physical activity or other forms of healthy eating (for example, reduced intake of sodium and fat) in the same intervention. The latter requires further research to establish conclusively however. Assessing the significance of these effects requires their translation into estimates of health gain and clinical significance together with their potential savings for health services.

The third major finding is that clear implications regarding the development of appropriate interventions could be derived from the smaller number of studies we identified which elicited children's perspectives on healthy eating. Moreover, we found a relationship between what children say is important and intervention effectiveness. There was some evidence that interventions which corresponded with the views of children led to bigger effects. Interventions which did not emphasise the health benefits of fruit and vegetables showed larger effects than those which did, increasing children's intake of fruit and vegetables by up to half a portion per day. Interventions which promoted vegetables separately from fruit had the biggest impact on vegetable intake.

Fourthly, considering the findings of children's views alongside the findings from interventions also highlighted a number of promising directions for the future development and testing of interventions to promote fruit and vegetables. In particular, there is scope to explore the effect of interventions which brand fruit and vegetables as being tasty rather than healthy and in creating opportunities for

children to influence the social context in which they eat. Additionally, one challenging implication calls for health messages to be made relevant and credible for children.

Finally, whilst the studies we identified for this review included children from diverse groups, including children from ethnic minority groups and those from areas of social and economic deprivation, they had little to say about reducing health inequalities specifically. Survey evidence suggests that children's consumption of fruit and vegetables is associated with their socio-economic status. However, whilst some studies targeted children in lower socio-economic groups, no studies set out to evaluate the impact of interventions in reducing inequalities in this area.

9.1 Recommendations for policy and practice

- **Implementing school-based interventions will lead to, on average, an increase in children's intake of fruit and vegetables equivalent to one fifth of a portion of fruit per day and a little less than one fifth of a portion of vegetables per day**. The kinds of interventions which lead to these small, but significant, positive effects typically combine: active learning about fruits and vegetables using cooking and taste testing; access to fruits and vegetables for lunch and breaks; and parental involvement in the promotion of fruit and vegetables.

- **Bigger effect sizes can be expected from interventions in which the promotion of fruits and/or vegetables is the main message.** Interventions which led to a negative effect or no effect on fruit and vegetable consumption were judged by reviewers to have given little prominence to their promotion in comparison to other interventions (Parcel *et al., 1999;* Perry *et al.,* 1998b).

- **Bigger effect sizes can be expected from those interventions which build on ideas for appropriate interventions derived from children's views and experiences**. We found that it is not necessary to promote the health benefits of fruit and vegetables in order for children's consumption of them to increase. Children did not see it as their role to be interested in health and were actively put off foods that they perceived to be healthy. Indeed, the highest effect sizes were obtained when health messages were not emphasised. We also found that children differentiate between fruit and vegetables and that the interventions which either did not promote both together, or promoted them in different ways, were more successful than those which did not.

- **Bigger effect sizes can also be expected as a result of intensive interventions targeted at parents who are motivated to change their behaviour**. A series of fortnightly meetings held over a six-month period to encourage attainment of the five-a-day fruit and vegetable target amongst parents with risk factors for cardiovascular disease increased children's fruit and vegetable consumption by nearly two portions per day (Epstein *et al.*, 2001).

- **For school-based interventions, teacher preparation time must be kept to a minimum in order to ensure their successful implementation**. This is of key importance when planning the duration and intensity of an intervention. Teachers

may be able to spend additional time preparing food and ingredients occasionally, but they cannot devote significant additional time over a long period. Process evaluations also suggest that teachers resent the 'imposition' of rigid curricula as well as those which they see as being over-demanding for their students. They do, however, welcome additional classroom support both to spread the workload and to address concerns regarding their ability to teach what is often an unfamiliar subject.

- **Children should be consulted on matters concerning the promotion of their healthy eating.** This is not only an ethical imperative but also critical in developing effective and acceptable interventions. Most of the (otherwise sound) current intervention research has not consulted children or their parents about intervention development or evaluation.

9.2 Recommendations for the future development and evaluation of interventions

In this section we recommend several interventions for further evaluation. These interventions have been singled out because they matched ideas for appropriate interventions derived from children's views, but were not evaluated in a sufficiently rigorous way. We also recommend several interventions suggested by studies of children's views and experiences that have not yet been evaluated.

- **Interventions which brand fruit and vegetables as being a 'tasty' rather than a 'healthy' product.** Whilst some interventions attempted to increase children's liking for fruit and vegetables, no interventions sought to evaluate the impact of portraying fruit and vegetables as being 'tasty' rather than 'healthy'.

- **Interventions that create opportunities for children to have ownership over the social context in which they eat their food.** The impact of children's social environment on their ability to exercise choice was explored in chapter six. There is scope to explore the impact on fruit and vegetable consumption of involving children in determining factors such as the physical layout of the school dining hall and other eating areas.

- **The 'Food Dudes' intervention matches several of the implications derived from children's views**: it does not place great emphasis on health messages; it promotes fruit and vegetables as being exciting and 'cool'; and it employs child-friendly strategies by employing cartoon characters, videos and accompanying merchandise. However, so far, it has only been evaluated in two very small studies that did not allocate more than one school to intervention or comparison groups. In order to decide whether it should be implemented more widely and to evaluate its cost effectiveness, it is important to discover whether or not the large effects found in these studies (which may have been due to environmental factors) can be replicated elsewhere on a larger scale. **We therefore recommend that this intervention receive further rigorous evaluation**.

- **Evaluate the provision of fruit tuck shops with additional promotional activities.** Two UK interventions (Anderson *et al.*, 2000; Moore, 2001) involved the provision of fruit via a tuck shop. Whilst the provision of tuck shops in the

study evaluated by Moore (2001) did not appear to increase children's fruit consumption, there was an increase in the intervention evaluated by Anderson *et al.* (2000). The more successful intervention included learning materials, changes in school lunches and peer support. The impact of the provision of fruit tuck shops, therefore, might be enhanced if accompanied by other promotional activities.

- **Develop and evaluate interventions which aim specifically at reducing inequalities.** Given that children from lower socio-economic groups do not, in general, eat as much fruit and vegetables as other children (see, for example, the National Diet and Nutrition Survey), there is scope for the development and evaluation of interventions, which target these children. Whilst some of the strategies identified in this review might be adopted in this regard, neither the outcome evaluations nor the 'views' studies contain specific findings or implications for the reduction in inequalities of fruit and vegetable consumption.

- **Develop and evaluate the impact of health messages which are credible and relevant for children.** Possibly the most challenging finding arising from the children's views was that current health messages are not taken seriously because they have no basis in most children's experience. It is difficult to see how this implication might be addressed, but one way forward might be to involve children more when planning the way in which health messages are to be packaged and delivered.

- **Children, parents and other stakeholders should be involved in planning the evaluation of interventions.** Their views will be valuable in determining relevant and appropriate data collection methods, tools and topics, and in determining outcomes to be measured.

9.3 Recommendations for conducting and reporting research

- **When possible, outcome evaluations should be designed as randomised controlled trials using individuals, families, schools, geographical areas or Local Education Authorities as units of allocation.** Although there may be circumstances in which this might not be possible, there are currently many missed opportunities for employing this design to evaluate effectiveness. Researchers need to work with teachers, health promotion practitioners and education officials to identify opportunities for setting up such evaluations. Policy-makers and research commissioners need to allocate sufficient funds to support such work.

- **Outcome evaluations should include integral process evaluations.** Well-conducted process evaluations can offer valuable insights into the reasons for the success (or otherwise) of interventions, and can elicit the views of those involved in delivering or receiving the intervention and monitor the contextual variables impacting on its implementation.

- **Key aspects of the methodology and results of outcome evaluations need to be reported in a detailed and consistent manner in order to promote**

confidence in their rigour. The outcome evaluations reviewed in this report did not describe consistently pre-test and post-test data of all participants; establish the equivalence of intervention and control groups; or report the impact of the intervention for all outcomes targeted. These are minimum benchmarks of quality. As complete information as possible should also be provided on the aims of the study; on the method of randomisation where used; on numbers of participants assigned to intervention and control groups; on attrition rates; and on the design, content and delivery of the intervention. Now that internet access and use is so widespread, authors are able to report their results and key messages in journals whilst publishing their full analyses on the World Wide Web.

- **Full details of the interventions being evaluated need to be reported in a way that facilitates replication.** Some of the outcome evaluations in this report did not describe their interventions in sufficient detail for the reviewers to gain an understanding of key aspects of the programmes being evaluated. Whether or not the study finds any effect, it is important for readers to know what was done – and how – in order to plan future initiatives and learn what might have been the most important features of the intervention in question. Where space does not permit the reporting of sufficient detail, authors are able to reference a further source of information and publish their materials on the Internet.

- **Studies which allocate groups (clusters) of individuals to control / comparison conditions need to take account of this in their analysis and reporting.** Some studies allocated clusters of individuals and then conducted their analysis as though the individuals themselves had been assigned to intervention / comparison groups; this assumes unwarranted statistical power. Analysis should take account of cluster allocation and the intra-class correlation (ICC) should be published with the results of the study. The design and analysis of these studies require the application of particular techniques which are beyond the scope of this report and we recommend that specialist statistical advice is sought in the early stages of a study. Murray (1998) and Donner and Klar (2000) are recommended as initial reading on the subject.

- **Studies examining children's views need to engage children in a way that respects them as research participants.** This can be accomplished by: ensuring that consent is obtained from parents **and** children; developing methods of data collection which minimise power differences between researchers and children; using data collection methods that allow children to feel comfortable about expressing their opinions; ensuring that appropriate methods are used to ground the data analysis in children's own perspectives; and actively involving children in the design and conduct of studies.

- **The reporting of studies of children's views and process evaluations needs to be more complete, as basic data are often missing.** Detailed descriptions of the selection, recruitment and characteristics of the sample and the methods used to collect and analyse data should always be presented. It is desirable that some attempts are made (and reported) to ensure the reliability and validity of the data collection and data analysis methods. An outline of how the study's findings contribute to the existing knowledge base is always helpful.

Many of the above suggestions do, of course, apply to health promotion research and research evaluating social interventions much more generally. The specific

points about research with children can be extended to other areas of research involving children, and apply also to many areas of research where data are collected from other social minority groups.

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APPENDIX A: Mapping exercise exclusion criteria

Round A: exclusion on the grounds of scope

There were three 'scope' criteria. Studies were excluded if:

(i) the study's focus, or main focus, was NOT healthy eating;

(ii) the study did NOT focus on children aged four to ten years;

(iii) the study was NOT about the promotion of healthy eating, or the barriers to, and facilitators of, healthy eating. Interventions were considered not to constitute health promotion if the children involved were identified or labelled as having an illness or disability (such as diabetes, obesity, hypertension).

Round B: exclusion on the grounds of study type

Studies were excluded if they were any of the following:

(i) editorials, commentaries or book reviews;

(ii) policy documents;

(iii) studies solely reporting the prevalence levels regarding the consumption of different foods;

(iv) non-systematic reviews;

(v) non evaluated interventions;

(vi) surveys examining influences on a range of dependent variables, including healthy eating, that do not explore influences on healthy eating per se (e.g. studies where healthy eating is one component of a composite score of health behaviour and healthy eating cannot be disentangled from health behaviour more generally);

(vii) resources;

(viii) bibliographies;

(ix) theoretical or methodological studies only; or

(x) single-case studies.

Round C: exclusion on the grounds of location of study

Studies were excluded if they described a non-intervention study (cohort study; case control study; cross-sectional survey) NOT carried out in the UK.

Round D: exclusion on the grounds of language of the report

Only those studies written in the English language were included.

APPENDIX B: Search strategies and sources

Sources	Availability	Time Period of Search
Major Databases		
MEDLINE	OVID Web version	1981- 07/2001
Embase	OVID Web version	1981- 07/2001
CINAHL (Cumulative Index to Nursing and Allied Health Literature)	WinSPIRS CD-Rom, Silver Platter	1982 – 07/2001
ERIC (Educational Resource Index and Abstracts)	OVID Web version via BIDS	1985 - 2001
SSCI (Social Science Citation Index)	ISI Web of Science via BIDS	1981 - 2001
PsycINFO	WinSPIRS CD-Rom, Silver Platter	1981 – 11/2001
Specialist Registers		
BiblioMap (the EPPI-Centre register of health promotion research)	http://eppi.ioe.ac.uk	Searched 11.2001
PrevRev (an internal EPPI-Centre database containing references from previous reviews)	Mediated search, not freely available	Searched 11.2001
DARE (Database of Abstracts of Reviews of Effectiveness)	http://agatha.york.ac.uk/darehp.htm and Cochrane Library via National Electronic Library for Health (NeLH) http://www.nelh.nhs.uk/	Cochrane Library 2001 issue 4
HealthPromis (Health Development Agency register)	http://healthpromis.had-online.org.uk	Searched 11.2001
CCTR (Cochrane Controlled Trials Register)	Cochrane Library via National Electronic Library for Health (NeLH) http://www.nelh.nhs.uk/	Cochrane Library 2001 issue 4
CDSR (Cochrane Database of Systematic Reviews)	Cochrane Library via National Electronic Library for Health (NeLH) http://www.nelh.nhs.uk/	Cochrane Library 2001 issue 4
CHG (Cochrane Heart Group, internal trials register)	Mediated search, not freely available	Searched 11.2001

STRATEGIES

MEDLINE

1 exp child/
2 exp adolescence/ or exp child, hospitalized/ or exp child institutionalized/ or exp disabled children/ or infant/
3 1 not 2
4 exp child preschool/
5 exp students/
6 ((university or college or medical or graduate or post graduate) adj2 student$).ti,ab.
7 5 not 6
8 (school adj3 (child$ or pupil$ or student$ or kid or kids or primary or nursery or infant$)).ti,ab.
9 or/3-4,7-8
10 exp health promotion/
11 exp health education/
12 exp preventive medicine/
13 (prevent$ or reduc$ or promot$ or increas$ or program$ or curricul$ or educat$ or project$ or campaign$ or impact$ or risk$ or vulnerab$ or resilien$ or factor$ or correlate$ or predict$ or determin$ or behavio#r$).ti,ab.
14 (health$ or ill or illness or ills or well or wellbeing or wellness or poorly or unwell or sick$ or disease$).ti,ab.
15 ((prevent$ or reduc$ or promot$ or increas$ or program$ or curricul$ or educat$ or project$ or campaign$ or impact$ or risk$ or vulnerab$ or resilien$ or factor$ or correlate$ or predict$ or determin$ or behavio#r$) adj3 (health$ or ill or illness or ills or well or wellbeing or wellness or poorly or unwell or sick$ or disease$)).ti,ab.
16 or/10-12,15
17 (determin$ or facilitat$ or barrier$).ti.
18 Risk factors/
19 Culture/
20 Family/ or Internal-external control/ or Life style/ or Prejudice/ or Psychology, social/ or Psychosocial deprivation/
21 child behavior/
22 habits/
23 poverty/
24 social class/
25 social conditions/
26 socioeconomic factors/
27 Family characteristics/
28 ethnicity.ti,ab.
29 Attitude to health/
30 or/17-29
31 Child nutrition/
32 exp feeding behavior/
33 exp diet/
34 diet records/
35 exp Nutrition surveys/
36 exp food services/

37 ((school$ or child$ or packed) adj3 (dinner$ or lunch$ or food$ or meal$ or snack$ or eat$)).ti,ab.
38 Obesity/
39 or/31-38
40 or/16,30
41 and/9,39-40
42 limit 41 to english language
43 limit 42 to yr=1981-2001

EMBASE

1 exp child/
2 Brain damaged child/ or Gifted child/ or Infant/
3 1 not 2
4 exp school/
5 College/ or Medical school/ or University/
6 4 not 5
7 Child health/
8 School health service/
9 (school adj3 (child$ or pupil$ or student$ or kid or kids or primary or nursery or infant or elementary)).ti,ab.
10 or/3,6-9
11 exp health education/
12 patient education/
13 11 not 12
14 primary prevention/
15 preventive medicine/
16 (prevent$ or reduc$ or promot$ or increas$ or program$ or curricul$ or educat$ or project$ or campaign$ or impact$ or risk$ or vulnerab$ or resilien$ or factor$ or correlate$ or predict$ or determin$ or behavio$).ti,ab.
17 (health$ or ill or illness or ills or well or wellness or wellbeing or poorly or unwell or sick$ or disease$).ti,ab.
18 ((prevent$ or reduc$ or promot$ or increas$ or program$ or curricul$ or educat$ or project$ or campaign$ or impact$ or risk$ or vulnerab$ or resilien$ or factor$ or correlate$ or predict$ or determin$ or behavio$) adj3 (health$ or ill or illness or ills or well or wellness or wellbeing or poorly or unwell or sick$ or disease$)).ti,ab.
19 or/13-15,18
20 Behavior modification/
21 Cardiovascular risk/ or Risk/ or Risk factor/
22 Lifestyle/ or "Lifestyle and related phenomena"/
23 Cultural deprivation/ or Homelessness/ or Social problem/ or Unemployment/
24 Cultural factor/ or Ethnic difference/ or "Ethnic or racial aspects"/ or Race/ or race difference/
25 Social psychology/
26 exp self concept/
27 child behavior/
28 Habit/
29 exp social status/
30 Social structure/ or Socioeconomics/
31 Family life/
32 Attitude/
33 (social$ adj3 (depriv$ or exclusion or exclude$ or disadvantage$)).ti,ab.

34 (facilitat$ or barrier$ or determin$).ti.
35 or/20-34
36 19 or 35
37 exp feeding behavior
38 Drinking behavior
39 37 not 38
40 Child nutrition/ or Nutrition/ or Nutritional health/ or Nutritional requirement/ or Nutritional value/
41 Atherogenic diet/
42 exp diet restriction/
43 diet/
44 Food packaging/
45 ((school$ or eat$) adj3 (dinner$ or lunch$ or food$ or meal$ or snack$ or junk)).ti,ab.
46 (health$ adj1 (eat or eating or diet$ or food$ or snack$)).ti,ab.
47 or/37-46
48 and/10,36,47
49 limit 48 to english language

CINAHL

1 "Child"/ all topical subheadings / all age subheadings
2 "Child,-Preschool"/ all topical subheadings / all age subheadings
3 "Child-Health"/ all topical subheadings / all age subheadings
4 "School-Health"/ all topical subheadings / all age subheadings
5 "School-Health-Education"/ all topical subheadings / all age subheadings
6 "Students,-Middle-School"/ all topical subheadings / all age subheadings
7 (school* near3 (child* or pupil* or student* or kid or kids or primary or nursery or infant*)) in TI,AB
8 #1 or #2 or #3 or #4 or #5 or #6 or #7
9 "Health-Promotion"/ all topical subheadings / all age subheadings
10 explode "Health-Education" tree: 3/ all topical subheadings / all age subheadings
11 "Preventive-Trials"/ all topical subheadings / all age subheadings
12 "Preventive-Health-Care"/ all topical subheadings / all age subheadings
13 (prevent* or reduc* or promot* or increas* or program* or curricul* or educat* or project* or campaign* or impact* or risk* or vulnerab* or resilien* or factor* or correlate* or predict* or determin* or behavio*) in ti, ab
14 (health* or ill or illness or ills or well or wellbeing or wellness or poorly or unwell or sick* or disease*)in ti,ab
15 #13 near3 #14
16 #9 or #10 or #11 or #12 or #15
17 (determin* or facilitat* or barrier*) in ti
18 "Risk-Factors"/ all topical subheadings / all age subheadings
19 "Cardiovascular-Risk-Factors"/ all topical subheadings / all age subheadings
20 "Coronary-Prone-Behavior"/ all topical subheadings / all age subheadings
21 "Culture"/ all topical subheadings / all age subheadings
22 "Attitude"/ all topical subheadings / all age subheadings
23 "Attitude-to-Life"/ all topical subheadings / all age subheadings
24 "Consumer-Attitudes"/ all topical subheadings / all age subheadings
25 "Cultural-Bias"/ all topical subheadings / all age subheadings
26 explode "Family-Attitudes"/ all topical subheadings / all age subheadings

27 "Gender-Bias"/ all topical subheadings / all age subheadings
28 "Social-Attitudes"/ all topical subheadings / all age subheadings
29 #22 or #23 or #24 or #25 or #26 or #27 or #28
30 "Child-Behavior"/ all topical subheadings / all age subheadings
31 "Habits"/ all topical subheadings / all age subheadings
32 explode "Poverty"/ all topical subheadings / all age subheadings
33 "Social-Class"/ all topical subheadings / all age subheadings
34 "Social-Problems"/ all topical subheadings / all age subheadings
35 explode "Discrimination"/ all topical subheadings / all age subheadings
36 "Juvenile-Delinquency"/ all topical subheadings / all age subheadings
37 "Latchkey-Children"/ all topical subheadings / all age subheadings
38 #34 or #35 or #36 or #37
39 "Socioeconomic-Factors"/ all topical subheadings / all age subheadings
40 explode "Family-Characteristics"/ all topical subheadings / all age subheadings
41 "Attitude-to-Health"/ all topical subheadings / all age subheadings
42 (social* near3 (depriv* or exclude* or exclusion)) in ti, ab
43 "Students-Elementary"
44 "Schools-Elementary;"
45 #17 or #18 or #19 or #20 or #20 or #21 or #29 or #30 or #31 or #32 or #33 or #38 or #39 or #40 or #41 or #42
46 #8 or #43 or #44
47 #45 or #16
48 "Child-Nutrition"/ all topical subheadings / all age subheadings
49 explode "Eating-Behavior"/ all topical subheadings / all age subheadings
50 "Nutrition-Education"/ all topical subheadings / all age subheadings
51 "Food-Labeling"/ all topical subheadings / all age subheadings
52 explode "Nutrition-Services"/ all topical subheadings / all age subheadings
53 "Nutrition-Policy"/ all topical subheadings / all age subheadings
54 explode "Food"/ all topical subheadings / all age subheadings
55 "Diet-Records"/ all topical subheadings / all age subheadings
56 "Food,-Fortified"/ all topical subheadings / all age subheadings
57 "Health-Food"/ all topical subheadings / all age subheadings
58 "Food-Intake"/ all topical subheadings / all age subheadings
59 "Food-Services"/ all topical subheadings / all age subheadings
60 "Food-Service-Department"/ all topical subheadings / all age subheadings
61 explode "Diet"/ all topical subheadings / all age subheadings
62 "Restricted-Diet"/ all topical subheadings / all age subheadings
63 "Diet,-Fat-Restricted"/ all topical subheadings / all age subheadings
64 "Diet,-Sodium-Restricted"/ all topical subheadings / all age subheadings
65 #62 or #63 or #64
66 "Obesity"/ all topical subheadings / all age subheadings
67 ((school* or food* or child* or packed) near3 (dinner$ or lunch* or food* or meal* or junk or snack* or eat*)) in ti, ab
68 #48 or #49 or #50 or #51 or #52 or #53 or #54 or #55 or #56 or #57 or #58 or #59 or #60 or #61 or #62 or #63 or #64 or #65 or #66 or #67
69 #46 and #47 and #68

ERIC

1 exp children/ or child.ab,ti. or children.ab,ti.
2 Health activities/ or Health education/ or Health programs/ or Health promotion/ or Health materials/ or Behavior

change/ or Behavior modification/ or Intervention/ or Crime prevention/ or Dropout prevention/ or Prevention/ or Preventive medicine/ or Risk management/ or Evaluation/ or Formative evaluation/ or Needs assessment/ or Summative evaluation/ or Outcome based education/ or Outcomes of education/ or Program effectiveness/ or promot$.ti. or increas$.ti. or prevent$.ti. or intervention$.ti. or program$.ti. or curriculum.ti. or health educat$.ti. or project$.ti. or campaign$.ti. or impact.ti. or reduc$.ti.

3 Disadvantaged/ or Disadvantaged environment/ or Educationally disadvantaged/ or Poverty/ or Poverty areas/ or Unemployment/ or Economically disadvantaged/ or Homeless people/ or Low income groups/ or Low income/ or Lower class/ or Poverty programs/ or Dropout characteristics/ or Dropout prevention/ or Dropout programs/ or Dropouts/ or Out of school youth/ or Potential dropouts/ or Truancy/ or Ethnic stereotypes/ or Racial attitudes/ or Racial discrimination/ or Black stereotypes/ or Cultural differences/ or Ethnicity/ or Disability discrimination/ or Learning disabilities/ or Ghettos/ or Urban population/ or Urban youth/ or risk/ or Delinquency/ or Delinquency prevention/ or Delinquency causes/ or Runaways/ or Youth problems/ or "Adjustment (to environment)"/ or Coping/ or Life satisfaction/ or Happiness/ or Well being/ or Emotional adjustment/ or Social adjustment/ or Social isolation/ or Stress management/ or Stress variables/ or Daily living skills/ or Self esteem/ or Alienation/ or Cultural isolation/ or Student alienation/ or risk factor$.ti. or vulnerab$.ti. or resilien$.ti. or (factor$ adj protect$).ti. or protect$ factor$.ti. or factors associated.ti. or correlat$.ti. or predict$.ti. or predictors.ti. or determinant$.ti. or self esteem.ti. or self concept.ti. or coping.ti. or well being.ti. or social support.ti. or social support.ti. or empower.ti. or empower$.ti.

4 exp adapted physical education/ or exp health activities/ or exp physical activities/ or exp physical education/ or exp physical recreation programs/ or exp playground activities/ or exp recreational activities/ or exp exercise/ or exp health related fitness/ or exp physical fitness/ or exp physical fitness tests/ or exp physical health/ or exp athletics/ or exp extracurricular activities/ or exp physical activity level/ or exp leisure education/

5 exp breakfast programs/ or exp dietetics/ or exp eating habits/ or exp food/ or exp health/ or exp lunch programs/ or exp nutrition/ or exp nutrition instruction/ or exp "recipes (food)"/ or exp vending machines/ or exp obesity/

6 2 or 3

7 1 and 6 and 5

8 British infant schools/

12 1 or 8

13 limit 12 to yr=1901-2000
14 12 and 6 and 7

SSCI

(child OR children* or childhood*) AND ((promot* OR increas* OR interven* OR program* OR curriculum* OR educat* OR campaign* OR impact* OR effect* OR prevent* OR reduc* OR risk factor* OR factors OR correlat* OR predict* OR determinant* OR disadvantag* OR inequalities OR social class OR working class OR high risk OR depriv* OR gender OR low income OR ethnic OR disabilit*) SAME (health* OR ill* OR well or wellbeing or wellness OR poorly or unwell OR disease)) AND (eating OR nutrition* OR food OR diet* OR fat OR cholesterol)

PsycInfo

* #55 #11 and #44 and #54
#54 #45 or #46 or #47 or #48 or #49 or #50 or #51 or #52 or #53 (12856 records)
#53 ((school* or child* or packed or junk)near3 (dinner* or lunch* or food* or meal* or snack* or eat*))in ti,ab
#52 explode diets
#51 Feeding-Practices in MJ
#50 'healthy eating' in ti,ab
#49 eating attitudes in de
#48 food preferences in de
#47 food intake in de
#46 food in de
#45 explode nutrition in de
#44 #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35 or #36 or #37 or #38 or #39 or #40 or #41 or #42 or #43
#43 (barrier* or facilitat* or determin*)in ti
#42 explode teacher attitudes
#41 explode student attitudes
#40 explode racial-and-ethnic-attitudes
#39 explode parental attitudes
#38 ('Obesity-' in DE) or ('Obesity-Attitudes-Toward' in DE))
#37 explode health attitudes
#36 explode eating attitudes
#35 explode community attitudes
#34 explode child attitudes
#33 (social near3 (exclusion or exclude* or disadvantage* or depriv*))in ti,ab
#32 explode self concept
#31 explode socioeconomic class attitudes
#30 explode social class
#29 poverty in de
#28 explode social influences
#27 explode social deprivation
#26 disadvantaged in de
#25 explode dropouts
#24 at-risk-populations in de
#23 educational-program-evaluation in de
#22 explode school environment

#21 explode lifestyle
#20 explode sociocultural factors
#19 risk factors in de
#18 #12 or #13 or #14 or #17
#17 #15 near3 #16
#16 (health* or ill or illness or ills or well or wellbeing or wellness or poorly or unwell or sick* or disease*) in ti,ab
#15 (prevent* or reduc* or promot* or increas* or program* or curricul* or educat* or project* or campaign* or impact* or risk* or vulnerab* or resilien* or factor* or correlate* or predict* or determin* or behav*)in ti,ab
#14 preventive medicine in de
#13 health education in de
#12 explode health promotion in de
#11 #1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9 or #10
#10 explode preschool students in de
#9 explode junior high school students in de
#8 explode elementary school students in de
#7 junior high schools in de
#6 nursery-schools in de
#5 elementary-schools in de
#4 (school near3 (child* or student* or kif or kids or primary or nursery or elementary)) in ti,ab
#3 preschool-age in ag
#2 childhood in ag
#1 school-age in ag

APPENDIX C: Methods for calculating and pooling effect sizes

C.1 Definitions

In order to clarify the statistical terms used, we have included some definitions here. *These are taken from Clarke and Oxman (2002) and Last (2000).

mean: the average value, calculated by adding all the observations and dividing by the number of observations*.

standard deviation: A measure of dispersion or variation and is the most widely used measure of dispersion of a frequency distribution. It is equal to the positive square root of the variance. The mean tells where the values for a group are centred. The standard deviation is a summary of how widely dispersed the values are around this centre*.

standard error: The standard deviation of an estimate. Used to calculate confidence intervals*.

standardised mean difference: The difference between two means divided by an estimate of the within-group standard deviation. When an outcome (such as pain) is measured in a variety of ways across studies (using different scales) it may not be possible directly to compare or combine study results in a systematic review. By expressing the effects as a standardised value the results can be combined since they have no units*.

pooled: combined*

effect size: a measure of the difference in outcome between the groups in a study.

C.2 Statistical methods

A supplementary framework was used to extract data on the outcome variables from each evaluation in order to calculate effect sizes for the meta-analysis. In order for the results of different studies using different measurement tools to be combined, their results need to be standardised in some way. For this review, the standardised mean difference was selected: this is essentially the difference in means between the two groups in the evaluation divided by their pooled standard deviation. A measure of uncertainty, the standard error, accompanies the standardised mean difference (which is described throughout the report as an 'effect size'). In order to calculate this effect size all that is needed is the number of people in each group, their post-test means (adjusted for baseline measures if necessary) and their standard deviations. Unfortunately, these data are not always reported and further calculation from the data presented becomes necessary before an effect size can be found. To facilitate this process, our specialised software, EPPI-Reviewer, was adapted to calculate effect sizes from the range of data encountered. By combining

the effect sizes from all of the included studies statistically, it is possible to estimate an overall measure of effect for the interventions included.

One complicating factor is the issue of studies in which the unit of assignment to intervention and comparison conditions is groups of individuals (for example, classes or schools) rather than individuals themselves. Though statisticians have discussed this topic for the last 20 years, it is only in the last decade that the special methods needed to evaluate such studies have been used widely. Methods for analysing these 'cluster' trials are still developing and methods for including such studies in meta-analyses are still in their infancy. It is possible, however, to extract outcome data from the reports of these studies for use in a meta-analysis though there were no detailed published works on the subject at the time of writing.

Of crucial importance is the 'unit' of analysis that was used in the original study and presented in the report. The standardised mean difference depends upon the standard deviation of individuals for the standardisation process to operate properly. If authors report the standard deviation between groups (or clusters) then this needs to be converted into the standard deviation between individuals before it can be used to calculate an effect size. Likewise, if a study has analysed clusters of individuals and presented standard errors, these standard errors need to be converted into standard deviations taking the *design effect* of the study into account. For more information on the analysis of cluster trials see Rooney and Murray (1996), Murray 1998, Donner and Klar (2002) and Donner *et al.* (2001). The formulae used to calculate effect sizes are presented in the table below.

Data were entered onto a specialised computer database (EPIC).

Sources for the statistical formulae in the table below:

1 Deeks JS, Altman DG, Bradburn MJ (2001) Statistical methods for examining heterogeneity and combining results from several studies in meta-analysis. In: Egger M, Smith GD, Altman DG (eds) *Systematic Reviews in Health Care.* London: BMJ Publishing Group.

2 Lipsey MW, Wilson DB (2001) Practical Meta-analysis. London: Sage Publications Inc.

3 Murray DM (1998) Design and analysis of group-randomized trials. New York: Oxford University Press.

Number	Formula	Notes
Formulae for calculating the standardised mean difference and associated variables		
1	$g_i = \frac{m_1 - m_2}{s}\left(1 - \frac{3}{4N-9}\right)$ where m_1 = mean group 1 m_2 = mean group 2 s = pooled standard deviation N = total number in both groups	This formula for Hedges' g is found in source 1. It is used to calculate a standardised mean difference and makes an adjustment for small sample sizes.
2	$SE(g_i) = \sqrt{\frac{N}{n_1 n_2} + \frac{g_i^2}{2(N-3.94)}}$ where n_1 = number in group 1 n_2 = number in group 2 N = total number in both groups g_i = Hedges' adjusted g	This is the standard error of Hedges' g (above) also found in source 1.
3	$s = \sqrt{\frac{(n_1-1)SD_1^2 + (n_2-1)SD_2^2}{N-2}}$ where n_1 = number in group 1 n_2 = number in group 2 SD_1 = standard deviation group 1 SD_2 = standard deviation group 2 N = total number in both groups	Pooled standard deviation. Used to calculate Hedges' g. (source 1).

Formulae to prepare data from cluster allocated trials		
4	$deff = 1 + (m-1)ICC$ where m = average cluster size ICC = intra - class correlation deff = design effect	The design effect for trials using cluster allocation (source 3). In order to correct for unit of analysis errors (studies which have analysed on the basis of individual when the unit of assignment was by cluster) multiply the standard error of Hedges' g by the square root of *deff* .
5	$SD_{individual} = \frac{SD_{cluster}\sqrt{n_{clustersize}}}{\sqrt{deff_{clustersize}}}$	If a study presents cluster data as though they were individuals (complete cluster level analysis), the SD presented will be SD between clusters. This formula corrects for this ready for calculating Hedges g.
6	$SD_{cl} = \frac{SE\sqrt{n}}{\sqrt{deff}}$ where n is number of individuals (not clusters)	In order to calculate the SD of a trial which presents standard errors having taken account of the design effect, this, rather than the traditional formula for getting from SE to SD should be used.
Formulae to prepare data from trials using individual allocation		
7	$SD = SE\sqrt{n-1}$ where SE = standard error of the mean n = number of individuals	To calculate the standard deviation of the mean when presented with the standard error (source 2).
8	$SE = \frac{0.5(CI)}{Z_{\alpha}}$ in practice for a 95% confidence interval $SE = \frac{0.5(CI)}{1.96}$ where CI = confidence interval (upper – lower)	To move from confidence intervals to the standard error of the mean (source 2).
9	$ES_{sm} = t\sqrt{\frac{n_1 + n_s}{n_1 n_2}}$ or where n1 = n2 $ES_{sm} = \frac{2t}{\sqrt{N}}$ n1 = individuals in group 1 n2 = individuals in group 2 N = n1 + n2	Moving from a t value to a standardised mean difference (source 2). This value is then adjusted for small sample size by multiplying by the 2nd half of formula 1. t can be found from p by using statistical tables (or certain computer software).

Formulae for combining studies using the inverse variance method		
10	$w_i = \frac{1}{SE(\Theta_i)^2}$ where Θ_i is the effect size of the study SE is its standard error	Each study is weighted according to this formula (source 1).
11	The combined effect, Θ_{iv} is calculated: $\Theta_{iv} = \frac{\sum w_i \Theta_i}{\sum w_i}$	(source 1)
12	and its standard error: $SE(\Theta_{IV}) = \frac{1}{\sqrt{\sum w_i}}$	(source 1)
13	$Q = \sum w_i (\Theta_i - \Theta_{iv})^2$	The heterogeneity statistic, Q, is calculated using this formula. Since it is distributed as a chi-square, a p-value is obtained with *k*-1 degrees of freedom, where *k* is the number of effect sizes being combined. (source 1).
14	$\Theta \pm (1.96 * SE(\Theta))$	95% confidence intervals for individual and overall effects are calculated. (source 1).
15	$z = \frac{\Theta}{SE(\Theta)}$	The test statistic (z) for overall effect. z then follows a standardised normal distribution.

As a result of calculating effect sizes for cluster allocated trials, it became clear to us that this is an area in which there is little guidance available to reviewers. Our statistical advisors have suggested some new methods and we are in the process of writing up this information for publication.

For further information on the methods used in statistical meta-analysis see Cooper and Hedges (1994), Egger *et al*. (2001), Lipsey and Wilson (2001).

We decided to adopt a 'mixed effects model' (Lipsey and Wilson, 2001: p. 124) to frame our meta-analysis. As its starting point this model assumes a that the results of studies only differ due to subject-level sampling error and that any significant differences (heterogeneity) between the studies can be explained by an examination of study characteristics (type of intervention, setting, population etc). If there is still significant heterogeneity after the examination is complete, a 'random effects model' is adopted to frame the unexplained (random) heterogeneity.

This model defined the methods used for the statistical synthesis. After identifying sub-sets of studies which presented data on the same outcome (knowledge, attitudes, behavioural measures) the same steps were followed for each sub-synthesis.

Firstly, the distribution of effect sizes was examined (through the use of stem and leaf and box and whisker plots) and a test for heterogeneity was conducted. If no significant heterogeneity was found, the results of the studies were pooled and a final effect size was calculated. If significant heterogeneity was found, reasons to explain the differences between studies were explored through a statistical technique (Analogue to the ANOVA, Lipsey and Wilson (2001: p. 120)) which divides heterogeneity into the portion which has been explained by a sub-division of studies and that which remains within the individual groups. If significant heterogeneity still remained, the final pooled effect size would be calculated using that portion of variance which was not explained by the Analogue to the ANOVA.

In order to protect the above procedure from becoming an exercise in data dredging and to maintain an explicit and transparent procedure throughout the review, the categorical variables which would be used in the 'Analogue' were specified in advance of the meta-analysis. These categories were: study type (RCT, CT); study quality (high / medium / four criteria for soundness); study population (sex, country, age); setting of intervention (classroom, school, home, community); type of intervention (fruit and vegetable promotion, healthy eating + fruit and vegetable promotion, fruit and vegetables + other promotion); type of intervention (education, 'hands-on' component). Since these categories were specified in advance, we did not know whether or not they would be practical to apply; their purpose was to define clear boundaries beyond which we could not stray in attempting to explain study heterogeneity.

After the final effect size was calculated and any issues of heterogeneity had been explored, the results were subjected to a sensitivity analysis to examine how robust they were. In previous EPPI-Centre reviews, only the findings of the sound outcome evaluations have gone on to contribute to the conclusions of the review about the effects of interventions. This is known as a 'threshold' approach. We deviated from such an approach in this review by conducting a sensitivity analysis as part of the statistical meta-analysis. As described in chapter 2, we identified two levels of study quality and compared the findings of studies categorised as 'medium' quality with those categorised as 'high quality' in order to see whether their findings differed significantly. In addition to testing the findings of the meta-analysis according to study quality, individual studies were removed and added to see whether the results of the meta-analysis were over-reliant on the findings of just one or two important studies.

Where possible the meanings of effect sizes of various magnitudes were illustrated using existing measures of fruit and vegetable consumption. For example, an effect size of 0.11 standard deviations is more meaningful when translated into 'an additional 20% of a portion of fruit a day'. We used the Health Survey for England 2001 (Doyle and Hosfield, 2003) as our benchmark for portion sizes and distributions.

APPENDIX D: Methods for the synthesis of children's views

Developing codes

Examining the findings of each study in turn, every sentence or paragraph within the report of the findings was assigned a code to describe it (e.g. children prefer fruit to vegetables). This process created a total of 36 initial codes. Reviewers looked for similarities and differences between the codes in order to start grouping them into a hierarchical tree structure. New codes were created to capture the meaning of groups of initial codes. This process resulted in a tree structure with several layers to organize a total of 12 descriptive themes. For example, the first layer divided the 12 themes into whether they were concerned with children's understandings of healthy eating or influences on children's food choice. A narrative summary of the findings across the studies organized by the 12 descriptive themes was then written by one of the review authors (AH).

Inferring barriers and facilitators

Up to this point it was becoming increasingly apparent that the findings of the studies had little direct information on what children saw as helping them to, or stopping them from, eating healthily. In fact the whole set of *a priori* questions we planned to use did not prove to be a useful way of making sense of our data set. We therefore decided to abandon our *a priori* questions and focus our attention on the 12 descriptive themes derived from the data set itself.

Reviewers decided to *infer* barriers and facilitators from the views children were expressing about other aspects of healthy eating or food in general which were captured by the descriptive themes. Using the narrative summary of these described above, all three reviewers inferred possible barriers and facilitators and considered the implication of children's views for intervention development. Each reviewer first did this independently. As the barriers and facilitators inferred by each reviewer were discussed, more abstract or analytical themes began to emerge. The barriers and facilitators and implications for intervention development were examined again in light of these themes and changes made as necessary. This cyclical process was repeated until the themes were sufficiently abstract to describe and/or explain all of our initial descriptive themes, our inferred barriers and facilitators and implications for intervention development.

APPENDIX E: Outcome evaluations included in the effectiveness synthesis

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Anderson *et al.* (2000)	UK	**Age** 6-11 years **Sex** - Mixed **SES** % of free school meals in four schools ranged from 14-48% **Ethnicity** not stated **Region** Not stated	School	*To increase consumption of fruits and vegetables in children aged 5 - 11 years	Classroom teacher Parent helpers in tuck shop Researcher providing ideas and resources to teachers	*Whole school intervention **'5 A Day the Bash Street way'** ***Food provision**: fruit sold daily in the tuck shop; school dinners - vegetable soup/starter each week; daily choice of salad and a cooked vegetable; weekly choice of a fruit based pudding; daily choice of fruit as a desert ***Materials**: children's news sheet; **parents** newsletter; videos; stories; posters (bash street characters) ***Activities**: topic work using fruit & vegetables; lunchbox topic for infants and upper primary; school assembly; class presentation of portion size; hands on activities to encourage the children to taste and enjoy fruit & vegetables ***Community**: parent helpers in the tuck shop;
Auld *et al.* (1998b)	USA	**Age** 7-11 years **Sex** - Mixed **SES** indicators of low SES **Ethnicity** large proportion Hispanic **Region** Not stated	School Home	*Long-term goal of achieving sustained dietary behaviour change in children and families. *Secondary goal to establish nutrition education as an accepted part of elementary school education through the use of local partnerships	Special Resource Teacher (SRT) = not usual class teacher Some parents recruited to provide lunchtime component	*School based **nutrition education programme** * 24 weekly taught classroom activities ***Activities** - food preparation and eating * Six corresponding parent-taught school lunchroom activities * 12 bimonthly newsletters to **parents** *Two family fun nights per school * Community nutrition/food resource development

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Auld *et al.* (1999)	USA	**Age** 7-10 years **Sex -** mixed **SES** - indicators of low SES **Ethnicity-** 90% Hispanic **Region -** Not stated	School	*To increase school lunchroom consumption of fruit & vegetables *To increase knowledge about and attitudes toward fruit & vegetables *To increase knowledge of the Food Guide Pyramid	Classroom teachers and special resource teachers Some parents recruited to provide lunchtime component	*School based **nutrition education programme** *16 weekly, experiential, behaviour change-oriented lessons *Taught in alternate weeks by the classroom teacher and SRT ***Six parent- taught lunchroom activities** ***Activities** - preparing or eating food and targeting a fruit or vegetable consumption behaviour, such as eat two fruits/vegetables at lunchtime
Baranowski *et al.* (2000)	USA	**Age** - 9-11 years **Sex** - Mixed **SES** – Not stated **Ethnicity** - 15.3% African American and 84.7% Euro-American **Region** - Not stated	School Home Local grocery stores	*To encourage and assist students to eat more servings of fruit, juice & vegetables *To increase fruit, juice & vegetable availability-accessibility at home and at fast food restaurants *To develop student asking skills *To enhance students' preferences for fruit, juice & vegetables * To increase fruit, juice & vegetable snack and meal preparation skills *To train students in goal setting and problem solving skills	Classroom teacher Produce managers at local grocery stores to provide family fun nights	***'Gimme 5' classroom curriculum** with **home component** *12 45 to 55 min sessions over six week period in each of two years ***Activities** - Behavioural objectives identified for each session Gimme 5 rap, participative learning, dietary goal setting, taste testing, children create comic strips on fruit & vegetable issues ***Materials** - handouts, worksheets, posters, newsletter * 4th grade learning activities emphasized 'veggies' 5th grade emphasized fruit but addressed veggies * Weekly newsletters to parents - suggestions and recipes for increasing fruit, juice & vegetable intake * Weekly home assignments with **family involvement** ** Team prize for completing six home assignments* **'MTV' format video sent home at two-week intervals emphasizing modelling of desired behaviours.* **Point-of-purchase education for parents* *Family night – including raffle

***** 'Try new food' studies

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Cullen (1997)	USA	**Age** - 9-12 years **Sex** - female **SES** - Not stated **Ethnicity** - Mostly Caucasian **Region** - Not stated	Junior Girl Scout troop	*To increase fruit & vegetable consumption, self-efficacy, knowledge and fruit & vegetable preference *To reduce negative influences from norms and barriers	The Girl Scout troop leaders. The principal investigator taught the 1st session.	*'**Eat 5 Badge'** intervention for Girl Scouts *Four weekly sessions of 1-1.5 hours * girls learned how to complete three-day food records *choose a buddy to call during the week and encourage to complete the food record * **Activities** designed to increase fruit & vegetable exposure and preparation skills and knowledge and skills in self-evaluation, self-monitoring, goal setting, and problem solving, and to establish troop norms for serving and eating fruit & vegetables * Fruit & vegetables prepared and tasted at each meeting. ***Parent** information sheets sent home to enlist parental support for supplying fruit & vegetables for tasting and to encourage fruit & vegetable consumption at home. ***Incentives** - Girls required to complete activities to receive 'eat 5 badge' including completion of three-day food record, trying new fruit & vegetables, creating an advertising program for eating five fruit & vegetables, achieving 5 A Day in own diet, preparing fruit & vegetable meals for family

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Epstein *et al.* (2001)	USA	**Age** – Children mean age eight Parents mean age 40 **Sex** – Children mixed sex Parents predominantly female **SES** - Not stated **Ethnicity** - Not stated **Region** - Not stated	Health care unit Home	*To reach at least two servings of fruits and three servings of vegetables per day *To reach a goal of no more than 10 servings of high-fat/high-sugar foods per week *Secondary goal - a decrease in weight for parents and to a stabilization of relative weight for children	'Therapist' (not further specified) ran individual meetings with parents Parent it was aimed that parents would complete workbooks with children and instigate changes to their own and their child's environment so as to facilitate healthy eating and physical activity	*Two groups with different targeted behaviours - **increase fruit & vegetables** or **decrease fat and sugar** *'6 month intensive treatment ***Parents weight control treatment, eight weekly meetings, four biweekly and two monthly meetings** * **Materials** - parent and child workbooks. Module on - weight control, Traffic-Light Diet, developing a healthy eating and activity environment for children, behaviour change techniques and maintenance. *Parents attend 30 minute individual meeting with therapist and 30 minute group meeting ***Families** provided additional nutritional information regarding reading food labels and shopping. *Parents taught positive reinforcement techniques that included praise for targeted behaviours. * Parents taught stimulus control to reduce access to high-fat/sugar foods and to increase access to fruit & vegetables, and to increase access to physical activity ***Incentives** - Children receive sticker on tracking sheet for involvement in activities At six month follow up children given gift certificates based on number of activities completed during the program.
Gortmaker *et al.* (1999)	USA	**Age** - mean age 9.2 years **Sex** - Mixed **SES** - low income **Ethnicity** - 90% African American **Region** - urban population	School	*to provide low-cost sustainable intervention *To decrease consumption of foods high fat *To increase consumption of fruit & vegetables to 5 A Day or more *To reduce television viewing to two hours per day *To increase moderate and vigorous physical activity *to increase knowledge of healthy diet and activity	Classroom teachers	***Classroom-based** interdisciplinary approach with **healthy eating** and **physical activity** units *13 50 minute lessons given each for grade 4 and 5 in two school years *5 physical education lessons focused on nutrition *3 classroom lessons with physical education theme involving students in movement *Links with **food service** ***Skill** building and **family** involvement *Focus - promoting fruit & vegetables 'Get 3-at-school & 5 A Day', limiting television viewing time 'My TV Unplugged), increasing walking ('walking clubs').

***** 'Try new food' studies

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Hendy (1999)*	USA	**Age** mean age 58.4 months **Sex** - Mixed **SES** 'mostly low income' **Ethnicity** Over 95% 'white' **Region** *Not stated*	Pre-school	*To compare the effectiveness of a number of mealtime actions to encourage children's acceptance of novel foods *To examine gender differences in the effectiveness of different adult actions for encouraging children's food acceptance	Teacher	*Comparison of interventions: **Simple exposure (control group)**; **Modelling**; **Reward**; **Insist try one bite**; **Choice-offering** *Foods were fruits or vegetables, included a variety of colours and textures, foods young children could handle without utensils, foods with which children have had little experience. *Four foods presented during preschool lunch for three consecutive days, observations lasted 20 minutes. ***Simple exposure** Foods placed in centre of table, in separate bowls. Teacher was allowed to answer children's questions about the foods briefly, but otherwise said nothing about them. The teacher did not eat any foods during the meal. **Modelling**: Teacher placed each of the foods on his/her own plate and ate at least two bites of each food, the teachers also said, 'I like to try new foods,' **Reward**: Teacher told all the children, 'If you try two of these new foods with at least one bite, you can have a special dessert. If you try all of these new foods, you can also have candy to take home for later.' **Insist try one bite**: Teacher stated, 'Please try one bite.' Children never forced to eat. **Choice offering**: Teacher asked, 'Do you want any of this?' gave a small sample of the food if child said, 'yes,' moved on to the next child if they said 'no.'

***** 'Try new food' studies

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Henry *et al.* (2001)	UK	**Age** - 5-7 years **Sex** - Mixed **SES** - Not stated **Ethnicity** - 88% 'white' **Region** - Not stated	School	*Obesity prevention in primary school children *Intervention to be school-based/family oriented acceptable and appropriate for primary school children	The programme was delivered by researchers and did not involve the teachers of the schools, although the project had their full support and backing.	***'Be Smart' intervention with nutrition and physical activity components** *'Eat Smart'- promotion of fruit & vegetables and power foods (high starch foods) *'Play Smart' to promote activity in daily life, activity in playground and reduction in television viewing. *'Eat Smart Play Smart' - received half the nutrition and half the physical activity programme each term *Four eight-week periods, weekly in term 1 and fortnightly in terms 2-4, each lesson 20 minutes ***Materials** – activity book for use at home *Specific weekly messages reiterated through related 'homework' ***Parent** messages through activity book & newsletter
Hopper *et al.* (1996)	USA	**Age** – Mean age 8.9 years Range 7-10 years **Sex** - Mixed **SES** – 74% parents 'white collar' **Ethnicity** – not stated **Region** - Rural	School Home	* To improve fitness and nutrition *To investigate effects of parental involvement	Unclear	***Cardiovascular exercise and nutrition programme with parent participation** *School only and school-home group *Nutrition Education emphasised reduction of saturated fat in diet * two 1/2-hr in-school sessions per week for 10 weeks ***Activities** include - preparing snacks using fruit & vegetables, reading food labels, consuming high-fibre foods, films, games, group discussion, and role-playing *Physical Fitness Education *Four 30-min sessions per week for 10 weeks ***Activities** included - non-competitive games, educational gymnastics, dance and rhythmic activities *School-home group given weekly home packet, families received directions for preparing healthy foods and completing exercise activities as a family

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Liquori *et al.* (1998)	USA	**Age** - 5-12 years **Sex** - Mixed **SES** - Low income **Ethnicity** - 85% African American 15% Hispanic **Region** - Not stated	School	* Primary goal to increase children's consumption of minimally processed whole grains and vegetables. *Secondary goals to enhance children's preferences for, attitudes toward, self-efficacy, and knowledge about these foods.	*Teachers* A member of the programme staff visited the school cafeterias each week to provide 'ongoing monitoring and support'. Volunteer student nutritionists *Parent volunteers* Food service staff	* three major components, school lunch; classroom; parent and community *Implemented over six months ***School lunch component** to increase the diversity of the vegetables and whole grains served to children and integration with classroom component ***Classroom component -** CS (cookshops) and FEL (food and environment lessons) **CS - food preparation with relevant food and environmental information - activities specifically related to cooking and tasting whole grains or vegetables, weekly newsletter to parents* ** FEL - activities about food but not including direct experiences with foods – focus on helping children understand why whole, minimally processed plant foods are foundation of a diet that is both healthful and resource conserving - activities included planting bean seeds* ***Parent and community component -** monthly newsletter 'Diets and Dollars' information on buying, storing, and preparing foods targeted in the CS Program as well as other information – to all groups including comparison
Moore (2001)	UK	**Age** – 9-11 **Sex** - Mixed **SES** - Indicators of low income population **Ethnicity** - Not stated **Region** - Not stated	School	To increase fruit consumption	The two project officers Tuck shops could be run by pupils or staff in schools Fruit supplied by recommended or local fruit retailer	***Fruit tuck shops** *12 month period of intervention *Schools provided with limited assistance in setting up and maintaining a fruit tuck shop, and were given great flexibility in how they chose to set up and run the tuck shops. The main conditions that the schools were asked to abide by were (i) that there should always be a choice of fruits; (ii) that fruits should be priced at 15p per portion; and (iii) that sweets, crisps or other items should not be stocked as alternatives to the fruit. A project officer was available to visit each school to provide support and advice, and schools were put in contact with a local fruit supplier.

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Parcel *et al.* (1999)	USA	**Age** - 8-10-years **Sex** - Mixed **SES** - Not stated **Ethnicity** - 62.3% Anglo 20.9% Mexican 14.8% 'Black' **Region** - urban location		* Overall goal of creating an environment supportive of healthful eating and physical activity practices among students	*Teacher* Catering staff	*'Three program components: School Lunch, Children's Active Physical Education (CAPE), and Go For Health curriculum (focus ***low fat and sodium***). ***School Lunch** - four areas targeted a) purchasing b) menu planning c) recipe development d) food preparation practices - a) & b) aim to provide meals lower in fat and sodium. * CAPE - new **PE curriculum** - two semester long units, six to eight weeks each. Activities structured to influence the health-related outcomes; the most important focus was on enjoyable movement. * Classroom **health education curriculum** - set of six modules - two four-week healthful eating modules and one six-week physical activity module. Lesson included modelling of desired behaviours, development of particular skills necessary for the performance of the behaviour, and opportunities for students to practice the newly learned behaviour. Follow-up activities provided opportunities for reinforcement.

***** 'Try new food' studies

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Perry *et al.* (1998a)	USA	**Age** - 9-11 years **Sex** - Mixed **SES** - low income population **Ethnicity** - 1.3% Native American, 6.4% Hispanic, 19.1% African American, 25.2% Asian American, 47.0% 'White' **Region** - Not stated	School	*To increase fruit and vegetable consumption	*Teacher* Food service staff industry executives	**Intervention on **fruit & vegetables** consisted of four components: **behavioural curricula** in the fourth and fifth grades, High 5' and '5 for 5'; **parental involvement**/education; school **food service changes**; **industry involvement and support*** **16 40-45 minute classroom sessions twice a week for eight weeks* * two curricula developed for each of the grade levels - each consisted of skill building and problem solving **activities**, snack preparation and taste testing ***Materials** - comic books in High 5 and an adventure story for 5 for 5 ***Incentives** - team competition to eat fruit & vegetables during lunch central component of each program. Students rewarded with small prizes on an individual student and team basis at the end of each program. * information activity packets brought home by children - parents required to sign return card then entered into a classroom draw *Four lunchroom strategies - point-of-purchase promotion using characters from classroom curricula; enhancing attractiveness of fruit & vegetables served; increasing variety of fruit & vegetables served; providing an additional fruit item on days when a baked desert was served * industry component - support from Minnesota 5 A Day coalition. - companies provided fruit & vegetables for classroom taste testing, home snack packs and school lunch - 30 minute presentations to 5th grade intervention classes

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Perry *et al.* (1998b)	USA	**Age** - mean age is 8.76 years **Sex** - Mixed **SES** - Not stated **Ethnicity** – 'White' - 835 Hispanic - 183 African - 125 Other - 40 **Region** - Not stated	School Home	* The primary goal of the CATCH food service intervention, Eat Smart, was to lower fat, saturated fat, and sodium in the school lunches. *To promote a generally healthful diet, including increasing fruit and vegetable intake. * to increase physical activity, *To reduce smoking	Class teacher PE Specialist teachers Food service managers and supervisors	* The **CATCH** intervention on **health in general** included **classroom curricula, food service changes, and Physical education** modifications in the 56 intervention schools. In addition, in 28 of the 56 intervention schools, **family-based education** was provided ** During the three years of intervention there were 15 lessons in the third grade, 24 lessons in the fourth grade, and 16 lessons in the fifth grade - (40 minutes each)* **CATCH dietary intervention - There were no specific lessons on fruit and vegetable consumption, although fruits and vegetables were mentioned in all of the nutrition lessons.* ***Activities** – Fruit & vegetables part of the food preparation and taste testing in the classroom. Messages and activities about healthful foods included fruits, vegetables, low-far dairy products, cereals, breads, lean meats, poultry, and fish. ***Family education** included **activity packets** that the children completed with their parents at home and family fun nights at school. fun nights consisted of booths, activities, and taste testing around healthy eating and physical activity * 30 **food service** guidelines including two promoting fruit & vegetables

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Resnicow *et al.* (1998)	USA	**Age** - mean age 8.7 yrs **Sex** - Mixed **SES** - Not stated **Ethnicity** - Children: 75% 'black', 25% **Region** - Not stated	Community (specify) of health risk appraisals at a centrally located station School	*To enhance the impact of Gimme-5 on student outcomes via Teacher wellness programme * To improve cognitive, behavioural, and physiological outcomes among the participating teachers	*Not stated who taught the teachers* The teachers provided Gimme-5	*Intervention group schools received the **Gimme-5 curriculum** and the **teacher wellness program** Comparison group schools received the Gimme-5 program only **The curriculum contains 12 sessions in both grade four and grade 5, with approximately three activities per session. The 12 sessions designed to be delivered twice a week over six weeks.* ***Gimme 5** - **health education** curriculum designed to increase students' consumption of **fruit & vegetables** ***TeachWell** - based on the Johnson and Johnson Live for Life program, includes promotional **materials**, printed educational materials, and a series of interactive **health workshops** for teachers In year 1, teachers were offered 36 health workshops addressing topics such as weight loss, blood pressure control, and stress management, each approximately 30 minutes in length. In year 2, 18 workshops were offered. An exercise program was also offered at each school two to three times per week after school. Participants also received personalised feedback incorporating their baseline physiologic results, and they were offered **incentives** (e.g., T-shirts) for attending TeachWell classes and increasing exercise as well.

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Reynolds *et al.* (2000)	USA	**Age** – Mean age 8.7 years **Sex** - Mixed **SES** - median household income between $40,000 and $50,000 **Ethnicity** - 83% European-American, 16% African-American, 1% other **Region** - Not stated	School Home	* To increase fruit and vegetable consumption * To evaluate long-term effects of the program on children's consumption of fruit & vegetables by examining the effects of the program using both an immediate and a 1-year post-intervention follow-up assessment * To evaluate the effects of the intervention on parents' consumption of fruit & vegetables	Curriculum coordinators and project nutritionists employed by the project	*'**High 5' curriculum and food service intervention** **7 week curriculum plus booster session – 14 lessons 30-45 minutes* * 'High 5' days - participants aim to eat five fruit & vegetable portions ***Learning methods** - modelling, self-monitoring, problem-solving, reinforcement, taste testing, ***Activities** –'Check-up' to review information from earlier lessons; High 5 Cheer to encode key concepts; Freggie (Fruit and veggie) Facts to relay new information; Learning Activities to build skills, self efficacy, and outcome expectancies and alter food preferences; Homework to reinforce skills. ***Materials** Freggie (homework) book, fridge magnets, use of characters (e.g., Indiana Banana) * **Parents** asked to help their children on High 5 Day and encouraged to eat five servings themselves, Kick-Off Night held at each school at the beginning of the intervention to provide overview, homework to be completed by parent and child, completion enables entry to raffle ***Food Service** Component - Food service managers and workers received a half-day of training on purchasing, preparing, and promoting fruit & vegetables that met High 5 guidelines with incentives to achieve this

***** 'Try new food' studies

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Sahota *et al.* (2001)	UK	**Age** - mean age 8.4 yrs **Sex** - Mixed **SES** – 'slight bias toward the more advantaged' **Ethnicity** - percentage of children from ethnic minorities ranged from 1% to 42%. **Region** - Not stated	Community School Home	*To improve diet and levels of physical activity in children whilst not jeopardising their growth and psychological well-being *To influence knowledge and attitudes towards healthy eating and physical activity *To incorporate healthy eating and physical activity in primary schools by adopting the Health Promoting School concept *To influence positive changes in the school environment where knowledge and informed choices can be put into practice *To involve and include parents in the intervention	*Teachers* An experienced paediatric community dietician (an author of the reports) was available to support the schools. Other professionals and agencies e.g. school nurses, dental team, local supermarkets and catering colleges	*__APPLES programme__ - development and implementation of **School Action Plans** focusing on **diet** and **physical activity** * Designed to take place over one academic year * **Class activities** integrating nutrition into the curriculum with whole school and community involvement * **Practical**, 'hands-on' work with food, to increase children's confidence and skills with food * work on self-esteem and body image * approach to **PE** which stressed the health benefits of exercise and to include activities which increase physical activity * Development of a **whole school policy** statement, 'mission statement' or set of aims for the promotion of healthy eating *__Providing food__ in school that enable children, staff and visitors to eat healthily, that reinforces good nutrition and that ensures that children are not hungry. * Improvement of the **physical environment** in which food is provided and in which staff and children eat, including meal arrangements; improvements in playground facilities.

***** 'Try new food' studies

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Shannon *et al.* (1982)*	USA	**Age** 5-12 years **Sex -** Mixed **SES** – Not stated **Ethnicity-** Not stated **Region –** Urban and rural	School	*To bring about the adoption of food habits consistent with optimal health *To improve nutrient intake and food patterns of children through nutrition education in schools	Teacher School catering staff	* Experimental and pupil-cantered Nutrition education '**Nutrition in a Changing World**' * Nine-week period. *Preschool - grade 3, emphasis on enhancing children's appreciation of a variety of foods and on teaching food sources and the association of food with health. *Grades 4 - 6, food as a source of nutrients emphasised, along with the nutrients' functions and more in-depth treatment of nutrients in relation to health. ***Materials** - Posters exhibited around the lunchroom e.g. grimacing garbage can imploring children to put nutrients in themselves, not the can. Other posters pictured comic book characters conveying a nutrition message. 'Iron Man' and 'Spider Man' were particularly popular. ***Activities** - activity sheets included games dealing with various aspects of nutrition and required only a crayon or pencil. *Incentives - competition in which children received a score if they ate each vegetable in the day's lunch. The highest scores at the end of the week were rewarded with stickers.

***** 'Try new food' studies

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Smolak *et al.* (1998)	USA	**Age** – 10-11 years **Sex** - mixed sex **SES** - Not stated **Ethnicity** – 'White' population **Region** - rural area	School	*To explain the importance of proper nutrition *To explain how to use the USDA Food Guide Pyramid to achieve healthy nutrition. *To encourage healthy, moderate exercise on a regular basis. *To teach students and parents about the diversity of body shape and to encourage the development of a positive body image. *To encourage healthy eating rather than calorie-restrictive dieting. *To encourage critical evaluation of media messages about body shape and nutrition.	*Teacher*	*'**Eating Smart, Eating for me'** *Ten lessons including 'Growth, Change, and Nutrition', 'Myths about fat', 'Eating and Exercising for you and your health', 'Positive body image' * Focused on **healthy eating** and **exercise** ***Homework** and **classroom** activities designed to capture the interest of younger children *Issues relevant to fifth graders (e.g., after school snacks, pubertal changes) were included.

APPENDIX E: Outcome evaluations included in the effectiveness synthesis (cont'd)

Item	Country	Population	Setting	Aim(s) of the intervention	Person(s) providing the intervention	Content of the intervention package
Wardle *et al.* (in press-a)*	UK	**Age** – 5-7 years **Sex** – Mixed 23 boys 26 girls **SES** – Not stated **Ethnicity** – Not stated **Region** - Urban	School	*To increase children's acceptance of an unfamiliar vegetable.	Researcher	*Comparison of **exposure** alone with exposure and **reward** and no intervention control on increase consumption of an unfamiliar vegetable. * Children presented with fresh, sweet red pepper cut into small pieces, and invited to eat as much as they liked, having previously watched the experimenter eating a piece. Children asked to rate their liking for the taste of the pepper. Consumption was measured by counting the number of pieces eaten. **Eight daily sessions over a two-week period at the same time every day* *The **reward** group were shown a sheet of cartoon stickers and told that they could choose one of them on condition that they ate at least one piece of the pepper. *Participants in the control condition were not seen between the pre- and post-treatment tests and received no further intervention.
Wardle *et al.* (in press-b)	UK	**Age** - mean age 53.2 months **Sex** - Mixed **SES** - indicators of low levels of deprivation **Ethnicity** - 74% 'white', Caucasian **Region** - Not stated	Home	*To increase children's liking for a previously dislike vegetable though parents exposing their children to a target vegetable over 14 days * To compare this intervention with the efficacy of providing parents with information about 5 A Day on increase in vegetable intake	*Parent - exposure group* Researcher - information group	***Comparison of **two treatment groups exposure** to unliked **vegetables** by **parents** vs. **information** on nutrition to parents **and a control group** **Exposure group parents asked to offer their child a taste of target vegetable every day for 14 consecutive days, verbal encouragement permitted but importance of not offering a reward was stressed* ***Materials** - colourful 'vegetable diary' for parents to record experiences; c**hildren to record their liking for the vegetable using 'face' stickers signifying 'like', 'okay' and 'dislike'.** ***Information group -** informed about the '5 A Day' recommendations, **invited to ask questions about healthy eating and told that they would be given further advice at the second visit, g**iven leaflet with advice and suggestions for increasing children's fruit and vegetable consumption,

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Anderson *et al.* (2000)	CT (cluster)	2 intervention and 2 control schools in Dundee, Scotland matched on socio-economic status, religious status, school role and staff	Taste preferences Monitoring of food consumed Amount and type of food sold at tuck shops Intentions Knowledge	138 children completed the psychology assessments 128 children completed 3-day food diaries	4 month and nine- month follow-ups were conducted	Means, SDs Unit: individual	Effect sizes calculated from means and SDs.
Auld *et al.* (1998b)	CT (cluster)	Three intervention schools (20 classes, 456 children) matched with three comparison schools (17 classes, 395 children)	Attitudes Behaviour (observed) Knowledge	Students with complete data: intervention: 226, comparison: 218 Intervention: 50% Control: 45%	Immediately after intervention	Least mean squares and SEM Unit: individual	Calculated from data in the paper assuming ICC = 0.02 and multiple correlation coefficient = 0.5

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Auld *et al*. (1999)	CT (cluster)	Two matched (on ethnic distribution) treatment and two comparison schools provided 38 classes and approximately 760 students. Results reported on 316 intervention and 331 (or 192) control children.	Attitudes Behaviour (observed) Knowledge	Varies according to measure: treatment: 316, control: 331 (except for plate waste: 192)	Immediately after intervention	Least mean squares and SEM Unit: individual	Calculated from data in the paper. ICC assumed to be 0.02.
Baranowski *et al*. (2000)	RCT (cluster)	16 volunteer schools were matched within school district: size, percentage of students participating in free or reduced-price, and percentage annual student turnover. Final cohort sample: 1172	Attitudes (fruit & vegetables and snack preferences) Behaviour (reported) Knowledge Self-efficacy/self-esteem/self-confidence	Not stated beyond saying that no statistically significant differences were detected in those remaining in the cohort versus those not, except for asking behaviours, wherein the dropouts reported slightly higher asking behaviours than non-dropouts.	12 months: post test 1 2 years: post test 2	Least squares mean and SE and p values Unit: school	Calculated from the p values in the text and means and SE presented in the tables. ICC assumed to be 0.02.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Cullen (1997)	RCT (cluster)	22 Girl Scout troops with approximately 300 girls were randomised by grade level into intervention or control condition. (126 intervention, 133 control)	Fruit and vegetable preferences fruit & vegetable intake Knowledge Barriers to fruit & vegetable intake Self-efficacy/self-esteem/self-confidence	Intervention: 126 Control: 133	Immediately after intervention and three-month follow up	Means and SD Unit: troop	Assuming average cluster size of 14 (text states about 300 children in 22 troops) and ICC of 0.02
Epstein *et al*. (2001)	RCT (individual)	30 families with at lest one obese parent and a six- to 11- year old non-obese child were recruited 15 families were assigned to each of the two groups 1) increase fruit and vegetable intake 2) decrease high-fat/high-sugar intake	Daily servings (intake) of fruit and vegetables Daily servings (intake) of high-fat/high-sugar foods % to which individual (both parent and child) is overweight (compared to average BMI for their age and sex)	Complete data were available for 27 of the 30 families allocated. One further adult was found to have extreme levels of dietary intake and weight loss and so was removed from analyses.	6 months	Means and SD Unit: individual	Calculated from the means and SDs.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Gortmaker *et al.* (1999)	CT (cluster)	Intervention was implemented in six elementary schools (319 children). Eight matched control schools (469 children) were selected prior to intervention	Dietary intake and physical activity; food frequency and activity. Dietary knowledge Activity knowledge	Attrition from allocation to follow-up: (355-190)/355 = 46.5% control: (516-289)/516 = 44.0% Attrition from baseline to follow-up: (319-190)/319 = 40.4% control: (469-289)/469 = 38%)	Unclear: between immediately and three to six months	Adjusted differences in means + 95% CI Unit: school	Calculated from means and CIs in the text. Design effect was accounted for in the original analysis.
Henry *et al.* (2001)	RCT (individual)	218 children from years 1 and 2 (aged five-7 years) were randomly assigned to one of four intervention groups.	Diet and physical activity Nutrition knowledge Children's growth (anthropometry): height, weight, arm span, skinfolds, circumferences	Be smart (control) n=51 Eat smart (nutrition) n=56 Play smart (physical activity) n=54 Eat/Play smart (combined) n =54 The dropout rate during the study was 17% (n=37), which made the final number of subjects in the study 181.	Immediately after intervention	Means and some standard deviations Unit: individual	Calculated from means and SDs supplied by the authors.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Hopper *et al*. (1996)	CT (cluster)	Two second grade and two fourth grade classes from the same school were assigned randomly to intervention or control conditions.	Food intake Knowledge of aerobic physical fitness, exercises, nutrition concepts Physiological measures (height, weight, skinfolds, mile run)	48 children were assigned to the school-home intervention condition and 49 children served as controls. Parents were invited to join by virtue of their children being assigned to the treatment group.	Immediately after intervention	i) Means of pre- post and change scores with p-value bands for significant results. ii) f ratios and degrees of freedom for some outcomes. Unit: individual	Calculated from data supplied by the authors assuming ICC = 0.02.
Liquori *et al.*; (1998)	CT (cluster)	39 classes from two schools were assigned to four groups.	Attitudes Behaviour (observed) Intentions Knowledge Food preferences Self-efficacy/self-esteem/self-confidence	Participation rates and number of children in the classes is not stated.	Immediately after intervention	Means and SDs. Unit: class	Effect sizes calculated from the means and SDs presented. Since the SDs represented SD between clusters rather than population, this was adjusted for and ICC assumed to be 0.02.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Moore (2001)	RCT (cluster)	43 schools were allocated randomly to intervention (23) or control (20) condition.	Attitudes Behaviour (reported): children's consumption of fruit and other snacks	In the 23 schools in experimental condition, 1037 pupils completed follow up questionnaires. In the 20 schools in control condition 887 pupils completed follow up questionnaires.	Immediately after intervention	Means and 95% CI Unit: school	Effect sizes calculated from the data presented after converting the CIs between clusters into a sample SD. An ICC of 0.02 was stated.
Parcel *et al.* (1999)	CT (cluster)	Two schools in the Texas City Independent School District were assigned to experimental condition and two others to control conditions. Third and fourth graders in the intervention schools received all intervention components.	Diet self-report physical activity self-report Diet behavioural expectations – Diet behavioural capability test Exercise behavioural capability test Self-efficacy/self-esteem/self-confidence	The number of children in each school is unclear. The only detail given is: 'In each of the four schools there were four to seven classes with 18-25 students in each class.' p.186	Self-reported behaviour 12 months: post-test 1 2 years Post-test 2 Cognitive measures 6 months: post test 1 18 months: post test 2	Means and SD Unit: individual	Effect sizes calculated from the data presented adjusting for unit of analysis assuming ICC of 0.02.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Perry *et al.* (1998a)	RCT (cluster)	20 schools were matched on the basis of size, ethnicity student population, and percentage of free or reduced-price meals and randomly assigned to the intervention or delayed intervention condition.	Student lunchroom observations 24-hour food recalls	657 students were selected at random for dietary measurement. Six hundred and fifty-two (99.2%) of these were observed during lunchtime. Five hundred and eighty students returned their food records the next day. Five hundred and thirty-six of these (81.6%) completed 24-hour food recalls. Four hundred and forty-one (82.3%) completed recalls at follow up - 12.5% were no longer attending the participating schools, 3.7% were missing as a result of absence and 1.5% refused.	12 months	Adjusted means and post-test differences, 95% CI and p values. Unit: school	Calculated from the 24-hour recall outcome scores from the data presented (exact p values). (The ICC was stated for each outcome class)

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Perry *et al.* (1998b)	RCT (cluster)	CATCH was a multi-site field trial in 96 schools at four sites in the U.S. The interventions were delivered to a cohort of children in 56 randomly selected schools when they were in the third through fifth grades, from 1991 to 1994.	Behaviour (reported) (dietary intake)	A sub-sample of the 5106 students participated in single 24-hour food recalls at baseline when they were in third grade and follow-up in 1994 when they were in fifth grade. All students who participated in the recall at baseline were recruited for a follow-up recall in fifth grade. The final sample size for this study was 1186 and includes paired baseline and follow-up recalls.	Immediately after intervention	Means and SE Unit: school	Calculated from the data presented. Since the text states that design effect had been accounted for, no further adjustment was made beyond calculating population SDs from the between cluster SEs given.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Resnicow *et al.* (1998)	RCT (cluster)	32 schools were matched on number of students, percentage of free lunches, and student turnover rate - and then randomly assigned to the experimental (n=16) or comparison group (n=16) group.	fruit & vegetable preferences Negative outcome expectations Dietary intake Children: fruit & vegetable knowledge Teachers: motivation to change student behaviour; job satisfaction; perceived organisational climate Physiologic Measures Self-efficacy/self-esteem/self-confidence of teachers and children	Baseline data were obtained from 1780 of the 2708 (66%) third graders. Of these students, follow-up data were obtained for 966 (54%). Between baseline and the end of year 1 (fourth grade), 29% of the original cohort of 1780 left their respective schools. Another 16% of the cohort migrated out between fourth and fifth grade. Thus, the 966 students retained from the original 1780 represented 95% of those students who were in the school all three years. p.254 2 control schools dropped out of the study and their results are not included in the analysis.	Immediately after intervention	Group X Time F ratios and p values Unit: school and individual	Calculated from F scores using t = Sqrt(F) adjusting for unit of analysis. This study was excluded from the meta-analysis later since the intervention targeted teachers rather than students.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Reynolds *et al.* (2000)	RCT (cluster)	28 elementary schools were paired and randomly assigned to an intervention group or a usual-care control group.	Cafeteria observation 24-hour diet recall interviews (children) Paper and pencil questionnaire - diet (parents) Knowledge children & parents Children & parents: stages of change; outcome expectancies Children only: social norms Self-efficacy/self-esteem/self-confidence: asking skills; perceived self-efficacy	Completion rates (follow-up 1 / follow-up 2): students: 89% / 84-89% parents: 87% / 74 %	1 year (follow-up 1) 2 years (follow-up 2)	Mean, 95% CI and p values Unit: school	Calculated from means and CIs after converting CIs for clusters into SDs for population. ICC of 0.02 was assumed.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Sahota *et al.* (2001)	RCT (cluster)	Schools were paired according to size, ethnicity and level of social disadvantage as reflected by the free school meal index... Randomisation was then carried out using the toss of a coin. Two schools expressed preferences to be assigned to either the Intervention or Comparison group due to pressure of preparing for their OFSTED inspection. As time did not permit recruitment of further schools, their preferences were taken into consideration and they were assigned to the Intervention or Comparison group as requested. It was not felt that this would bias the results of the trial. p.13	24-hour recall of diet; three day food diary; 24 hr recall of physical activity Anthropometrical data: BMI, weight, height, mid upper arm circumference, triceps skinfold measurement, waist circumference Psychological measures including self-esteem dietary restraint body shape perception scale	All 10 schools that participated also completed the project. Only 21 children did not consent to participate in the study. The total of 634 children were studied at baseline. At the end of the first year 42 children had left the study and 40 new children had joined. Five hundred and ninety-four (94%) children were measured at baseline and at the end of the intervention period. p.23	Immediately after intervention and one year follow up	Weighted mean differences and 95% CI Unit: school	ICC = 0 was inferred from the text. Calculated from mean differences and CIs.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Smolak *et al.* (1998)	CT (cluster)	The curriculum lessons were presented to eight fifth grade classrooms. Three classrooms served as controls. All classrooms were drawn from six of the seven elementary (K-5) schools in a rural school district.	Attitudes towards fat people What children ate for breakfast and lunch the preceding day, as well as which fruits and vegetables they had consumed the previous day. Exercise participation during the preceding two days. Incidence of teasing regarding weight and shape. Food guide pyramid/nutrition; understanding about why some people are fat; frequency and type of weight loss attempts Self-efficacy/self-esteem/self-confidence: body esteem	253 children participated in the pre-test and 88% were available at the time of post-testing.	1-4 months after the intervention	Means and SDs of some outcomes.	The number of children in each class or group is not stated. The effects sizes were calculated based on the class rather than individual as the unit of analysis. The size of effect will be the same, though confidence intervals are likely to be wider.

APPENDIX F: Details of outcome evaluations included in the statistical meta-analysis: study methodology and methods employed to calculate effect sizes (cont'd)

Author	Design (unit of assignment)	Groups compared	Outcomes measured	Participation/ attrition issues	Follow-up interval	Data presented and unit of analysis	Comments on effect size calculation
Wardle *et al.* (in press-b)	RCT (individual)	After the pre-intervention taste test of children's preferences for six test vegetables, participants were randomly assigned to one of the three experimental treatment conditions exposure (n=50), information (n=48) or control (n=45).	Attitudes Behaviour (observed)	9 children did not complete baseline measures and were not included in the study. Three children) were withdrawn from the study by their parents after pre-intervention. Fourteen participants in the exposure group failed to complete a minimum of 10 out of 14 tasting sessions	Immediately after intervention	Means, SDs, SEs. Unit: individual	Effect sizes were calculated from data supplied by the authors.

APPENDIX G: Results of the statistical meta-analysis

This appendix presents the results of the meta-analysis in detail. It is structured around the various outcomes used in the studies to measure intervention impact. Each heading covers a different outcome: knowledge, preferences, self-efficacy, fruit intake, vegetable intake, and fruit and vegetable intake. The structure within each sub-section is the same. First of all, the relevant studies are examined to see if the studies are similar enough to be combined by checking for any outliers. The graphics used to show the distribution of effect sizes are box and whisker plots. The box shows the interquartile range which contains 50% of the values with a line across representing the median value. The 'whiskers' are lines which extend from the box to the highest and lowest effect sizes excluding outliers. The same scale is employed for all outcomes to allow easy comparisons to be made. The second section examines results of pooling the studies, to establish whether an overall effect is present and whether heterogeneity needs to be explored. Where appropriate, this section also contains details of sub-group analyses which attempt to identify aspects of the interventions or settings which affect the size of effect that was measured. A description of the various outcomes that were measured is presented next in order to supply some context for the findings. Finally, a sensitivity analysis is conducted in order to check whether a) the findings of the studies of medium methodological quality appear out of line compared with higher quality studies; or b) the overall findings are trustworthy, i.e. whether an overall finding relies heavily on the results of just one or two studies. In cases in which statistical heterogeneity could not be explained, the results are presented using a random effects model (see Lipsey and Wilson, 2001; Egger *et al*., 2001).

Except where otherwise stated, all figures in the text and graphs are standardised mean differences with 95% confidence intervals. Since the size of a 'portion' of fruit and vegetables varied between studies, it was necessary to standardise their results in order for comparisons to be made. The formulae used in all of the calculations can be found in appendix C.

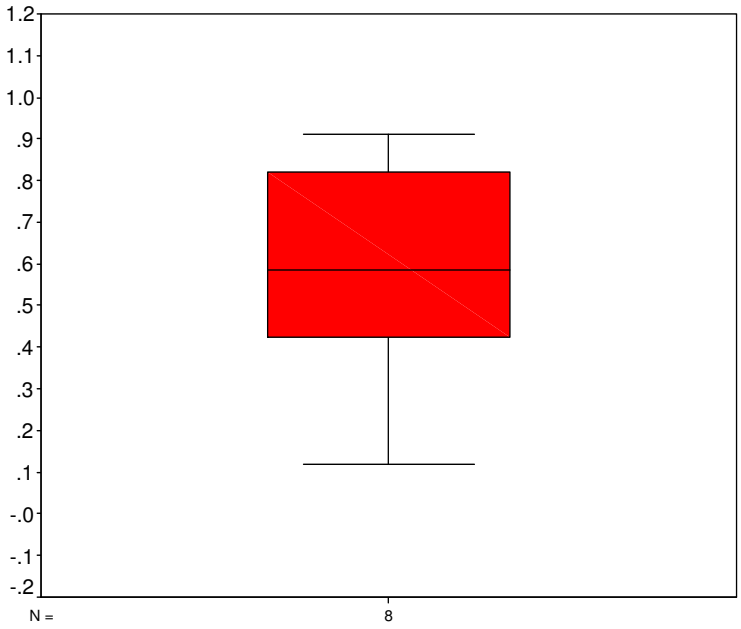
It was decided to remove one study, Resnicow *et al*. (1998) from the meta-analysis. This study evaluated the impact of the 'TeachWell' programme, involving 54 workshops for teachers, on teacher and pupil outcomes. The children were all receiving the 'Gimme-5' programme (described in Baranowski *et al.,* 2000) so this study was examining whether the implementation of the children's intervention was affected by the teacher wellness programme. Unlike the other studies, the children did not receive any part of the intervention under investigation and its impact is one step removed from them. The study appears to be qualitatively different to the other studies and it was therefore not included in the statistical meta-analysis.

G.1 Did the interventions increase children's knowledge of fruit and vegetables?

Eight studies reported the impact of their intervention on the knowledge of children. They all showed a positive effect, though one did not achieve statistical significance.

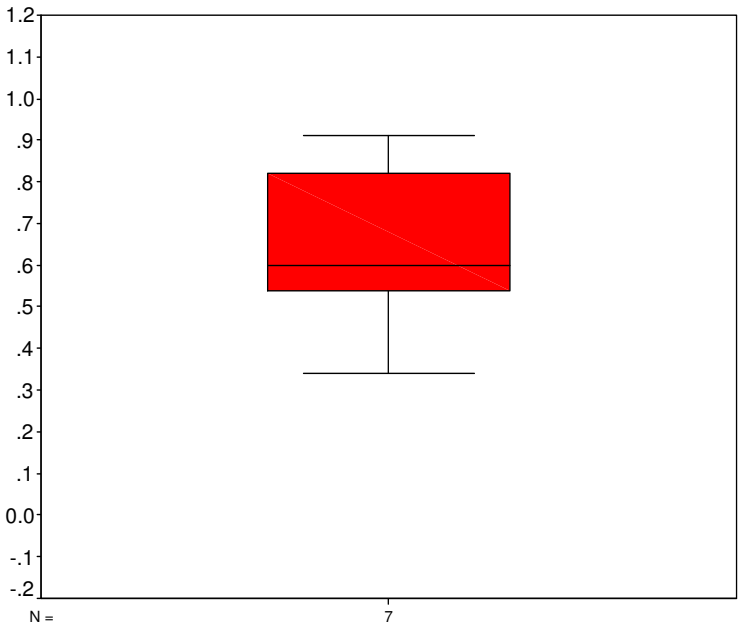
G.1.1 Are the studies similar enough to be combined?

Figure G.1: Distribution of effect sizes for all studies with knowledge outcomes (n=8)



As figure G.1 shows, there are no extreme outliers, though the distribution does have a longer tail towards the lower effect sizes. This is due to one study: Baranowski *et al.* (2000) that had a particularly small effect on knowledge (effect size = 0.12) when compared to the other studies. There is clearly something different about the impact of the Baranowski *et al.* intervention on knowledge, since the heterogeneity statistic, Q, shows significant heterogeneity (Q=66.8, df=7, p<0.01) with Baranowski *et al.* included in the pool of studies, but no statistically significant heterogeneity when this study is excluded (Q=9.63, df=6, p=0.141). The closest effect size to Baranowski *et al.* is Henry *et al.* (2001), which at 0.34 is nearly three times as great. Figure G2 shows a much more compact distribution when the Baranowski study is excluded.

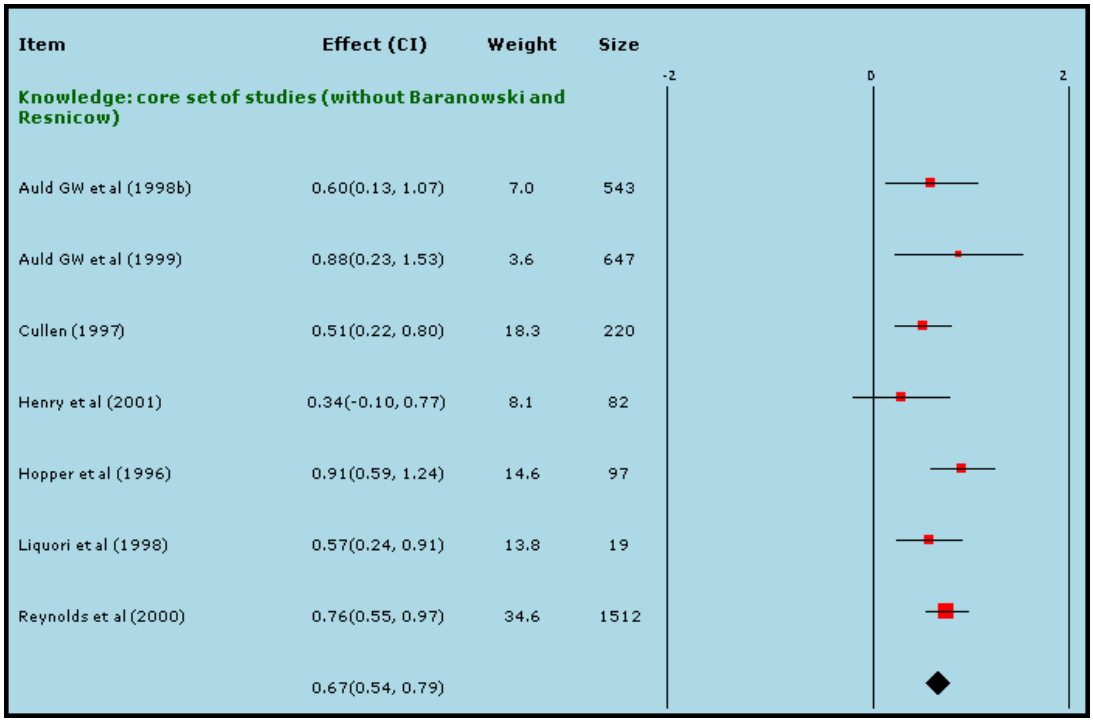
Figure G.2 distribution of effects sizes for knowledge outcomes without Baranowski (n=6)



G.1.2 What are the results?

When the effect sizes of the six studies (without Baranowski *et al.,* 2000) are pooled, they suggest that educational interventions aimed at increasing children's knowledge of fruit and vegetables have a strong effect: the effect size 0.67 (0.54, 0.79) is significant with $p < 0.001$. When compared with Lipsey and Wilson's (1993) distribution of effect sizes from 302 psychological, educational and behavioural studies, 0.67 is above average, but some distance from the top quartile of effect sizes.

Figure G.3: Effect of interventions on children's knowledge (n=6)



As figure G.3 shows, the lowest effect was 0.34 (Henry *et al.,* 2001) with the highest (Auld *et al*., 1999) at 0.88. To give a practical example of the meaning of these figures, an effect size of between 0.5 – 0.7 would represent an improvement of one GCSE grade in English compulsory subjects (Coe, 2000).

The inclusion of the Baranowski *et al.* (2000) study brings the overall effect down to 0.49. However, given the significant heterogeneity this would introduce, it is not appropriate to draw conclusions from pooling all the studies in this way. This study appears to have placed much more emphasis on the outcomes related to fruit and vegetable intake, with even the educational aspects of the intervention containing specific behavioural, rather than knowledge-based, outcomes (p. 98). This may go some way to explaining the small impact on knowledge and the longevity of its behavioural impact (see chapter five, section 5.2.3).

G.1.3 What was measured?

Auld *et al.* (1999) measured children's knowledge of fruit and vegetables and specifically the food guide pyramid. Children in the intervention group were more likely to recognise foods which could be added to existing meals in order to increase fruit and vegetable intake. Reynolds *et al.* (2000) appears to have measured the same kinds of knowledge with specific mention of '5 A Day' and the food guide pyramid. The intervention described in Hopper *et al.* (1996) also contained a physical activity component, so the score from this study is not solely about nutrition. Henry *et al.* (2001) included a physical activity component for some groups, but in this case it is possible to separate the nutrition knowledge outcomes from knowledge about other subjects. Some studies compared different intensities or types of intervention

with one another by allocating children to more than two groups. It is not possible simply to add each finding to the meta-analysis as a separate outcome though –the children in the control group would then be represented in the synthesis more than once. Whilst it is possible to average outcome values across groups in order to gain a single score for each study, we have usually selected the outcome of most relevance to this review. In this instance, the knowledge score in Liquori *et al.* (1998) for the group which received the practical lessons and the group which received food and environment lessons were similar. This lends some support to the authors' claims regarding utility of practical lessons in gaining knowledge.

G.1.4 How trustworthy are the findings?

A sensitivity analysis separating the studies in a number of ways demonstrates that the results are robust and are not over-reliant on a small sub group or affected by issues relating to study quality.

Separating the studies depending on whether or not groups were allocated randomly reveals no significant differential effect size (RCTs: 0.68, CTs: 0.63) with negligible heterogeneity (Q=0.146, df=1, p=0.702) being explained by this sub-division of studies.

Likewise, separating the studies according to an overall assessment of their quality did not undermine the results. The four studies rated 'high' had an overall effect size of 0.72 and those rated as 'medium' scored 0.67. The heterogeneity explained by this separation was also not significant (Q=1.306, df=1, p=0.254).

Finally, it is possible to remove the four studies with the highest findings without the effect size falling below 0.50 or becoming non-significant at the 95% confidence level.

G.2 Did the interventions affect children's preferences for fruit and vegetables?

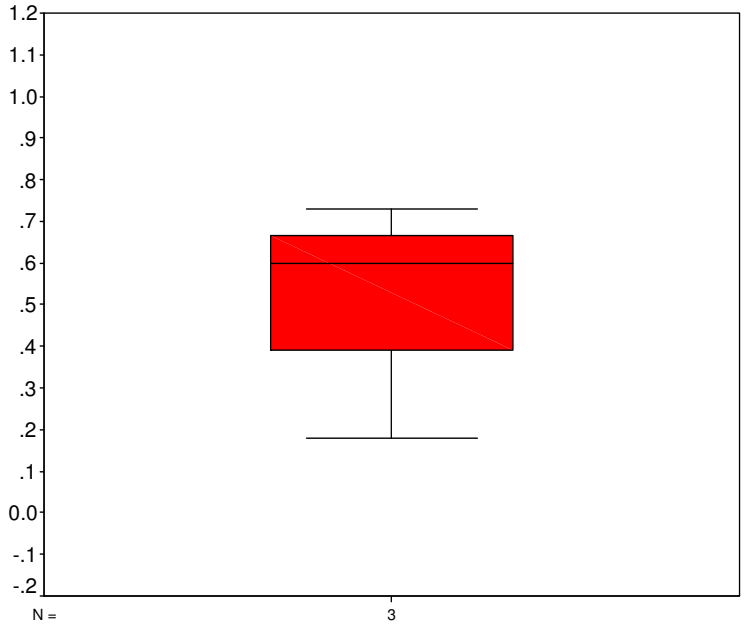
Three studies reported the impact of their respective interventions on children's preferences for fruit and vegetables: Baranowski *et al.* (2000), Liquori *et al.* (1998) and Wardle *et al.* (in press-a).

As figure G.4 shows, the distribution is somewhat skewed, with the lowest effect size being less than half that of the median. However, since there are only three studies remaining for this outcome, it is difficult to draw any conclusions here.

Heterogeneity among the three studies is low (Q=1.13, df=2, p=0.568), so combining the studies is reasonable given these findings.

G.2.1 Are the studies similar enough to be combined?

Figure G.4 Distribution of effect sizes for fruit and vegetable preferences



G.2.2 What are the results?

Taken together, the three studies show that their interventions did have a significant impact on children's preferences towards fruit and vegetables. The overall effect size is 0.65 (0.38, 0.91) and the studies range between 0.18 (low) and 0.60 (medium - high).

Figure G.5: Impact of the studies on children's preferences

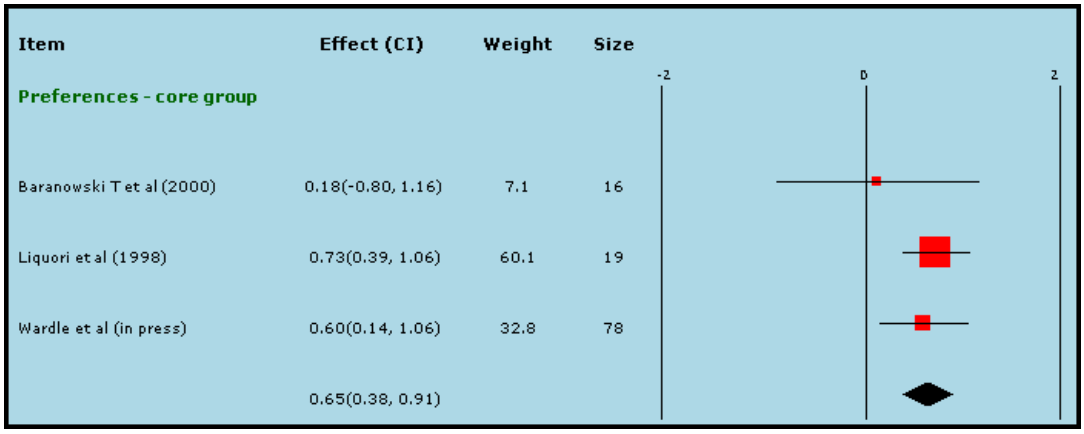


Figure G.5 shows the results of the individual studies for this outcome. The study by Wardle and colleagues has more weight given to its findings than the two other studies due to its relative size.

G.2.3 What was measured?

Baranowski *et al*. (2000) assessed how much the children liked 10 commonly eaten vegetables and 10 fruits or juices. They also assessed snack preferences between higher fat/sugar and fruit, juice or vegetables. The Liquori *et al.* (1998) study aimed to increase children's preferences for minimally processed whole grains and vegetables measuring children's responses on a Likert-type scale. Finally, Wardle *et al*. (in press-b) measured children's liking for the six vegetables being targeted using a '3-point 'faces scale''. None of the studies included a physical activity component, so the results here are all relevant to fruit and vegetables, though only one of the three studies assessed children's preferences for both (Baranowski *et al.,* 2000).

G.2.4 How trustworthy are the findings?

The exclusion of any one study leaves only two studies in the analysis. Whilst it is difficult to draw conclusions from such small numbers, any study can be removed without affecting the overall result.

Wardle *et al*. (in press-a) and Baranowski *et al*. (2000) employed random assignment for their studies whereas Liquori *et al*. (1998) did not. Given the small numbers of studies in this section it is not possible to draw conclusions regarding the effect that study design may or may not have had.

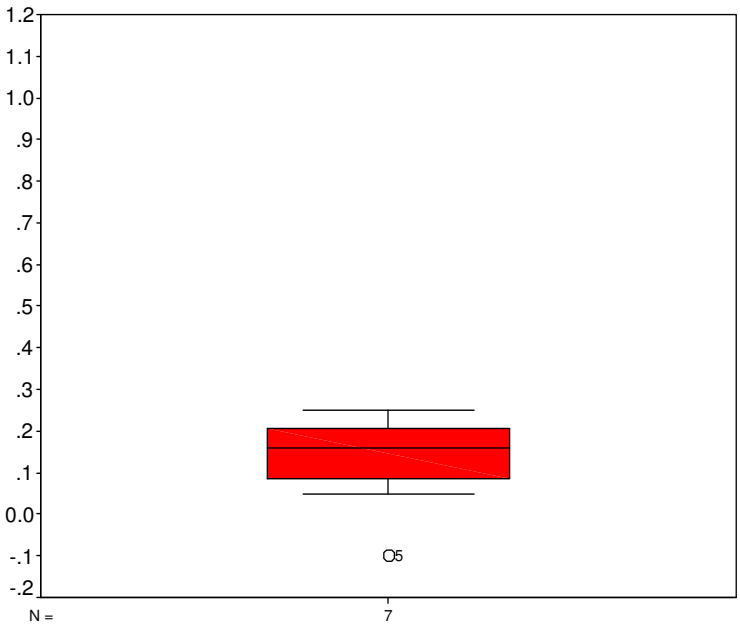
G.3 Did the interventions have any effect on children's self-efficacy in relation to fruit and vegetables?

Seven studies examined the impact of their interventions on children's self efficacy with none of them demonstrating significant impact on their standardised mean differences.

G.3.1 Are the studies similar enough to be combined?

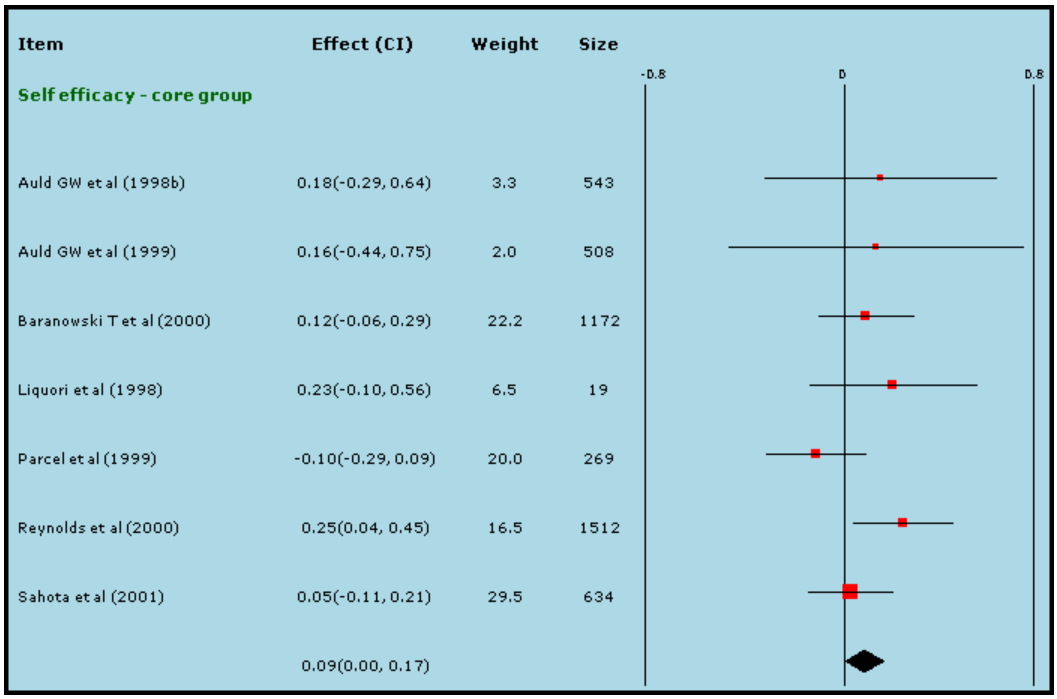
The box and whisker plot (figure G.6) for this outcome reveals one outlier (Parcel *et al.,* 1999). Heterogeneity is fairly low at Q=9.35, df=6, p=0.155 though, and it is therefore appropriate to combine this pool of studies.

Figure G.6: Distribution of effect sizes for self-efficacy



G.3.2 What are the results?

Figure G.7: Impact of the interventions on children's self-efficacy



As figure G.7 shows, the studies show a small and barely significant impact on children's self-efficacy. Only Reynolds *et al.* (2000) is significant statistically on its own, and the pooled effect size of 0.09 is very modest.

G.3.3 What was measured?

As might be expected with a concept as broad as 'self-efficacy', the studies had a range of views and interpretations as to what might constitute improvement in self-efficacy in relation to fruit and vegetables. Auld *et al*. (1998, 1999) measured children's confidence in their own ability to 'prepare foods' or 'eat five or more servings of fruits and vegetables a day'. Liquori *et al.* (1998) also related self-efficacy towards cooking skills and children's confidence about preparing certain dishes with varying amounts of outside help. Self-efficacy in the Parcel *et al.* (1999) study was less to do with food preparation than children's ability to select 'healthful alternatives' in different situations. The Baranowski *et al.* (2000) and Reynolds *et al.* (2000) studies do not contain much information about the way in which they assessed self-efficacy – they were more focused on behavioural outcomes. Reynolds *et al.* (2000) targeted two measures of self-efficacy: children's confidence in their ability to eat five servings of fruit and vegetables a day and their food/drink choices when snacking between meals. Focusing as it did on obesity, the APPLES project (Sahota *et al.*, 2001) covered a range of topics in this area which are probably closer to self-esteem than self-efficacy.

G.3.4 How trustworthy are the findings?

Figure G.7 shows clearly that all the studies are agreed that they a modest or no appreciable effect on their self-efficacy scores. Even the highest effect size (0.25) is a very modest effect. Separating the studies between those that employed random allocation and those that did not shows an increased effect size for the randomised controlled trials (0.12 (0.02, 0.22)) compared with the others (0.09 (0.00, 0.16)). The analogue to the ANOVA does not show that significant heterogeneity was explained by this sub-group analysis (Q=1.292, df=1, p=0.257) though, so no conclusions can be drawn from this difference.

Removing the only study to show a negative effect (Parcel *et al*., 1999) from the meta-analysis increases the effect size slightly (0.13 (0.04, 0.23)) but does not change the overall conclusion. The sensitivity analysis shows that the removal of studies for various reasons (quality, outcome measures) does not change the overall findings, so these results can be considered to be an accurate summary of the studies' findings in relation to self-efficacy.

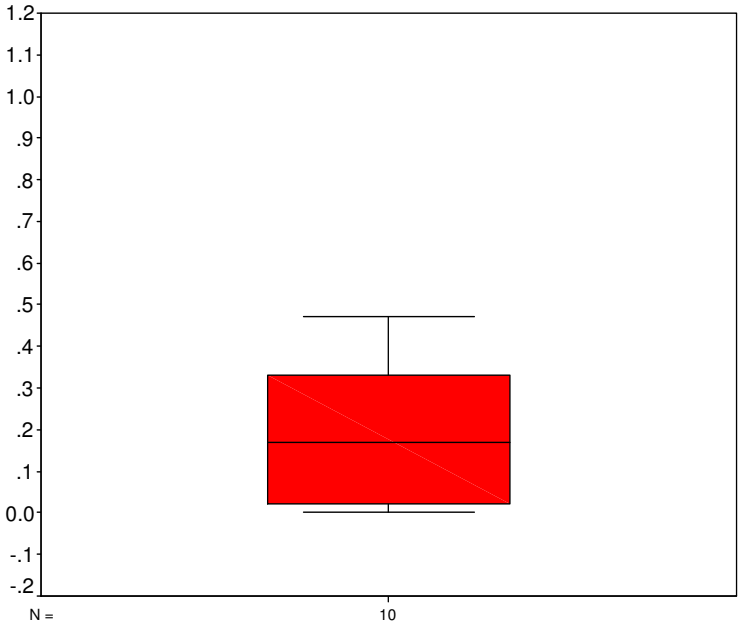
G.4 Did the interventions increase children's consumption of fruit?

Ten studies examined the impact of their intervention on children's fruit consumption. For some of the studies – for example, the fruit tuck shop study described in Moore (2001) fruit consumption was their main finding. Most of the studies which measured fruit consumption though, also examined children's intake of vegetables.

G.4.1 Are the studies similar enough to be combined?

As figure G.8 shows, most of the studies showed a small or no effect on children's consumption of fruit. The median effect size is only 0.17 - only a little above the lowest effect size. The highest score is 0.48 though, which skews the box and whisker plot slightly. Heterogeneity among this pool of studies for this outcome is not statistically significant (Q=13.1, df=9, p=0.157), so this would not seem to be an argument against pooling their results.

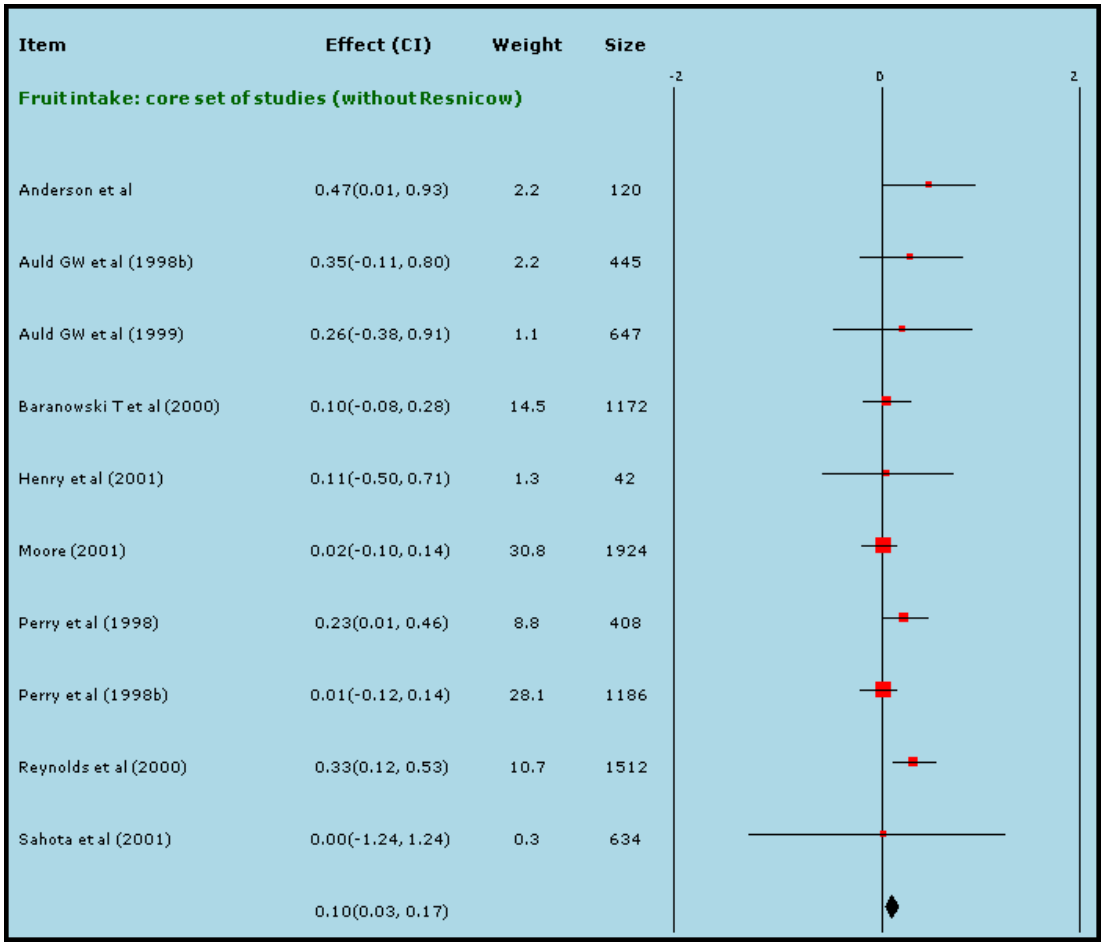
Figure G.8: Distribution of effect on children's consumption of fruit



G.4.2 What are the results?

As figure G.9 shows, the studies show a small and barely significant effect on children's consumption of fruit (effect size 0.10 (0.03, 0.17)). According to the baseline statistics for the APPLES project (Sahota *et al.*, 2000: p. 22), children in the comparison group ate 1.85 portions of fruit each day. An effect size of 0.10 would increase this to a daily intake of 2.02 portions of fruit.

Figure G.9: Effect of interventions on children's consumption of fruit



G.4.3 What was measured?

There is little variation between the studies with regard to how this outcome was measured though they often used differing definitions of what constitutes one 'portion' of fruit and some included fruit juice in this outcome whilst others counted only solid foods. (Variation in the way in which a portion is defined will not affect the pooling of their results since the effects sizes are calculated on a standardised scale.)

Many of the studies relied on written 24-hour recalls of food completed by children to collect these data whilst others observed children's choice of food at lunchtime and measured how much fruit was eaten and how much was wasted. For the purposes of this meta-analysis, the 24-hour recall was selected from studies which employed more than one method as this was the most common means of measuring food intake.

G.4.4 How trustworthy are the findings?

There appears to be something of a methodological divide on this outcome with the seven randomised controlled trials reporting very little effect (0.09 (0.02, 0.16)) and

the three non-randomised trials suggesting that their interventions increased fruit consumption by nearly two-thirds of a serving a day (0.38 (0.09, 0.67)). The heterogeneity explained by this subgroup analysis is significant at the p<0.1 level (Q=3.738, df=1, p=0.0532) leaving less residual heterogeneity within the groups (Q=9.398, df=8, p=0.31). However, the numbers are rather small to come to any definitive conclusions and there may be other reasons for the three non-randomised trials (Anderson *et al.*, 2000; Auld *et al.,* 1998; Auld *et al.,* 1999) coming to different conclusions to the others. Changing the method of analysis from a fixed to a random effects model does not change either the total pooled effect (0.12 (0.04, 0.21)) or the methodological division mentioned above (RCTs: 0.10 (0.01, 0.19); non-RCTs: 0.38 (0.08, 0.68)). Since these two methods are giving such similar results we can conclude that there is little important statistical heterogeneity.

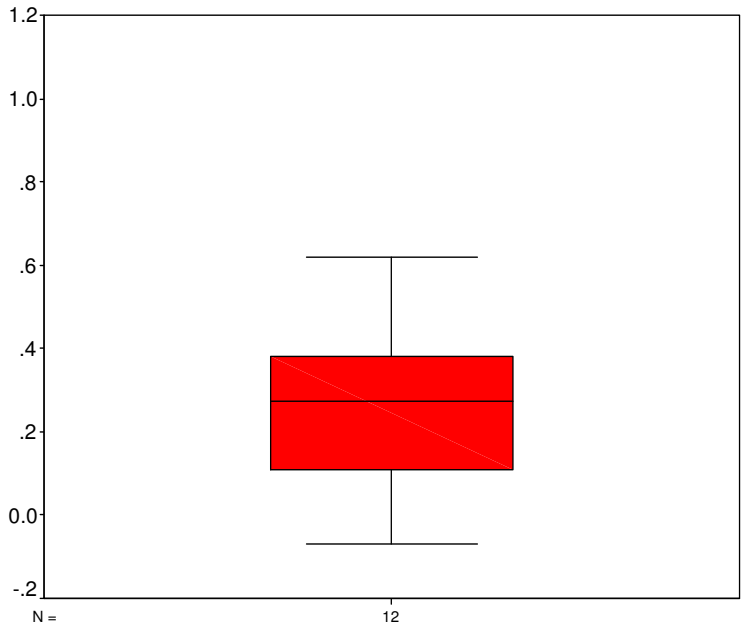
G.5 Did the interventions increase children's consumption of vegetables?

Twelve studies examined the impact of interventions on children's consumption of vegetables. In general, their findings were similar to those examining fruit outcomes.

G.5.1 Are the studies similar enough to be combined?

As figure G.10 shows, the distribution for this set of outcomes is more balanced than for other outcomes with no extreme outliers. However, there is significant statistical heterogeneity (Q=26.9, df=11, p=0.005), so we will be cautious in presenting overall statistics and explore reasons to explain differences between the studies.

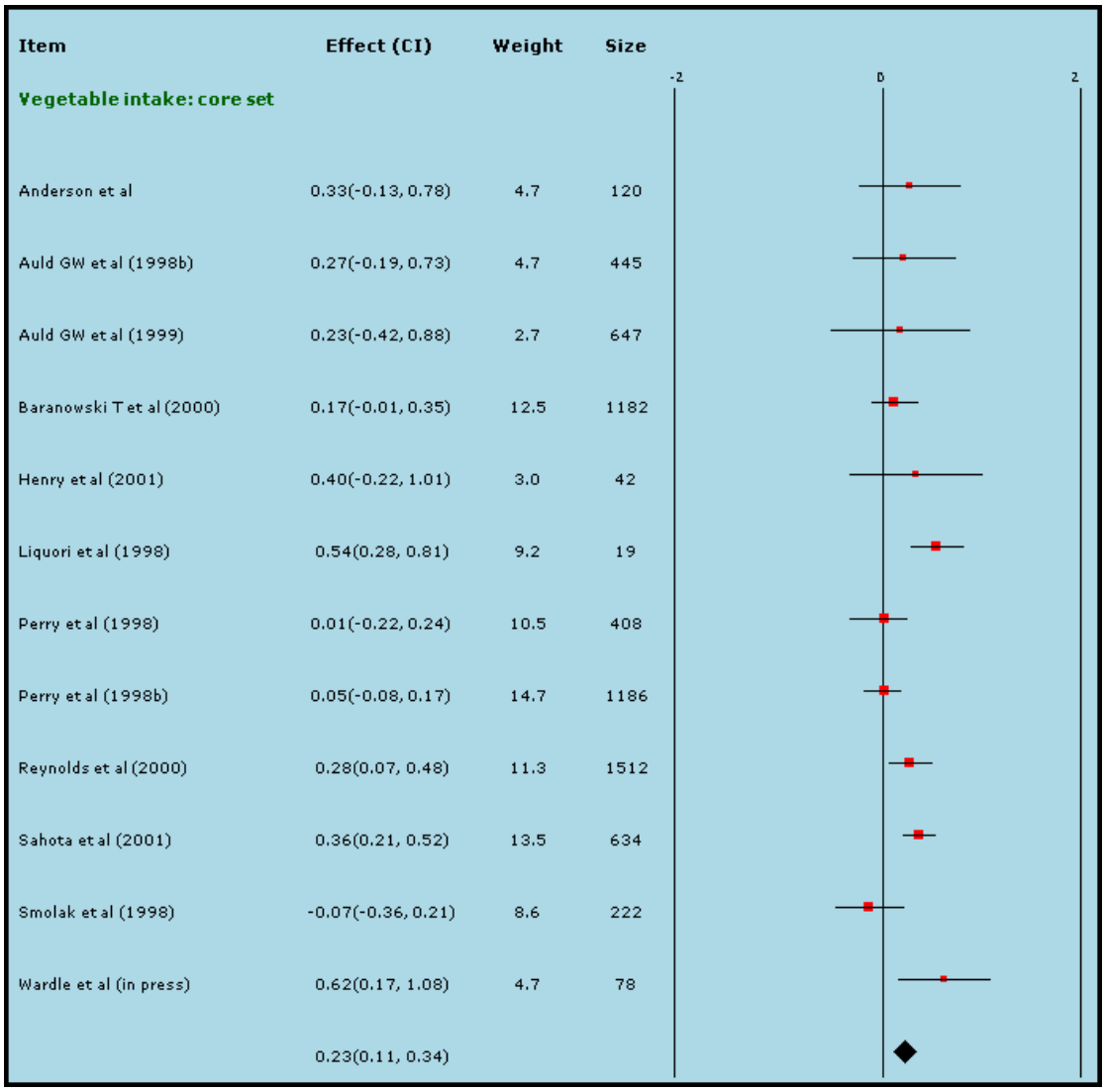
Figure G.10: Distribution of effect sizes for children's consumption of vegetables



G.5.2 What are the results?

The pooled findings suggest a slight increase in vegetable consumption (0.20 (0.13, 0.27)). However, eight of the 12 studies have effect sizes of 0.2 and above (and 5 over 0.4) and it is possible that their findings are being outweighed by some of the larger studies which did not focus on fruit and vegetable intake as their primary outcomes. Changing to a random effects model supports this view with the overall effect size increasing to 0.23 (0.11, 0.34). Sub-dividing the studies between those which contained a physical activity component and those which did not goes some way to explaining the heterogeneity leaving a relatively large homogenous group which did not include physical activity reporting an effect size of 0.25 and a smaller remainder with an effect size of 0.15. Since some residual heterogeneity remains in the group including physical activity in their interventions, we will not draw any conclusions from this sub-division of studies. There is little difference between the results of the fixed and random effects models suggesting that this combination of studies does not contain important statistical heterogeneity. Since Q was significant though, we will present the results of this outcome using a random effects model. Again, using the APPLES study as an example, this effect size is equivalent to an increase of 0.161 portions of vegetables per day.

Figure G.11: Impact on children's consumption of vegetables: random effects model



G.5.3 What was measured?

In the same way as for fruit outcomes, vegetable outcomes were measured using both direct observation and written record – most often the 24 hour food recall. Studies often used national guidelines regarding portion sizes and the types of vegetables which 'count' towards '5 A Day' targets. Again, any differences between studies in the size of portions will have been taken account of in the standardisation of the effect sizes.

A few differences do emerge between studies regarding which types of vegetables were measured under this heading. For example, the aim of the Wardle *et al.* (in press-a) study was to increase children's liking for previously disliked vegetables. They therefore assessed children's consumption of a specific vegetable rather than all vegetable intake *per se*. They also had a very precise method of assessment –

weighing the amount of vegetable on the plate before and after the children had eaten.

Liquori *et al.* (1998) also had a somewhat different agenda to those studies attempting to increase fruit and vegetable consumption in order to reach '5 A Day' targets. The intervention described in Liquori *et al*. (1998) aimed to increase children's consumption of minimally processed whole grains as well as vegetables and does not appear to have targeted fruit intake at all.

It would appear that some of the interventions had different aims and, with regard to the significant heterogeneity, it is worth exploring whether or not this has affected the overall outcome.

G.5.4 How trustworthy are the findings?

Separating the studies depending on whether or not they employed random assignment reveals that the non-randomised trials have a combined effect size of 0.27 (0.10, 0,43) whilst the randomised trials have 0.18 (0.11, 0.26). Employing a technique designed to examine heterogeneity (Analogue to the ANOVA described in Lipsey and Wilson (2001)) however, does not suggest that the heterogeneity is explained by this division (Q=0.801, df=1, p=0.371). In the same way, examining the studies according to the categorisations of quality made by the reviewers does not suggest the high trustworthiness studies are finding different results to those of medium trustworthiness.

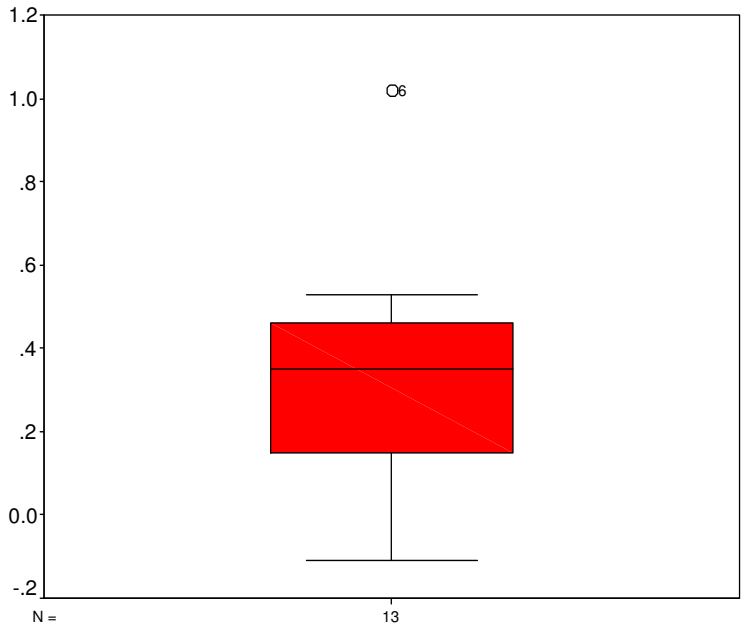
Statistical techniques were unable to account for all the statistical heterogeneity, though it should be noted that most of the studies did report a small to medium effect. Heterogeneity is also explored in narrative form in chapter 5.

G.6 Did the interventions increase children's consumption of fruit and vegetables?

The largest number of studies – thirteen – measured this outcome bringing some studies which have not featured in the fruit or vegetable only syntheses into the analysis. Smolak *et al.* (1998), Wardle *et al.* (in press-b), Liquori *et al.* (1998) and Sahota *et al.* (2001), all of which were in the meta-analysis examining vegetable outcomes did not present results of fruit and vegetable intake combined. Instead, three studies examining both physical activity and fruit and vegetable intake join this analysis, so it is possible to examine the finding reported under vegetable intake through this outcome – that multi-component interventions involving physical activity do not increase fruit and vegetable consumption as much as those which only promote fruit and vegetables.

G.6.1 Are the studies similar enough to be combined?

Figure G.12: Distribution of effect sizes for fruit and vegetable consumption



As can be seen from figure G.12 the distribution of effect sizes reveals one outlier – Epstein *et al.* (2001) – with a reported effect size of 1.02. Heterogeneity is significant (Q=31, df=12, p=0.002) suggesting that caution is required in pooling the findings of these studies on this outcome. Removing Epstein *et al.* (2001) does not solve the problem, since residual heterogeneity without this study is still significant.

G.6.2 What are the results?

Given that the results of the analysis of the distribution reveal significant differences between the studies, it would not be appropriate simply to pool their results and we must look for reasons to explain their differences. The previous section was unable to account for all the observed heterogeneity and whilst this section also examines possibilities, it must be remembered that exploring heterogeneity is an exercise in hypothesis generation rather than coming to firm conclusions. First, issues of quality and reliability must be examined.

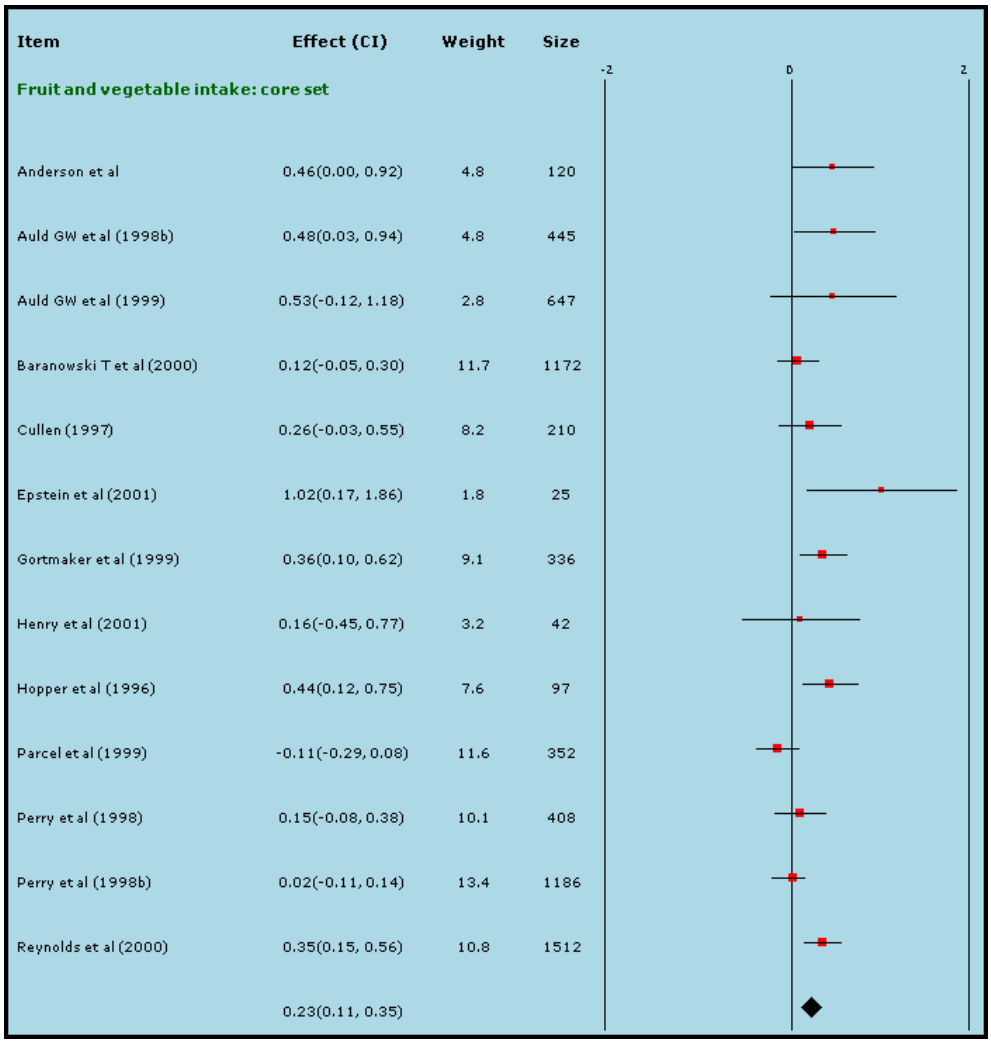
Dividing the pool of results between studies which employed random allocation and those that did not reveals little differences between the two groups of studies. The studies which employed random allocation have a pooled effect size of 0.16 (0.08, 0.24) and those with non-random allocation have 0.14 (0.00, 0.27). No significant heterogeneity is explained by this analysis (Q=0.061, df=1, p=0.805), with significant heterogeneity still remaining. The test for heterogeneity has low power with these small numbers of studies, so it is far more likely to fail to find heterogeneity than it is to find heterogeneity where none exists. (Statistical significance for these tests is often set at $p<0.1$ rather than $p<0.05$ because of this.)

Dividing the studies into sub-groups based on the quality assessment by reviewers also proves to be a poor explanation for heterogeneity.

Using one of the categories we had specified *a priori* however, does suggest that there might be a link between effect size and the type of intervention undertaken. Splitting the studies between those which did and did not have a physical activity component, shows a possible explanation for some of the observed heterogeneity. Studies which contained a physical activity component had a pooled effect size of 0.06 (-0.03, 0.16) whilst those which were concentrated on fruit and vegetable consumption only achieved 0.25(0.15, 0.35). The heterogeneity explained by this division is significant (Q=7.346, df=1, p=0.007) though significant heterogeneity still remains. An alternative method for exploring heterogeneity described in Egger *et al*. (2001) also suggests that this division of studies has statistical significance ($p<0.004$).

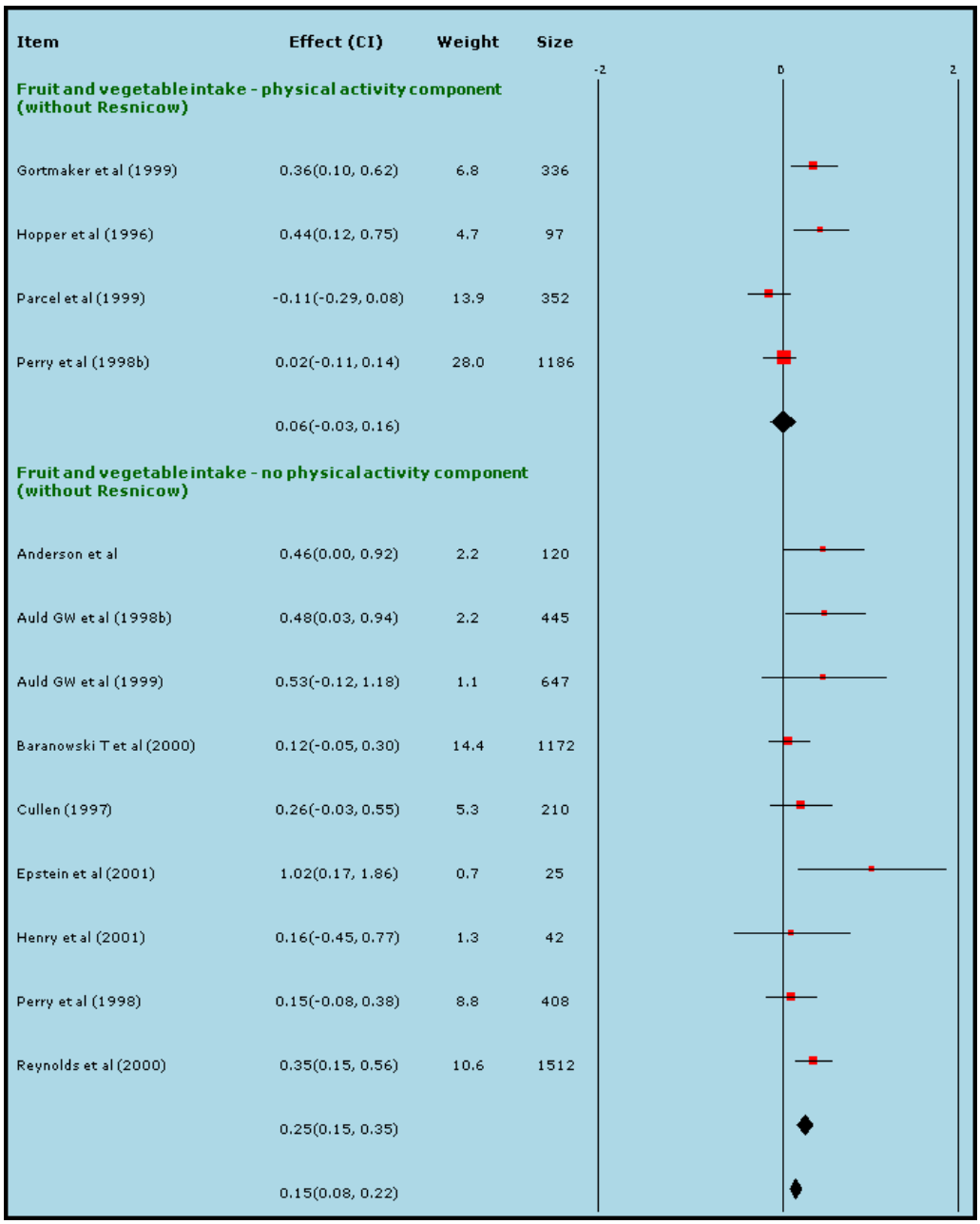
Figures G.13 and G.14 show two forest plots for this outcome: one splitting the studies into the division discussed above and the other employing a random effects model to combine the studies. Since this is simply an exercise in hypothesis generation and there is no clear way of accounting for heterogeneity, the narrative in chapter 5 is likely to be more illuminating than summary statistics.

Figure G.13: Impact on fruit and vegetable consumption: random effects model.



The above figure shows the result of employing a random effects model for combining the studies. Since the studies had different interventions and different results, it is difficult to discover the precise reasons for heterogeneity. The random effects model places less emphasis on the larger studies than the fixed effects model does and is more appropriate for combining heterogeneous groups of studies.

Figure G.14: Impact on fruit and vegetable consumption: dividing the studies between those with, and those without, a physical activity component.



As the above figure shows, the overall result for this pool of studies is an effect size of 0.15. However, this figure is only displayed for interest, since overall, the studies are significantly heterogeneous and it is not appropriate simply to combine them.

The results from the subgroups can be combined more safely as this division has some statistical significance. These findings suggest that interventions which combine a physical activity component with the promotion of healthy eating only increase fruit and vegetable consumption by about 0.2 portions per day (effect size 0.06 (-0.03, 0.16)). Interventions which focus on fruit and vegetables without

promoting physical activity too increase fruit and vegetable consumption by 0.5 of a portion per day (effect size 0.25 (0.15, 0.35)). It must be remembered, however, that these are small numbers of studies and two of the studies in the no physical activity group achieved higher effect sizes than some of those in the other group.

G.6.3 What was measured?

Fruit and vegetable consumption was measured in the same way as has already been documented under the earlier outcomes (using a mixture of reported measures - 24-hour recalls – and observation).

G.6.4 How trustworthy are the findings?

The subgroup analysis which resulted in the above finding was not found as a result of dredging the dataset for significant differences between groups. A limited number of concepts were specified *a priori* for examination and all analyses which were run are reported here. Neither sub-dividing the studies by study design nor quality proved to be a means of explaining heterogeneity.

As reported above, it is difficult to explain the heterogeneity observed for this outcome. Whilst one explanation is suggested here, the narrative in chapter 5 is likely to be more useful and the summary statistics presented here treated with caution.

APPENDIX H: Details of studies of children's views: methodology

Study	Study design summary	Sampling, recruitment and consent	Data collection methods	Reliability and validity of data collection methods	Data analysis methods	Reliability and validity of data analysis methods
Baxter *et al.* (2000)	A cross-sectional survey collecting quantitative data on perceptions of vegetables amongst children from two schools in Glasgow.	*Sampling frame:* Two primary schools hand-selected to represent 'advantaged' (deprivation category = 1) and 'disadvantaged' areas (deprivation category = 7). *Selection:* Classes within each school in one year group were used to select children. *Recruitment:* Not stated *Consent*: Sought from parents, local education authority and schools	Interviews with pairs of children were used to generate a list of each child's 'personal constructs' for eight vegetables (via asking children to compare and contrast photos of vegetables). Children were presented with these constructs and asked to rate each from 'not at all' to 'extremely'. They were also asked to rate their preference for each vegetable.	*Reliability:* Not stated *Validity:* Children were familiarised with the rating tool using fruit as an example. Interviewers used strategy to help children feel comfortable with them; the order of the scale on the preference score sheet was randomised across children	'Generalised Procrustes Analysis (GPA)' to plot children's preferences for different vegetables according to negative and positive dimensions. Differences according to socio-economic status and sex examined using the Mann-Whitney test for significance.	*Reliability*: Use of software packages to conduct statistical tests. *Validity*: Authors state that GPA adjusts for the children using different ranges to score vegetables.
Dixey *et al.* (2001)	A cross-sectional survey collecting qualitative data from children in 10 schools in Leeds on their understanding of diet, health, fatness and thinness	*Sampling frame:* The 10 schools taking part in the intervention arm of the 'APPLES' trial. *Selection:* Not stated how children were selected from the schools, but six focus groups were carried out in each school from two year groups. *Recruitment:* Not stated *Consent*: Not stated	60 mixed and single sex focus groups. The focus group guide covered 14 questions (e.g. are there things to encourage you to eat healthily?; do you think that fat people are always healthy; If someone ate salad every day for a year, would that be a healthy diet?).	*Reliability:* Focus groups tape recorded and transcribed on the same day; followed a standard protocol; same two facilitators ran each group; a senior researcher monitored the focus groups. *Validity:* Questions piloted; facilitators tried to encourage children to express themselves freely.	Not stated	*Reliability:* Not stated *Validity:* Not stated

APPENDIX H: Details of studies of children's views: methodology (cont'd)

Study	Study design summary	Sampling, recruitment and consent	Data collection methods	Reliability and validity of data collection methods	Data analysis methods	Reliability and validity of data analysis methods
Edwards and Hartwell (2002):	A cross-sectional survey collecting quantitative and qualitative data from children in one school in the South of England on their perceptions of fruit and vegetables and healthy eating.	*Sampling frame:* One school located on the South Coast of the UK (in the area where the researchers are based). *Selection:* Classes to represent three different year groups within the school were used to select children, but no details are given on how the selection was done. *Recruitment:* Not stated *Consent*: It is only stated that the head teacher and school staff gave their support	A combination of group discussions (to assess perceptions of healthy eating) and a self-completion questionnaire were used (for acceptability of fruit and vegetables).	*Reliability:* Not stated *Validity:* Authors report that the children were 'talked through' the questionnaire in advance. Questionnaire was designed in collaboration with a teacher and piloted with a group of children of a similar age and a small number of amendments were made.	Statistical tests (e.g. One-way ANOVA, Tukey's) used to test differences by age and sex. Qualitative data sorted by ages 'to gain a broad understanding' (p368) of children's views.	*Reliability:* Use of software packages to conduct statistical tests. *Validity:* Not stated

APPENDIX H: Details of studies of children's views: methodology (cont'd)

Study	Study design summary	Sampling, recruitment and consent	Data collection methods	Reliability and validity of data collection methods	Data analysis methods	Reliability and validity of data analysis methods
Gibson *et al.* (1998)	A cross sectional survey collecting quantitative data from mothers and children from south-east London on their beliefs about fruit, vegetables and confectionery.	*Sampling frame:* The registers of five local primary care practices identified to reflect the range of neighbourhoods typical for southeast London. *Selection:* All families with children in the nine to 11 year old age range were selected. *Recruitment:* Via letter and follow-up phone call. *Consent*: Sought from mothers	Self-completion questionnaire covering knowledge of nutrient content; knowledge of recommended changes in consumption; practical nutritional knowledge; beliefs and attitudes influencing food choice; diet-disease relationships; ratings of liking for and healthiness of fruit, vegetables and confectionary.	*Reliability:* Authors report a scoring system which prevented artificially high scores due to blanket responding *Validity:* Attitudinal variables were constructed from the product of the individual diet-disease belief score, the rated worry about health problems, and rated perceived personal risk of their children developing health problems.	Descriptive statistics and significance testing to describe mother's beliefs, attitudes and preferences. (Analysis also involves regression analysis to predict fruit, vegetable and confectionary consumption, but this was not included in the synthesis of this review.)	*Reliability:* Use of software packages to conduct statistical tests. *Validity:* Not stated

APPENDIX H: Details of studies of children's views: methodology (cont'd)

Study	Study design summary	Sampling, recruitment and consent	Data collection methods	Reliability and validity of data collection methods	Data analysis methods	Reliability and validity of data analysis methods
Hart *et al*. (2002)	A cross sectional survey collecting qualitative data from children in four schools in the south of England concerning their perceptions of 'good' and 'bad' foods, diet-disease links and food groupings.	*Sampling frame:* Twelve schools in Guildford were approached representing both the highest and lowest quartile of percentage of free school meals (FSM). *Selection:* All pupils in two years groups of each school were used to select children. Seven girls and seven boys were then systematically sampled from each participating class using every third child on an alphabetical, single gender class list. *Recruitment:* The first five children in each case were invited to participate. *Consent*: Sought from parents.	Focus groups using a list of prompts to guide discussion (e.g. what rules do your parents have about food?; what foods can make you fat/are bad for you?; what are good foods and bad foods?; which foods can be grouped together?).	*Reliability:* The same moderator conducted each group; Groups were audio taped and transcribed verbatim within two weeks of completion of the groups. *Validity:* Not stated.	Transcripts were analysed for major and minor themes. All participant quotes were then allocated to one of these theme categories. One exemplar quote selected as an illustration. The group was the unit of analysis, as individual voices within a group could not always be separated.	*Reliability:* Allocation of quotes to themes was repeated by a second investigator blinded to the source of each quote *Validity:* Not stated

APPENDIX H: Details of studies of children's views: methodology (cont'd)

Study	Study design summary	Sampling, recruitment and consent	Data collection methods	Reliability and validity of data collection methods	Data analysis methods	Reliability and validity of data collection methods
Mauthner *et al.* (1993)	A number of site-visits to observe, and collect qualitative data from, children in one school in the south of England about their experiences of school dinners and their views about food and healthy eating.	*Sampling frame:* One primary school selected for its cultural diversity and attempts to promote healthy eating. *Selection:* Two classes from different year groups within the school were selected to include children of different ages. All children took part in various parts of the study. *Recruitment:* The head of the school was contacted to take part by letter followed by a visit from researchers to explain the purpose of the research. *Consent*: Sought from head teacher and local education authority.	Participant observation in several school settings (the classroom, the playground and the dining hall) and interviews and mini-focus-groups (structured around activities such as reading, sorting picture cards). Themes covered: favourite school dinner; what you like best/least about lunchtime; and eating at home.	*Reliability:* The interviews / focus groups were tape-recorded. The 24-hour recalls and drawing were also permanent. *Validity:* Researcher spent time with the children prior to interviews or focus groups to get to know them; reflection on methods throughout to ensure the most natural setting for the children to talk.	Categories for coding the interviews were derived from the themes in the interview guide (service provision, eating at school, factors affecting food intake, eating at home, meanings of food, food in a social context, food as a topic among others).	*Reliability:* Not stated *Validity:* Not stated

APPENDIX H: Details of studies of children's views: methodology (cont'd)

Study	Study design summary	Sampling, recruitment and consent	Data collection methods	Reliability and validity of data collection methods	Data analysis methods	Reliability and validity of data collection methods
Neale *et al.* (1998)	A cross-sectional survey collecting quantitative and qualitative data from children in three schools in Nottinghamshire, England on their attitudes, preferences and knowledge about fruit and fruit consumption.	*Sampling frame:* Three schools chosen from being geographically convenient to the researcher. *Selection:* No details given on how children were selected from schools but the aim was to obtain a sample with at least fifty boys and girls from upper middle and lower socio-economic groups. *Recruitment:* Not stated *Consent*: Not stated	Interviews using a structured questionnaire for children to rate attitudes to fruit and fruit preferences and open-ended questions on their opinions on a range of foods and food components.	*Reliability:* Not stated *Validity:* Photographs and coloured stickers were used to help children answer questions.	Frequencies of children responding that we should eat more, less or the same amount of fruit are calculated and presented according to gender and social class.	*Reliability:* Not stated *Validity:* Not stated

APPENDIX H: Details of studies of children's views: methodology (cont'd)

Study	Study design summary	Sampling, recruitment and consent	Data collection methods	Reliability and validity of data collection methods	Data analysis methods	Reliability and validity of data collection methods
Tilston *et al.* (1991)	A cross-sectional survey collecting quantitative and qualitative data from children in one school in Nottingham, England on their beliefs about whether we should eat more, less or the same amount of 11 food groups.	*Sampling frame:* One primary school *Selection:* Within the school, eight classes were used to select 'older' and 'younger' children, but no details on how children were selected. *Recruitment:* Not stated *Consent*: Not stated	Groups interviews which asked children whether we ought to eat more, less or the same of each of the following foods: bread; potatoes; dairy produce; fat; fish; meat; fresh fruit; salt; sugar; or sweets. Several picture cards were made up of the 10 food items and some real examples were used.	*Reliability:* Not stated *Validity:* The children were helped to answer the question by means of a card game. Each child was given three cards, each showing a different face as representative of their answer.	The proportions of children responding that we should eat more, less or the same amount of the food items were tabulated. Chi-square was used to examine differences between the responses of the 'oldest' and 'youngest' children	*Reliability:* Use of software package to perform statistical tests. *Validity:* Not stated

APPENDIX I: Details of studies of children's views: aims, sample, findings and quality

Study	Aims	Sample characteristics	Study findings contributing to views synthesis (***associated coding by reviewers***)	Quality criteria met
Baxter *et al.* (2000)	1) To examine children's perceptions of vegetables in relation to their preferences 2) To examine differences in perceptions according to socio-economic status.	***Location:*** Glasgow, Scotland ***Sample number****:* 42 ***Age range****:* Eight to 10 years ***Sex****:* Mixed sex ***Class****:* Twenty-two children from a school within a disadvantaged area and 20 children from a school in an advantaged area. ***Ethnicity****:* Not stated ***Other information****:* The children at both schools had been taught about food and nutrition prior to the research. ***Exclusions****:* None stated	Identified children's preferred and least preferred vegetables and their attributes (***food preferences***) Disliked green leafy vegetables were associated with health (***perceptions of health benefits***) No differences in perception between boys and girls or those from advantaged or disadvantaged schools (***differences amongst children***)	A, B, C, D, E G, H, I J, K
Dixey *et al.* (2001)	To examine: 1) Whether children understand the concepts of a 'healthy diet' and 'balance' and their ideas about importance of a healthy lifestyle. 2) The facilitating and inhibiting factors for children in eating healthily. 3) Whether they think size, fatness and thinness matter (and why) and whether they feel pressure to be a particular shape.	***Location:*** Leeds, England ***Sample number****:* 300 ***Age range****:* Nine to 10 year olds ***Sex****:* Mixed sex ***Class****:* Authors report that schools from both advantaged and disadvantaged areas were sampled. ***Ethnicity****:* Not stated ***Other information****:* Children were of mixed ability; school had received the 'APPLES' intervention. ***Exclusions****:* None stated	Children understood the concept of a balanced diet (e.g. 'a good balance of sugar, fruit and veg'), with variation (e.g. 'eating a bit of everything from different categories') and moderation (e.g. 'you need a bit of fat'). (**H*ealthy eating concepts*)** Children identified long-term consequences (heart disease and cancer) and importance of healthy eating so that they could do things now ('move and run about') (***health consequences****)* 'When they [the APPLES project] come round, you think, I'm going to get healthy now, but when you get home, you get something out of the fridge or something' *(**knowledge v behaviour**)* 'All the things that are bad for you are nice and all the things that are good for you are awful' (***perceptions of health benefits***) Children reported throwing away foods they knew had been put in their packed lunches because they were healthy (***perceptions of health benefits***)	A, B, C, D F, G J, K, L

***Key**

Quality of study reporting
A: Aims and objectives were clearly reported
B: Adequate description of context of research
C: Adequate description of the sample and sampling methods
D: Adequate description of data collection methods
E: Adequate description of data analysis methods

There was good or some attempt to establish the:
F: Reliability of data collection tools
G: Validity of data collection tools
H: Reliability of data analysis
I: Validity of data analysis

Quality of methods for research with children
J: Used appropriate data collection methods for helping children to express their views
K: Used appropriate methods for ensuring the data analysis was grounded in the views of children
L: Actively involved children in the design and conduct of the study

APPENDIX I: Details of children's views studies: aims, sample, findings and quality (cont'd)

Study	Aims	Sample characteristics	Categories and themes study findings contributed to views synthesis	Quality criteria met
Edwards and Hartwell (2002):	1) To evaluate whether children could correctly identify selected fruit and vegetables readily available in retail outlets. 2) To assess the acceptability of these fruit and vegetables. 3) To gain a broad understanding of children's interpretation of healthy eating.	***Location:*** A town on the South Coast England ***Sample number****:* 221 ***Age range****:* Eight to 11 years ***Sex****:* Mixed sex ***Class****:* Not stated, although author notes many children in the school come from single parent families ***Ethnicity****:* Not stated ***Other information****:* School encourages healthy snacks and fruit juice and discourages fizzy drinks. ***Exclusions****:* None stated	75% of children familiar with term healthy eating; 52% related it to balanced diet and eating fruit & vegetables *(**healthy eating concepts**)* Unhealthy foods mentioned included 'junk food, chocolate, sweets' and 'fattening *foods (**'Good' and 'bad' foods**)* Health eating stops you 'dying' 'getting scurvy', 'getting spots' (***Health consequences****)* Fruit rated as more acceptable than vegetables *(**Food preferences**)* Older children had better recognition of vegetables (***Differences amongst children***) Significant differences in fruit and vegetable preferences both by age and gender (***Differences amongst children***)	A, D G, H J, K,
Gibson *et al.* (1998)	To investigate the psychosocial (e.g. attitudes and beliefs) and environmental factors (e.g. socio-economic status and mothers attitudes and beliefs) relating to children's consumption of fruit, vegetables and confectionary.	***Location****:* London, England ***Sample number:*** 92 mothers and their children. ***Age range:*** Nine to 11 years ***Sex:*** Mixed sex ***Class:*** Classified on a deprivation index: low = 45; moderate = 23 high = 10; very high = 11 ***Ethnicity:*** 63% 'white'; 16% AfroCarribean; 10% other ***Other information:*** Children and mothers recruited from primary care practices identified as reflecting the range of neighbourhoods typical of south London area ***Exclusions:*** Those who could not speak fluent English	Children rated taste as the most important factor in choosing food for themselves (*preferences*) Children rated their liking for fruit nearly as high as their liking for confectionary (*preferences*) Children in families with indicators of lower SES less likely to consume fruit juice and fruit (*Differences amongst children*)	A, B, C, D, E F, G, H, I J

***Key**

Quality of study reporting
A: Aims and objectives were clearly reported
B: Adequate description of context of research
C: Adequate description of the sample and sampling methods
D: Adequate description of data collection methods
E: Adequate description of data analysis methods

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APPENDIX I: Details of children's views studies: aims, sample, findings and quality (cont'd)

Study	Aims	Sample characteristics	Categories and themes study findings contributed to views synthesis	Quality criteria met
Hart *et al.* (2002)	To examine children's understanding of: 1) parental control over food choice; 2) how diet and diseases are connected, specifically dental health and obesity; and 3) the categorisation of food into groups and the schemes children use to do this.	***Location:*** Guilford, England ***Sample number:*** 114 ***Age range:*** Seven to 10 years ***Sex:*** Mixed sex ***Class:*** 40 from schools with high % free school meal entitlement; 70 from schools with low % free school meal entitlement ***Ethnicity:*** Not stated ***Other information:*** None ***Exclusions:*** None stated	Moderation - 'junk food … once in a while' Variety - 'a bit of everything' (***healthy eating concepts***) Four categories used by children when describing food as good or bad, health links, nutrient links, preferences and food quality ***('Good' and 'bad' foods)*** Accurate knowledge of dental health consequences; Knowledge of 'fattening' foods in relation to obesity ***(Health consequences)*** Parental rule categories identified including restrictions, 'food deals', prescriptions, 'free choice' ***(Parental influence/food rules)*** Girls responses more accurate in identifying 'fattening foods'; older children and children from lower SES background more likely to cite 'free choice' (***differences amongst children***)	A, B, C, D, E F, G, H J, K, L
Mauthner *et al.* (1993)	1) To gather data on primary schoolchildren's diets, especially in the context of school meals. 2) To explore factors affecting children's food consumption. 3) To increase understanding of the contexts in which food is eaten and of children's views on how food eaten at school contributes to their diet.	***Location:*** Town in south of England ***Sample number****:* 57 ***Age range****:* Five to nine years ***Sex****:* Mixed sex ***Class****:* Authors report that many of the children came from disadvantaged families with a high proportion living on benefit. ***Ethnicity****:* Authors indicate that they chose a school that was culturally diverse. ***Other information****:* School was attempting to promote healthy eating. ***Exclusions****:* None stated	Sour taste used as an explanation for why vegetables are 'good for you' whereas a sweet taste used as the explanation for why fruit is good for you*;* 'Jam. Good for you. If you put it on toast. That's good for me.' *(**'Good' and 'bad' food**)* Immediate health consequences of eating healthily mentioned less often than long-term consequences (***Health consequences****)* Chips, sausage and beans was the favourite dinner *(**Food preferences**)* *Pressure to choose and eat food quickly; important to be able to enjoy schools dinners as a social occasion and spend time with friends (***Provided foods in the school***) Budget constraints; Food shortages; (**Factors further constraining a limited choice**) One of the main conclusions *was that there was a **Contradiction between promotion and provision of healthy foods*** 'When my mum goes out we quickly eat (sweets) …When she comes back we put them away' (***Breaking rules and asserting independence)***	A, B, C, D F, G J, K, L

***Key**

Quality of study reporting
A: Aims and objectives were clearly reported
B: Adequate description of context of research
C: Adequate description of the sample and sampling methods
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K: Used appropriate methods for ensuring the data analysis was grounded in the views of children
L: Actively involved children in the design and conduct of the study

APPENDIX I: Details of children's views studies: aims, sample, findings and quality (cont'd)

Study	Aims	Sample characteristics	Categories and themes study findings contributed to views synthesis	Quality criteria met
Neale *et al.* (1998)	To investigate the effects of gender, social class, and culture on children's attitudes to fruit, their preferences and their familiarity with a wider range of fruits commonly available	***Location:*** Nottinghamshire, England ***Sample number****:* ***Age range****:* Nine to 11 years ***Sex****:* Mixed sex ***Class****:* Children from families of social classes A, B, C1, C2, D and E are included. ***Ethnicity****:* Not stated ***Other information****:* None ***Exclusions****:* None stated	Most popular fruits were apples and strawberries; least popular fruits were figs and dates *(**Food preferences**)* Neither gender nor socio-economic status had significant effect on preferences (***Differences amongst children***)	A, D J, G
Tilston *et al.* (1991)	To examine the dietary awareness of children towards selected food items	***Location:*** Nottingham, England ***Sample number****:* 137 ***Age range****:* Five to seven years ***Sex****:* Mixed sex ***Class****:* Authors report that sample school served a large concentration of council-owned properties; many children were entitled to free school-meals ***Ethnicity****:* Not stated ***Other information****:* None ***Exclusions****:* None stated	Prioritised taste preferences and dismissed health concerns *(**Health consequences**)* 'I don't like them so they must be healthy' (***Perceptions of health benefits****)* Appears that older children are more aware that they should not eat more sugar *(**Differences amongst children**)*	B G, H J

***Key**

Quality of study reporting
A: Aims and objectives were clearly reported
B: Adequate description of context of research
C: Adequate description of the sample and sampling methods
D: Adequate description of data collection methods
E: Adequate description of data analysis methods

There was good or some attempt to establish the:
F: Reliability of data collection tools
G: Validity of data collection tools
H: Reliability of data analysis
I: Validity of data analysis

Quality of methods for research with children
J: Used appropriate data collection methods for helping children to express their views
K: Used appropriate methods for ensuring the data analysis was grounded in the views of children
L: Actively involved children in the design and conduct of the study

APPENDIX J: Cross-study synthesis matrix

Studies of children's views		Outcome evaluations	
Themes and associated barriers and facilitators	**Implications for interventions**	**Sound**	**Other**
Theme 1 Children don't see it as their role to be healthy or interested in health *Associated barriers and facilitators:* *Children dismiss the health consequences of eating or not eating healthily and prioritise taste preferences *Children consider taste, not health, to be a key influence on food choice *Food labelled as healthy may lead children to reject them ('I don't like them so they must be healthy') *Children don't see buying healthy foods as a legitimate use of their money	(1) Brand fruit and vegetables as a 'tasty' rather than a 'healthy' product.	No soundly evaluated interventions identified	None identified
	(2) Promote children's favourite fruit and vegetables or target the ones they don't like	Wardle *et al.* (in press-a) Wardle *et al.* (in press-b) Hendy (1999)	None identified
Theme 2 Children do not see future health consequences as personally relevant or credible *Associated barriers and facilitators:* *Children dismiss possible health consequences of not eating healthily for them personally *Children feel that health messages (e.g. 'sweets rot your teeth') do not match their experience *Immediate health consequences maybe more relevant to children (e.g. effects on skin; energy to mover around)	(3) Reduce emphasis on health messages particularly those which concern future health	Liquori *et al.* (1998) Smolak *et al.* (1998) Wardle *et al.* (in press-a) Wardle *et al.* (in press-b) Hendy (1999)	Domel *et al.* (1993)
	(4) Make health messages credible and relevant for children	No soundly evaluated interventions identified	None identified

APPENDIX J: Cross-study synthesis matrix (cont'd)

Studies of children's views		Outcome evaluations	
Themes and associated barriers and facilitators	**Implications for interventions**	**Sound**	**Other**
Theme 3 Fruit, vegetables and confectionery have very different meanings for children *Associated barriers and facilitators:* *Children do not like (some) vegetables because they taste sour *Children like fruit because it is sweet *Children do not like large and hard vegetables *Children prefer brightly coloured, small, soft, juicy and sweet vegetables *Eating sweets is a social and 'exciting' activity to be shared with friends and siblings	(5) Do not promote fruit and vegetables in the same way		
	(5a) Do not promote fruit and vegetables in the same intervention	Liquori *et al.* (1998) Moore (2001) Wardle *et al.* (in press-a) Wardle *et al.* (in press-b)	Smith and Justice (1979)
	(5b) If promoting fruit and vegetables in the same intervention treat them differently	Baranowski *et al.* (2000)	None identified
	(6) Brand fruit and vegetables as an 'exciting' or child-relevant product, as well as a tasty one	Baranowski *et al.* (2000) Hopper *et al.* (1996) Perry *et al.* (1998a) Reynolds *et al.* (2000) Shannon *et al.* (1982) Anderson *et al.* (2000)	Boaz *et al.* (1998) Lowe *et al.* (submitted for publication) Lawatsch (1990) Foerster *et al.* (1998) Domel *et al.* (1993) Friel *et al.* (1999)
Theme 4 Children actively seek ways to exercise their own choices with regard to foods *Associated barriers and facilitators:* *Eating sweets, despite parental rules, is a way for children to assert their own independence *Children can feel under pressure to choose and eat food quickly in school *For girls, choosing healthy foods appears to be a way for them to exercise their own choice	(7) Create situations for children to have ownership over their food choices	Moore (2001)	Foerster *et al.* (1998)

APPENDIX J: Cross-study synthesis matrix (cont'd)

Studies of children's views		Outcome evaluations	
Themes and associated barriers and facilitators	**Implications for interventions**	**Sound**	**Other**
Theme 5 Children value eating as a social occasion *Associated barriers and facilitators:* *Eating sweets is a social and 'exciting' activity to be shared with friends and siblings *Children like to sit with their friends when eating dinner at school	(8) Create opportunities for children to have ownership over the social context in which they eat their food (In addition, see implication (7))	No soundly evaluated interventions identified	None identified
Theme 6 Children recognise the contradiction between what 'adults' promote in theory and what is provided in practice *Associated barriers and facilitators:* *Easy access to tempting (unhealthy) foods *Contradiction between the promotion of healthy foods in the classroom and the provision of unhealthy foods in the school dining hall	(9) Ensure messages promoting fruit and vegetables are supported by appropriate access to fruit and vegetables	Anderson *et al.* (2000) Parcel *et al.* (1999) Perry (1998a) Perry (1998b) Reynolds *et al.* (2000)	Domel *et al.* (1993) Resnicow *et al.* (1992)