## Public Health Research Consortium

# The process and impact of change in the school food policy on food and nutrient intake of children aged 4-7 and 11-12 years both in and out of school; a mixed methods approach 

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## List of abbreviations used

| BMI | Body Mass Index |
| :--- | :--- |
| CCT | Compulsory Competitive Tendering |
| CI | Confidence Interval |
| CRB | Criminal Records Bureau |
| D.O.B | Date of Birth |
| DRV | Dietary Reference Value |
| FAST | Food Assessment in Schools Tool |
| g | Gram |
| ID | Unique Identification Number |
| IMD | Index of Multiple Deprivation |
| ISM | Institute for Social Marketing |
| kcal | Kilocalories |
| LA | Local Authority |
| LEAs | Local Education Authorities |
| mg | Milligram |
| n | Number |
| NCC | Newcastle City Council |
| NCMP | National Child Measurement Programme |
| NDNS | National Diet and Nutrition Surveys |
| NMES | Non-milk extrinsic sugars |
| NSP | Non-starch Polysaccharides (fibre) |
| NVQ | National Vocational Qualification |
| PL | Packed Lunch |
| PSHE | Personal Social and Health Education |
| RNI | Reference Nutrient Intake |
| SD | Standard Deviation |
| SES | Socio-economic Status |
| SL | School Lunch |
| SMRP | School Meal Review Panel |
| $\mu g$ | Microgram |
| WHO | World Health Organization |
|  |  |

## Preface

## What this study adds

In 2006 a major initiative to improve school food in England was launched. For the first time since 1980 this set out food and nutrient-based requirements for school lunch to which schools all had to adhere to by September 2009. While previous studies have measured the food and nutrient content of packed lunches and school lunches, there are few studies to date in the UK that have been able to examine the impact of school and packed lunch on total diet; and to our knowledge this is the only study to examine this during the time of change in school food policy and across different age groups. This study was possible because detailed dietary data had been collected in schools in the North East of England in previous studies completed prior to the implementation of the new school food policy.

We found that primary schools were fully compliant with the school food standards in the food offered while middle schools were working towards these standards but they were not yet fully compliant. The qualitative work on the process of implementation identified that the larger schools such as middle and secondary schools face greater challenges in meeting the standards.

This study has found that the diets of children aged 4-7yrs and 11-12yrs have generally improved over recent years; we found improvements in key nutrients for younger children between 2003-4 and 20089 and for older children between 1999-00 and 2009-10. While the foods offered in both primary and middle schools were either compliant or almost compliant with the standards, we found that the school lunches selected by children were generally not fully compliant; this highlights the need for children to be guided in their food choice. Despite this there were marked improvements in the nutritional quality of school lunch; this was lower in \% energy from fat, saturated fat and non-milk extrinsic sugars as well as salt but also higher in micronutrients. While there was evidence of improvements in packed lunches consumed by children, school lunches were overall of higher nutritional quality. Changes for the older children were less marked than those for younger children.

It is acknowledged that school food is only one factor influencing children's diets. However, this study has clearly demonstrated the effect of the change in school food not only on the food consumed at school lunch time but also on the total diet of children, and this improvement was regardless of levels of deprivation. For younger children, those having school lunch had a total diet which was closer to dietary recommendations than previously.

While generally there was an improvement in the quality of children's dietary intakes, some food and nutrients were not in line with nutritional recommendations. Of particular note was fruit and vegetable intake in general and iron intake (in older girls), which were lower than desirable and sodium intake though reduced, remained high. Promotion of a school lunch over the alternate packed lunch has the potential to have a positive impact on nutritional intake for children's total diet regardless of family circumstances.

## 1. Executive summary

## Background

School meal provision was introduced in the mid-19 ${ }^{\text {th }}$ Century as a public health response to undernutrition of children. In the late $20^{\text {th }}$ Century, the focus for public health shifted as the obesity epidemic in children emerged; and as part of this, the need to improve children's diets was identified. Central to 'improving children's diets' is the need for a reduction in \% energy from fat, saturated fat, non-milk extrinsic sugars 'added sugars' and intakes of sodium, while maintaining and increasing intakes of protein, non-starch polysaccharides 'fibre' (NSP) and micronutrients such as calcium and iron.

Following a period of over 20 years from 1980 to 2000 during which there was no regulation of school food, a plethora of evidence pertaining to the poor state of children's diets, a rapid rise in levels of childhood overweight and obesity and the current and projected economic costs, the last ten years have seen a major acceleration in public health initiatives. One such initiative was in 2006 when the Government announced new standards for school food in England. These standards are both food and nutrient-based, crucially, they say what cannot be served (for example, confectionery and crisps), and limit the number of times that certain foods can be provided (for example, meat products, starchy foods cooked in fat or oil and deep-fried foods). A change in school food has potential to impact on the diet of children from across the socio-economic spectrum and so impact on inequalities in health. Critical to the success of implementing any new policy and achieving its objectives is how it is perceived and experienced by key stakeholders, this is particularly important to school food, where if parents and children do not like the provision they can choose a packed lunch rather than school lunch.

There was a need to evaluate both the process of implementation and the effect of this policy on school food and total dietary intake of children.

## Project aims

The primary aim was to measure the process and effect of change in national school food regulations on food and nutrient intake of children aged 4-7yrs and 11-12yrs both at school and throughout the day.

## Methods

Dietary intake: A cross-sectional study was undertaken in two areas of North East England. Dietary, anthropometric and socio-economic data were collected from children aged 4-7yrs and 11-12yrs who consented to take part. These data were collected at three different time points (pre, mid and postimplementation of the school food policy) in both primary and middle schools at two levels; school and individual. Using an observational method during the school day, and parental completion at home, the 4-7 year olds completed a 4-day food diary which included three weekdays and one weekend day. The 11-12 year old children recorded their own dietary intake in two 3-day food diaries approximately six months apart; this included four weekdays and two weekend days. Anthropometric measurements were collected.

Process evaluation: Implementation was examined at two levels, firstly across the larger sample of schools taking part in the cross-sectional element of the study and secondly in a smaller sub-sample of schools. The first level of data collection assessed progress towards implementation across all participating schools by contacting the policy lead in each school prior to, and following, the implementation deadline. At the second level of data collection, a case study approach was used to provide more detailed insights into the implementation process within selected individual schools, and the main factors hindering and facilitating implementation. In the selected case study schools, further interviews were conducted with key implementers, including catering staff, teachers and teaching assistants, dining supervisory staff, administrators and governors. Focus groups were conducted with parents in selected primary and middle schools, and also with children in the case study middle schools.

## Main findings

There were significant and important improvements in the dietary intake of children in the period from pre to post-implementation of the school food policy. There were statistically significant differences found in the mean nutritional intake from school and packed lunch. Post policy lunch time food choice was found to have a significant effect on the total diet in children aged 4-7yrs. In contrast, there was little evidence of an effect of lunch type on total diet in the 11-12yr olds.

Change in dietary intake of $4-7 y r$ olds 2003-4 to 2008-9: There were significant improvements in the nutrient content (\% energy from total fat and saturated fat and sugars) of both school lunches and packed lunches; however the extent of change was greatest in school lunch. School lunches were higher in NSP and micronutrients (iron, calcium and vitamin C) and lower in sodium than packed lunches. There was evidence of a widening gap between school and packed lunches, with school lunch offering the healthier option.

- In school lunch there was a fall in the proportion of children having chips, confectionery, crisps and sugared drinks along with an increase in the proportion of children having fruit and vegetables reflecting the food based standards of the school food policy. These changes were also observed in packed lunches though to a lesser extent; this reflected our finding that some schools had adopted policies restricting foods in packed lunches.
- There were significant improvements in total dietary intake: in 2008-9 children had diets lower in fat, saturated fat, sugars and sodium but higher in protein, NSP and micronutrients than in 2003-4. In food terms there was a fall in the proportion of children eating chips, confectionery, crisps and sugared drinks and an increase in the proportion eating fruit or vegetables over the four days reported.
- Clearly children's food choice is influenced by many factors other than school lunch type. Despite this, we found that there was a significant interaction between year and lunch type, that is, the effect of lunch type choice on total dietary intake changed from pre to post-implementation of the school food policy. Post-implementation children having a school lunch had a lower \% of energy from fat, saturated fat and sugars and intake of sodium and a higher intake of protein, NSP, vitamin C, iron, zinc and folate in their total diet than children having a packed lunch. For some nutrients this was a reversal of intakes prior to the school food policy when children having packed lunches had had the more favourable diets and clearly demonstrates the impact of the school food policy not only on lunch time intake but also on the total dietary intake of primary school children.

Change in dietary intake of 11-12yr olds 1999-00 to 2009-10: There were significant improvements in the content of some nutrients in both school and packed lunch. There was a fall in the \% energy from fat, saturated fat and amount of sodium in school lunches consumed by these older children. These improvements were not observed in packed lunches. Conversely there were increases in NSP, calcium, vitamin C and vitamin A in packed lunches which were not observed in school lunches rather there was evidence of a fall in intake of iron, vitamin A and folate from a school lunch.

- In school lunch there was a fall in the proportion of children having chips, crisps, confectionery and sugared drinks; for chips this fall was particularly striking. While there was an increase in the proportion having vegetables the proportion choosing fruit as part of their school lunch fell. While these findings reflect a move towards implementation of the school food policy in these schools it was evident they were not fully compliant with the policy, in that children still had the opportunity to buy sugared drinks and crisps in some schools. In packed lunches there were also positive changes with fewer children having crisps, confectionery and sugared drinks and an increase in the proportion having fruit and vegetables.
- In total diet there were significant improvements in $\%$ energy from fat but no change in saturated fat or sugars which both remained above recommendations. There was a reduction in sodium, and
increases in calcium and vitamin C, but also and importantly, there was a significant reduction in intakes of iron and folate; intakes of these nutrients, particularly in girls, is a concern.
- There were some positive changes in food choices. The proportion of children having chips, crisps and sugared carbonated drinks fell and the proportion consuming fruit and vegetables increased.
- In contrast to our findings in 4-7yrs olds there was limited evidence of the effect of school day lunch type choice on the total diet of these 11-12yr olds. The exception was in \% energy from fat; in 199900 children having school lunch had a higher total fat intake than those having packed lunch, by 200910 this difference was no longer apparent.

Extent and process of implementation: The process evaluation suggested that schools in the study had coped well with the challenges involved in implementing the school food policy. In Local Authority provision schools, school meal menus were developed and nutritionally analysed centrally, meaning that the main challenges for schools were adjusting to the increased amount of preparation involved and promoting the new meals to parents and children. In contrast schools which opted out of Local Authority meal provision also had to develop and analyse their own menus for compliance. Here differences emerged, with catering staff in the schools having varying degrees of understanding and confidence in relation to the new skills and processes. Responsibility within schools for day-to-day implementation largely fell to the catering manager or cook while many headteachers had only limited awareness of the detailed policy requirements. The amount and nature of leadership shown within a school on food issues appeared to influence how well supported the catering staff felt and how enthusiastically the school implemented the standards and promoted the new meals. The knowledge and skills of catering staff themselves, and their ability to adapt to new processes and ways of working, were also important implementation factors; our findings suggest that most adapted well, although some struggled with certain aspects.

Additional actions undertaken by schools to enhance the impact of the policy: Most schools in the study had gone beyond the compulsory aspects of the policy in terms of instituting additional actions and changes to promote the new meals and healthy eating in general. Such actions included making serving areas and dining rooms more attractive (for example, through replacing old counters or crockery, decorating the walls, increasing the sociability of the dining experience), offering tasters of new dishes to children and inviting parents in to sample the meals, addressing healthy eating across the curriculum (for example, in lessons, themed events and food-growing initiatives), inviting children's feedback on the meals and involving them in decision-making relating to food provision and communicating with and engaging parents; these activities were almost exclusively limited to primary schools.

One area where it was felt to be particularly challenging to engage with and influence parents was in relation to encouraging healthy packed lunches; most schools fought shy of implementing a strict
policy, but the absence of such a policy was felt potentially to threaten the impact of the policy changes to school meals, by allowing children to opt for an alternative which was often less healthy.

Views of key stakeholders groups on the new standards: Most stakeholder and implementer interviewees supported the school food policy, some catering managers and cooks felt that the speed and extent of change were excessive and that it was wrong to provide meals that many children would not eat and would potentially be wasted. Parents tended to support the notion of restricted choice for primary school children, feeling that this helped to facilitate and normalise healthy eating, but there was more ambivalence surrounding middle school children, for whom growing autonomy and more firmly developed preferences were recognised as important considerations. Opinions of the new meals varied. While some interviewees were pleased with the new meals, others felt that taste and quality could be inconsistent and that there was a lack of variety and sometimes appropriateness for local food cultures and tastes. A recurring issue across several schools and interviewees was the importance of providing face-to-face guidance and encouragement to children at the point of choosing their meal and while eating.

## Implications for policy, practice and future research

This study has found evidence of many encouraging changes in the diet of children aged 4-7yrs and 11-12yrs. School food is just one of many factors influencing children's diet but our findings clearly show the effect school lunch can have on children's total diet and thus the beneficial effect of the school food policy. The extent of this change was different in primary schools (4-7yr olds) than for older children (11-12yr olds) and reflects our finding that while primary schools were compliant with the policy, middle schools were still working towards this and demonstrates the greater challenge of influencing food choice as children become older and more autonomous in their food choice. It was evident for both age groups that the food choice available was only one factor in the decision to have school lunch or packed lunch; the dining room experience and encouragement offered to children is part of this choice. This is supported by the findings from the process evaluation where across several schools and interviewees the importance of providing face-to-face guidance and encouragement to children at the point of choosing their meal and while eating was expressed. Similarly issues around queuing for lunch and the general ambience of the dining room discouraged some children from choosing a school lunch.

Our findings for 4-7yr olds have demonstrated the potential for school lunch to have a positive impact on the total diet and some tentative evidence that this can have an influence on inequalities in diet from children from different social backgrounds. To maximise this impact school meals should continue to be promoted to both children and parents. This calls for a continued and concerted effort to change perceptions of school lunch given both previous research findings and media headlines prior to the introduction of the school food policy; this is a particular challenge in children aged 11yrs and older. While every effort should be made to ensure children can benefit from a healthy school
lunch there will always be some children who choose a packed lunch. Whether comparable policies can be applied to packed lunch remains a subject of debate. This study found evidence of some policies already in place and also of improvements in packed lunches in both age groups.

The ultimate aim is to ensure that all children have a nutritional intake in line with recommendations and ensure that they achieve maximum health and well-being to be able to gain most from the educational and other opportunities offered to them. Food in schools is about more than provision of nutrients; it also offers a social opportunity and an opportunity for learning across the wider curriculum.

## 2. Introduction

School meal provision was initially introduced in the mid- $19^{\text {th }}$ Century as a public health response to under-nutrition of children and subsequent poor health of potential army recruits for the Boer war. In the late $20^{\text {th }}$ Century, the focus for public health shifted as the obesity epidemic in children emerged. ${ }^{1}$ The causes, complexities and adverse health effects of overweight and obesity are well documented ${ }^{2-4}$ as are the current and projected economic costs. ${ }^{5}$ There has been a major shift in the focus of public health to combating the increasing prevalence of childhood overweight and obesity; and as part of this, to improve children's diets. ${ }^{6,7}$ These were prime objectives in the previous Government's health strategy which placed improving children's diets high up the policy agenda. ${ }^{8,9}$ Although previous Government targets aimed to reduce the proportion of children overweight and obese, ${ }^{10}$ results from the 2009-10 National Child Measurement Programme (NCMP) found nearly a quarter of reception children (23.4\%) and a third of year 6 children (33.4\%) either overweight or obese. ${ }^{11}$

While it is recognised that what children consume at home is paramount, school plays a key role in assisting children establish healthier choices; ${ }^{12-14}$ within this school meals are central, both as a means of providing nutrition to children regardless of social background, and potentially, as a means of translating the taught curriculum on nutrition into practice. Of course school lunch can only directly influence the diet of children who have school lunches. Many other factors affect children's diets; the influence of school lunch time food choice (school lunch or packed lunch) on total dietary intake is examined in the analysis.

A summary of key developments in school meals since their introduction 140 years ago is given below (See Figure 1 on page 11 for a timeline of the history of school meals and the development of the school food policy).

## Introduction of school meals (1870-1940)

School meal provision dates back to the mid-19th Century, but was confined to the work of charities. ${ }^{12}$ Findings from two major publications highlighted the public health concern of under-nutrition in children (Inter-Departmental Committee on Physical Deterioration (1904) and Inter-Departmental Committee on Medical Inspection and Feeding of Children attending Public Elementary Schools (1905)); leading to the development of the 1906 Education (Provision of Meals) Act. This Act required that children received adequate food in school and gave power to the Local Education Authorities (LEAs) to provide free meals. ${ }^{1}$

## Establishment of nutritional standards (1941-1979)

Nutritional standards for school meals were first introduced in 1941 with guidelines applying to the provision of energy, fat and protein. The 1944 Education Act imposed a legal duty on LEAs to provide school meals to any pupil who wanted them with the full cost of school meals in 1947 being met by Government. This provision of free school meals continued until the introduction of a standard charge in 1950. During this period nutritional standards were reviewed on three occasions: 1955, 1965 and 1975. ${ }^{15}$

## Removal of nutritional standards (1980-2000)

This 20-year period had a substantial detrimental effect on the provision of school meals; commencing with the 1980 Education Act, which resulted in the removal of all nutritional standards for school meals, this despite the Black Report (1980) highlighting that nutritious school meals were paramount to child health. ${ }^{16}$ Further negative developments in this period included the removal of the LEAs' obligation to provide school meals, except to those entitled to free school meals; the loss of entitlement to free school meals by children living in families in receipt of family credit; abolishment of fixed pricing; and the introduction of compulsory competitive tendering (CCT). CCT heralded the beginning of an 'unregulated school meals market'. ${ }^{12}$

In 1989, findings from the Department of Health survey 'Diets of British School Children' reported that $75 \%$ of children had fat intakes above the recommended level and micronutrient levels for many children were below recommended guidelines. ${ }^{17}$ In 1992, twelve years after the abolishment of nutritional standards, the School Meal Campaign of the Caroline Walker Trust called for the reintroduction of nutritional standards and published recommended standards; these were ignored. ${ }^{1}$ By 1997 CCT was replaced with 'best value' adding further financial incentives for LEAs to provide the cheapest possible meal service.

With emerging evidence of increasing levels of foods high in fat and sugar in children's diets, and a rapid increase in the prevalence of childhood overweight and obesity, concern began to develop. ${ }^{12,17}$ This was underpinned by the publication of two Public Health White Papers in the 1990's: The Health of the Nation; and Saving Lives: Our Healthier Nation. ${ }^{18,19}$ In 1999, public health initiatives were established to begin to address concerns of children's poor diet and increasing adiposity, starting with the introduction of the 'National Healthy Schools Programme'. ${ }^{20}$ A publication by the Department of Health in 2000 added further evidence of low nutrient intakes in school children, especially micronutrients; ${ }^{21}$ leading to a further school-based public health initiative, the National School Fruit Scheme (later the National School Fruit and Vegetable Scheme), which aimed to provide a piece of fruit or vegetable during the school day for every child aged 4-6yrs. ${ }^{22}$

## Development of the school food policy (2001-2011)

Following a period of over 20 years with no regulation of the food or nutrient content of school food, a plethora of evidence pertaining to the state of children's diets and the rapid rise in levels of childhood overweight and obesity, the last ten years have seen a major acceleration in public health initiatives as the extent of the 'obesity time bomb ${ }^{, 23}$ became apparent. ${ }^{4,8}$ This has led to the introduction of various public health initiatives and regulations, including, the development of a national policy on food in schools.

Central to 'improving children's diets' was the need for a reduction in \% energy from fat, saturated fat and non-milk extrinsic sugars (NMES 'added sugars'), along with a decrease in absolute intakes from fat, saturated fat, NMES and sodium while maintaining and increasing intakes of protein, non-starch polysaccharides (NSP 'fibre') and micronutrients such as calcium, vitamin C, iron, and zinc. These recommendations can be summarised as promotion of a less energy dense diet with an increased nutrient density or higher nutrient quality. These aims have formed the basis for change in school food. For reference, recommended dietary reference values by the Department of Health, $1991^{24}$ for children's intake of all nutrients examined in this study can be seen in Appendix 10.1.

In 2001, food-based standards for school lunches were reintroduced based on Government advice using the Balance of Good Health. These standards imposed on caterers the need to provide "healthy" options at lunch time, specifying the types of foods and frequency of serving; but they did not limit choice or specify nutrient-based standards (for example, limiting the percentage of energy from fat)..$^{25}$ In 2004 and 2006, two reports made clear that in spite of the introduction of standards, school lunches remained high in fat, sugar and salt and low in dietary fibre and micronutrients, and that children were not making healthy food choices. These reports further highlighted the importance of school meals, in that between a quarter and a third of energy and nutrients were provided by school meals, signifying the potential of school meals to make a significant impact on the total diet of children. ${ }^{26,27}$

2005 was a major turning point for school food provision with three key developments that year:
i. The broadcast of Jamie Oliver's 'Jamie's School Dinners' attracting attention at both public and Government levels (February).
ii. Establishment of the School Meal Review Panel (SMRP) to advise on a major revision of current school meal standards (March).
iii. Establishment of the School Food Trust with the remit to 'transform school food' (April).

The SMRP (2005) noted the crisis in school food was as a result of 'financial pressures', the 'fragmentation of school catering', a 'lack of standards' and 'ultimately years of public policy failure'. ${ }^{12}$ In May 2006 new standards for school food in England were announced by the Government. ${ }^{28}$

Schools were given an interim period to comply with these, but by September 2008, primary schools were to be fully compliant, with secondary schools fully compliant by September 2009. The standards are food and nutrient-based, and they are based on provision, not consumption. Crucially, they say what cannot be served (e.g. confectionery, crisps), and limit the number of times that certain foods can be provided (e.g. meat products, starchy foods cooked in fat or oil, deep-fried foods) over a period of two or three weeks. Food-based standards apply to the whole school day, including breakfast and after school clubs. This means that if a school serves sausages at breakfast, they can serve sausages on only one further occasion within the following two weeks. Nutrient-based standards apply to the average school lunch over a (typically) three-week menu cycle. ${ }^{29}$ A full breakdown of the food and nutrient-based standards are given in Appendix 10.2.

## Rationale for study

The history above illustrates major changes and investment in school food. With the additional benefit of school food reaching across the entire socio-economic spectrum, the recent changes in legislation has the potential to improve the nutrient intake of the poorest children and so reduce inequalities in dietary intake. This can only be achieved if children have a school lunch and it must be noted that since introduction of the school food policy there has been a decline in the number of children having a school lunch in some areas and among some age groups, although, there has been a much lesser fall in uptake among those children entitled to a free school meal and among younger children*. To measure the effect that these major changes have had on food and nutrient intake of children both at school and throughout the day, there was a need to evaluate the implementation of this policy. Given that the implementation of these standards began in September 2006, such an evaluation was possible only through the use of existing datasets as the baseline against which any change could be measured. The positive impact of school food legislation on provision and consumption of food in schools has been shown. ${ }^{30}$

An important limitation of the previous surveys of school food was the lack of information on food intake outside of school, ${ }^{26,27}$ making it impossible to ascertain the contribution of changes to school food on a child's total diet. This information is vital to assess the:
i. effectiveness of changes in school food in improving the overall food consumption and nutrient intake of children across the socioeconomic spectrum
ii. extent to which school food impacts on food choice in the home environment
iii. potential contribution of changes in school food in addressing the public health priority of improving the diets of children and reducing childhood obesity.

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Figure 1: A history of school meals to the development of the school food policy in England

## 3. Purpose of the study

## Aim

The principal aim of this study was to measure the process and effect of change in national school food regulations on food and nutrient intake of children aged 4-7 and 11-12 years both at school and throughout the day.

## Key research questions addressed:

1. Had the school food standards been fully implemented in both primary and middle schools? If so, what was the process of this implementation and how was this change regarded by key stakeholders?
2. What was the impact of the change in school food standards on children's food choice at school lunch and at other times of the school day?
3. What contribution did school food make to the total dietary intake of children in 2008 and 2009 and how had this changed since 2000 for 11-12 year olds and since 2003-4 for 4-7 year olds?
4. What was the impact of change in school food on the total diets of children of different age, gender and socio-economic strata?

A separately funded sub-study entitled 'An economic evaluation of change in school food policy' examined the costs associated directly with change in the school policy compared to short-term outcomes on a cost-consequence analysis. Furthermore, this sub-study included an exploratory analysis of the changes in the occurrence of future health events, particularly cardiovascular events, resulting from dietary change to estimate longer term impacts on costs and quality adjusted life years. The findings from this work can be found at http://phrc.Ishtm.ac.uk.

## Contribution to the Public Health Research Consortium (PHRC) themes:

This study adds to our knowledge and understanding of the role of school food in meeting the nutritional needs of children, particularly, children of low socio-economic status (SES) and/or high deprivation. The results of this work will demonstrate the efficacy of recent changes in the school food regulations on bringing about positive change in school food and perhaps more imperative the potential influence this has on total diet of children.

## 4. Dietary data collection: design and methods

### 4.1 Ethical approval

Ethical approval for all aspects of this study was sought and granted by Newcastle University Ethics Committee; application number: 000011/2007.

### 4.2 Overall design

A cross-sectional study was undertaken in two counties in the North East of England: Newcastle upon Tyne, Tyne and Wear (primary schools); Morpeth, Ashington and Newbiggin-by-the-sea, Northumberland (middle schools). Dietary, anthropometric and socio-economic data were collected from children aged 4-7yrs and 11-12yrs who consented to take part. These data were collected at three different time points in both primary and middle schools at two levels; school and individual (Figure 2). To ensure consistency in dietary data collection, the methods used at baseline, mid and post-implementation phases were identical. Due to the need for age appropriate data collection tools; primary and middle schools are discussed separately.


Figure 2: Primary and middle school cross-sectional survey time points

### 4.3 Methods: Primary schools

### 4.3.1 Recruitment in primary schools

## Schools

The 16 primary schools in Newcastle which took part in the 2003-4 survey (baseline) were approached and invited to take part in the mid (2007-8) and post-implementation (2008-9) surveys. These schools had originally been identified to include schools from areas of a range of deprivation determined from the Free School Meal index and also to include schools with a high proportion of children from ethnic minority groups. Schools were contacted by letter detailing what the study involved. This was followed by a phone call to arrange a personal visit and ascertain if they were interested in taking part. Thirteen schools (of 16) agreed to take part and suitable dates were arranged with individual schools to complete the data collection. On completion of each phase of data collection schools received a fruit basket and book vouchers to the value of $£ 1$ for each child who participated. Each school was allocated a unique identification number (ID) number to enable school level analysis.

## Children

All children aged 4-7yrs in Reception, Year 1 and Year 2 attending these schools were considered eligible and invited to participate. A time was arranged with individual schools to talk with the children; this gave opportunity to show them the dietary data collection tools and to ask questions. Each child received an information pack to take home to parents/guardians with a letter explaining study details and a consent form to be returned to school (see Appendix $10.3 \& 10.4$ ). The consent information included personal contact information i.e. address, telephone number, child's name, gender, date of birth (D.O.B). The research team collected completed consent forms from the schools. As the date approached when the study would take place in individual schools a reminder letter was sent to parents asking them to return the form, if they had not already done so, by a specified date if they wanted their child to take part. All recruitment was opt-in by informed written parental consent. On completion children received a certificate of achievement. Each child was allocated a unique ID number to enable analysis at both an individual and school level.

### 4.3.2 Lay observers: Recruitment and training

Lay observers were recruited to assist with dietary data collection. This was due to the age of children participating which required the use of an observational method (see section 4.3 .3 for a full explanation of method used). Parents were asked to complete these at home, while a team of lay
observers were present in schools to observe and record what children consumed throughout the school day. The number of lay observers required was dependent on the number of children taking part in each school. See Figure 4 for process used to collect dietary data.

## Recruitment

Adverts were placed on the University website and in the Evening Chronicle; this resulted in a good response and candidates were selected for interview. Following interview, successful applicants were appointed on a zero hour contract by Newcastle University and invited to attend a training day.

## Training

A training day was provided for all lay observers covering issues such as background to the study, development of the food diary tool 'FAST' (Food Assessment in Schools Tool) ${ }^{31}$ along with a practical session in its application. Information was provided about completion of timesheets, reporting sickness and the process for obtaining criminal records bureau (CRB) and personal ID

### 4.3.3 Data collection

## Dietary data

Dietary data were collected for each child over four consecutive days: three weekdays and one weekend day. A prospective dietary assessment tool 'FAST', developed and validated to be used in 2003-4 (baseline), which incorporates elements of both a food diary and food frequency method was used. This is a simple food diary developed based on knowledge of frequently consumed foods within six defined timeslots derived from known food intake patterns, together with age and sex specific portion size data derived from relevant National Diet and Nutrition Surveys (NDNS). ${ }^{21,32}$ Each of these six defined timeslots contained two sections for recording of dietary intake:
i. a pre-printed tick list of foods frequently consumed referred to as 'standard foods'
ii. a facility to record food items not listed under 'others' referred to as 'other foods' (See Figure 3).

Portion sizes for any foods recorded as 'other foods' were determined retrospectively from NDNS data and work by Wrieden et al, 2008. ${ }^{33}$ For these foods average portion sizes consumed by all children aged 4 to 7 years were used rather than age and sex specific portion sizes.

| Day 1 .................... |  |  |  | $\begin{aligned} & \text { I choool Lunch } \\ & \text { Packed Lunch } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: |
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Figure 3: Example from food diary used with 4-7yr olds

Diaries were distributed in a clear plastic A5 wallet to participating children on Tuesday afternoon at school enabling data collection to commence Wednesday morning. Each child's name, individual ID and class were written onto the front cover of each diary. Diaries were distributed to children and travelled between school and home with the child; these were completed by parents at home and trained lay observers at school throughout the school day, including breakfast and after school clubs.

The first page of each diary had instructions and an example for parents on how to complete. Parents and lay observers had to either 'tick' (standard foods) or 'write' (other foods) the foods consumed by the child on the correct page (individual pages corresponded to the relevant day of data collection) and in the appropriate timeslot; there was no need for them to record the quantity or weight of the food item.

The design of the diary ensured ease of separation of 'school food' from 'food consumed at home' and easy identification of school lunch and packed lunch. This extended to food consumed at breakfast clubs, break time, after school clubs or if a special occasion occurred at the school i.e. child's birthday or special taster sessions (Figure 3).

## Staff protocol for working in schools

An enhanced CRB was obtained for all research staff and lay observers during the data collection phases. Copies of these were made available to schools prior to data collection. All staff wore university ID badges while in schools.


Figure 4: Process for data collection in primary schools

### 4.3.4 Data coding

## Data coding for calculating nutrient intake

All dietary data coding for nutritional composition was using McCance and Widdowson's Integrated Composition of Food Dataset. ${ }^{34}$ This dataset was incorporated into the MS ACCESS relational databases used for all data storage and analysis of nutrient and food group intake. A different approach had to be adopted for each 'type' of food recorded in the FAST diaries.

## i. 'Standard' foods

This required a simple tick to be placed either in the box or circle, dependent on source (home or school), beside foods consumed from the pre-printed list in the diary. Sex and age-specific weights were associated with each of these foods.

## ii. 'Other' foods

Foods listed in the 'other' column were coded either into 'standard' foods where appropriate or coded individually. Some foods were written under 'others' but could be coded into standard foods (e.g. Kit Kat). Occasionally for some 'other' foods where no matching food composition code was available a product search was conducted using the three main supermarkets. This allowed nutrition information to be obtained and subsequently the food composition code best matching the nutritional composition of the item recorded used.

## iii. 'School lunch' foods

School lunch recipes were obtained from the city council provider to 12 of the 13 schools for both winter and summer periods in 2007-8. In 2007-8 one school had opted out of local county council catering but were unable to provide adequate school menu recipes, therefore, in that school, school lunch was coded using either 'standard' or 'other' foods. In 2008-9 recipes were obtained from the two catering providers for all thirteen schools including winter and summer periods. All school meals were entered onto Excel spread sheets including a food name, food code, portion weight and nutrient analysis. These were double checked and imported into the ACCESS database so that school recipes were used to determine nutrient intake from school meals. Occasionally a child had consumed an item at school for which a school meal recipe was not available due to a change in the menu on a given day. These items were subsequently coded using either a 'standard' or 'other' food.

## Portion size

'Other' foods
Weights for all 'other' foods reported were derived retrospectively based on work by Wrieden et al, $2008 ;{ }^{33}$ if identical matches were not available then the closest available match was used (e.g. if parsnip was consumed it was allocated the same weight as carrots).

## 'School lunch' foods

Weights for 'school lunch' foods were based on a standard portion weight as served.

### 4.4 Methods: Middle schools

### 4.4.1 Recruitment in middle schools

## Schools

The same seven middle schools in Northumberland which had participated in the 1999-00 study (baseline) were invited to take part in the two surveys: 2007-8 (mid-implementation) and 2009-10 (post-implementation phase). In 2007-8 one of the original seven schools had closed, the other six agreed to take part. In 2009-10 two schools merged to form one school and all of these five remaining schools participated. The schools had originally been identified to ensure representation across the social spectrum. ${ }^{35-38}$

Schools were contacted in the first instance by letter detailing what the study involved and inviting them to participate. This was followed up by a phone call to arrange a personal visit to provide additional information, answer any questions and ascertain if they were interested in taking part. Suitable dates were arranged with individual schools to complete data collection. On completion of each phase of data collection the schools received a fruit basket and a book voucher to the value of £1 for each child who participated.

## Children

All children aged 11-12yrs in Year 7 were eligible and invited to participate. A time was arranged with individual schools to meet with Year 7 children to present the study, show them the dietary data collection tools used and give opportunity to ask questions. Each child received an information pack to take home to their parents/guardian, which included a letter explaining what the study entailed and a consent form (Appendix $10.4 \& 10.5$ ). Parents were asked to supply contact information i.e. address, telephone number, child's name, gender, D.O.B and to return forms to school. Completed
consent forms were collected from the schools by the research team. As the date of the study in each school approached a reminder letter was sent to parents asking them to return the form by a specified date if they wanted their child to take part. On completion of the study each child received a certificate of achievement. All recruitment was by opt-in by informed written parental consent. Each child was allocated a unique ID number to enable analysis at both an individual and school level.

In 2009-10 the same methods were used to inform the children about the study. However, due to both low consent (39\%) and completion rates (27\%) in 2007-8 by comparison to previous studies (1980, 1990, 2000), ${ }^{35-37}$ using identical recruitment methods, schools and children of the same age, where recruitment rates were $59-76 \%$ and completion rates $59-69 \%$, there were two major changes in this post-implementation phase (2009-10). First, an amendment to the ethics approval allowed a change in consent procedure from opt-in to an opt-out basis; (four of the five schools agreed to opt-out after opinion was sought from both Heads and Governors) however, despite ethical approval for opt-out one school preferred to remain in the study on parental opt-in consent only. This particular school remained supportive and keen to take part in the study; therefore, the decision was made to retain this school in the study despite the different consent procedure to the other schools. In the four schools following parent opt-out consent, children were asked to return the form to school if they did not want to participate in the study (Appendix 10.6); in the school remaining as opt-in children were asked to return the form if they did want to participate. Secondly, along with their certificate of achievement, all children completing the study were given a high street voucher to the value of $£ 10$ as a token of appreciation.

### 4.4.2 Data collection

The same dietary method previously validated in the 1999-00 survey was used. This method has been used extensively; validity of the method and reliability of the data obtained have been reported previously. ${ }^{35,37, ~ 39-41}$

Children were asked to record their own dietary intake in two 3-day food diaries with each 3-day dietary record being approximately six months apart. Three consecutive days were recorded in each diary with the second diary being different days from the first; children completed food records for a total of 4 weekdays and 2 weekend days.

Food diaries were designed to be pocket size. Diaries were given to each child by the nutritionist along with a description of what was required. The front cover of the food diary included child's ID, diary number (T1 or T2), and space to record the dates during which dietary information was to be collected. Instruction on how to complete the diary was given on the inside cover and the appointment date of collection was recorded on the first page. Each diary consisted of an example page and eight
pages on which to record intakes of food and beverages. Each page included: an area to record the day and date of study, time at which items were consumed, details of items consumed in terms of brand name, amount consumed excluding leftovers, and an area was reserved for 'office use' used by the nutritionist during the interview.

On the day following, or at most two days (to minimise memory lapse) after completion of each food diary, each child was interviewed by the study nutritionist. Interviews took place on an individual basis and were used to review the diary with the child to ensure all foods eaten over the three days had been recorded, and to clarify the information recorded in the diary such as legibility and obtain any missing detail on the type of foods recorded e.g. "Biscuit - chocolate or plain?", the time, place of intake and portion size consumed. Portion sizes were estimated using food models ${ }^{35,37-41}$ and a photographic food atlas for 11-14 year olds. ${ }^{42}$ Figure 5 provides a detailed overview of the process involved in collection of dietary data.


Figure 5: Process for data collection in middle schools

### 4.4.3 Data coding

## Data coding for calculating nutrient intake

All dietary coding for nutritional composition was completed using McCance and Widdowson Integrated Composition of Food Dataset. ${ }^{34}$ This dataset was incorporated into the ACCESS relational databases used for all data storage and analysis of nutrient and food group intake. Occasionally for some 'other' foods where no matching food composition code was available a product search was conducted using the three main supermarkets. This allowed nutrition information to be obtained and subsequently the food composition code best matching the nutritional composition of the item recorded used.

An Excel spreadsheet was created of all foods that had a brand name and could be given more than one food code according to their nutritional composition (e.g. Flora). This allowed standardisation of coding i.e. only checking once for comparable nutrition data and using one single code for that product throughout. Where dishes were made up of several components, each component was allocated the relevant food code from the database and the weights were calculated as a proportion of the total product weight.

## ‘School lunch' foods

In 2007-8 school lunch recipes were obtained from the local city council provider to five of the six schools. In 2007-8 one school had opted out of local city council catering but were unable to provide adequate school menu recipes, therefore, school lunch was coded using McCance \& Widdowson. In 2009-10 there was a change in school catering providers: two were city council and the remaining three were in-house catering. School lunch recipes were obtained from four of the five schools. As in 2007-8 for the school unable to provide adequate school menu recipes school lunch was coded using McCance \& Widdowson.

All school meals were entered onto Excel spread sheets including a food name, food code and nutrient analysis per 100 g . These were double checked and imported into the ACCESS database so that school recipes were used to determine nutrient intake from school meals. Occasionally a child had consumed an item at school for which a school meal recipe was not available due to either a change in the menu or to no school meal recipe available. These items were subsequently coded using McCance \& Widdowson.

## Data coding for calculating intake by food group: Primary and middle schools

In order to report food intake by food groups, for example fruit, vegetables, soft drinks etc. as well as by nutrient intake, all individual foods recorded were allocated a 'FAST' food group, that is, banana 'fruit'; hummus - 'beans and pulses' and quiche 'meat, fish, cheese and egg dish'. See Appendix 10.7.

### 4.5 Data processing and handling: Primary and middle schools

## Data quality checking

Identical methods of data collection and coding were used throughout the datasets. Two procedures were adopted to ensure consistency of food coding throughout these datasets.
i. An Excel spread sheet was created at the start of dietary data coding in 2007 containing all the food codes used/allocated to foods. This was referred to frequently to ensure the same code was allocated for these foods both in individual diaries and across the datasets.
ii. On completion of dietary coding an output of all food codes, weights and food groups allocated across the datasets was exported and interrogated. This enabled a check of consistencies across the datasets. Any inconsistencies were identified and changes were made to individual datasets.

In addition, all nutrients reported were checked for completeness in McCance and Widdowson Integrated Composition of Food Dataset. ${ }^{34}$ Any found to be incomplete e.g. saturated fat or non-milk extrinsic sugars were changed and corrected across all databases.

## Data entry

All data were entered onto separate but identical purpose-built ACCESS relational databases; one for each phase of the study (1999-00, 2007-8 and 2009-10 (middle schools) and 2003-4, 2007-8 and 2008-9 (primary schools)). This ensured individual records of children's information i.e. name, ID, DOB, address, dietary, anthropometry and any additional notes were stored together. Each child's dietary record allowed separation of days and timeslots for foods consumed at 'home' or 'school'. All databases were password protected for security; diaries were stored according to University policy and regulations.

## Data checking

## Primary schools

There were a number of in-built elements and range checks in the database to facilitate identification of errors and checking of data while entering. For example, as foods were selected and entered in each time slot a summary appeared to allow checking prior to saving the data entered and moving on to the next time slot. In addition, a sub-sample of diaries (20\%) from each of the three years were double entered. Any errors were dealt with by referring to the original diary and corrected accordingly on the database.

## Middle schools

Some simple checks built into the database ensured errors during entry were minimised. For example food codes were limited to a maximum of five digits.

Food codes were sorted by frequency to detect any unusual codes or foods with two codes for the same nutritional data. Frequency of food codes were sorted by weight to search for any unusually high or low weights for particular foods and amended if necessary. In addition, a sub-sample of diaries $(20 \%)$ from each of the three years were double entered. Any errors were dealt with by referring to the original diary and corrected accordingly on the database.

### 4.6 Anthropometric and socio-economic data collection: Primary and middle schools

## Anthropometry

Anthropometric measurements including height, weight, waist-circumference and percent body fat were obtained from children who had consented. Children were taken in small groups and before any measurements were obtained the exact procedure was explained to them along with a verbal agreement they were happy to proceed. Prior to anthropometric measurements children were asked to remove shoes, socks and any outdoor clothing to a single layer (i.e. shirt and trousers). Although children came in small groups measurements were taken individually behind a screen to respect confidentiality and privacy. One research assistant measured children to limit inter-observation error, the other person recorded date, time, child's name and ID onto a sheet with a record of all measurements and a print out of body composition from the Tanita ${ }^{T M}$ bio-impedance machine.

The least invasive procedure was carried out first:
i. Height using a portable Leicester Stadiometer measured to the nearest mm
ii. Weight and body composition using a Tanita ${ }^{\text {TM }}$ bio-impedance machine
iii. Waist circumference using a standard tape measure to the nearest mm .

Measurements were taken twice and an average calculated. Body Mass Index (BMI) was calculated as weight/height ${ }^{2}$. Overweight and obesity were defined using International Obesity Task Force cutoffs for overweight $25 \mathrm{~kg} / \mathrm{m}^{2}$ (Boys 17.55; Girls 17.34) and obese $30 \mathrm{~kg} / \mathrm{m}^{2}$ (Boys 19.78; Girls 19.65) in the 4-7 year olds and for the 11-12 year olds overweight $25 \mathrm{~kg} / \mathrm{m}^{2}$ (Boys 20.89; Girls 21.20) and obese $30 \mathrm{~kg} / \mathrm{m}^{2}$ (Boys 25.58; Girls 26.05). ${ }^{6}$ Primary school children were measured in conjunction with dietary data collection during visits to the different schools; middle school children were measured between T1 and T2.

## Socio-economic indicators

All schools taking part were asked to provide anonymous postcodes for all eligible children. SES was assessed using the Index of Multiple Deprivation (IMD). IMD is based on lower level super output areas and incorporates aspects such as health, crime, barriers to entering society, employment and the local environment ${ }^{43}$. IMD (as a deprivation score) was divided into quartiles - the least deprived being quartile one to the most deprived being quartile four. The representativeness of the recruited sample was assessed by comparing the IMD of those with dietary data against the total eligible sample

### 4.7 Statistical analyses

### 4.7.1 Preliminary analyses

For each age group, 4-7yrs (primary schools) and 11-12yrs (middle schools) there was data for total diet, lunch time diet only and food groups. Primary and middle schools were analysed separately and summary statistics were produced for all macro and micro nutrients at each of the three time points and according to whether a packed lunch or school lunch was consumed. Summary statistics were also produced for gender, IMD (as a deprivation score) age and BMI.

There were three time points for each of the age groups:
i. For 4-7 year olds; 2003-4 (baseline), 2007-8 (mid-implementation), 2008-9 (postimplementation).
ii. For 11-12 year olds; 1999-00 (baseline), 2007-8 (mid-implementation), 2009-10 (postimplementation).

Food and nutrient variables under consideration were:
i. Food: fruit and vegetable intake, fried chips, fizzy drinks, cordial/squash, confectionery, crisps and savoury snacks.
ii. Energy and nutrients: energy intake (kcal), percentage of energy from fat, saturated fat and non-milk extrinsic sugars, fat (g), saturated fat (g), carbohydrates (g), protein (g), non-starch polysaccharides $(\mathrm{g})$, non-milk extrinsic sugars $(\mathrm{g})$, sodium $(\mathrm{mg})$, calcium $(\mathrm{mg})$, vitamin $\mathrm{C}(\mathrm{mg})$, iron $(\mathrm{mg})$, zinc $(\mathrm{mg})$, vitamin $\mathrm{A}(\mu \mathrm{g})$ and folate $(\mu \mathrm{g})$.

### 4.7.2 Modelling analyses

The preliminary analyses described above consider effects of variables such as school lunch type, year and gender separately. This can lead to biases. Suppose, for example, that some variable has a higher mean for boys than girls and suppose also the proportion of girls who eat a packed lunch is higher than the proportion of boys who do likewise. It follows that the mean of the variable will inevitably be lower for those having a packed lunch simply due to the gender effect. To overcome this we fit linear mixed effect models (using xtmixed in Stata version 9). This allows the simultaneous effect of lunch type, year, gender and IMD to be assessed. We also use the random effects to allow for the effect of school. Residual plots were used to assess the adequacy of the models. Models were fitted for each of the above mentioned macro and micro nutrients for overall diet. This was done separately for primary school data and middle school data. School lunch/ packed lunch days were handled within child for both primary and middle schools.

In the primary school analysis it was consistently found that there was no significant difference in nutrient data between mid-implementation and post-implementation time points and so this data was combined for simplification of the analysis. In the middle school data this was not found to be the case and so the three time points remain throughout that analysis.

When fitting a series of complicated models to a large number of outcome variables the modelling strategy needs some care, so that substantive questions central to the project can be answered while not presenting so many results that it becomes difficult to distinguish between genuine effects and Type I errors. To this end our approach was guided by the following considerations.
i. The effects of principal interest were lunch type and year: call these Class $A$ effects. We also gave equal importance to the interaction between these effects. These effects are fully reported.
ii. Effects of no direct interest, such as gender and IMD, call these Class $B$ effects. These effects can be in the models because their presence will allow for biases, such as those mentioned above, and can make the analysis more precise. However, the significance of these effects was no direct interest and they are not reported.
iii. An intermediate class of effects is the interactions that might arise between an effect in Class A and an effect in Class B, such as a lunch type by IMD interaction or a gender by year interaction. These are reported if significant or close to significance (p close to 0.05 ). Given the number of analyses performed and the less central role of these effects in the whole analysis, substantial caution should be exercised in the interpretation of these effects. While the items reported may be of interest, independent corroboration should be sought for all but those which are very strongly significant.

## 5. Main findings in primary schools

This chapter reports the main findings from primary schools. The chapter begins with a presentation of preliminary analysis of dietary-related changes pre, mid and post-implementation of the school food policy in:
i. school and packed lunches,
ii. compliance of nutrient-based standards (only applicable to mid and post-implementation), and iii. total diet.

This is followed by an in-depth analysis using linear mixed effect models to allow for the simultaneous effect of lunch type, year, gender and IMD (sections 4.7 and 5.2). These analyses consider changes in nutrient intake. In the final section of this chapter we report changes in school lunch, packed lunch and in total diet by key food groups such as fruit, vegetables, high sugar drinks, and crisps. Throughout this chapter summary boxes are given at the end of key sections.

### 5.1 Primary schools: Preliminary analysis

This analysis included 6,648 days of observed dietary intake data collected from 1,662 children including three weekdays (school days) and one weekend day for each child. Table 1 shows both the total number of children and numbers of boys and girls included in the analysis at each of the three time points. In 2003-4 children were slightly younger than those in the second two surveys; there were no differences found in the ratio of boys to girls, mean BMI or IMD. See Appendix 10.8 for a flowchart detailing the percentage of children who completed at each time point along with reasons for exclusions in both school lunch and total diet analysis.

Table 1: Study sample characteristics in 4-7yr olds

|  | $\mathbf{2 0 0 3 - 4}$ | $\mathbf{2 0 0 7 - 8}$ | $\mathbf{2 0 0 8 - 9}$ |
| :--- | :---: | :---: | :---: |
| Total number | 407 | 614 | 641 |
| Boys | 198 | 293 | 322 |
| Girls | 209 | 321 | 319 |
| Mean Age (years) | 5.7 | 6.1 | 6.1 |
| Mean IMD | 27.3 | 26.9 | 26.3 |
| Mean BMI (wt/ht ${ }^{2}$ ) | 16.4 | 16.4 | 16.1 |

### 5.1.1 School and packed lunch: Changes in mean nutrient intakes 2003-4 to 2008-9

There were statistically significant changes in the mean daily intake of nutrients from both school and packed lunches pre and post-implementation of the school food policy (see Table 2). While there have been changes in both school and packed lunch across the three time points the greatest differences were observed in school lunches. Table 2 shows the direction of change in mean daily intakes for each of the individual nutrients by lunch type pre and post-implementation along with a pvalue (derived from an ANOVA) for the change over time.

## School lunches

Energy content in school lunches increased from 2003-4 to 2008-9 (448 to 497 kcal ; $\mathrm{p}<0.001$ ). However, it is important to note this value remains lower than the nutrient-based standard of the school food policy (Appendix 10.2) of $530 \pm 5 \%$ (kcal); energy remains the only nutrient where there is $5 \%$ flexibility above or below the recommended level. Despite this increase in mean intake of energy from a school lunch, there was a statistically significant decrease in \% energy from fat, saturated fat, NMES and absolute intakes of fat, saturated fat and NMES post-implementation ( $p<0.001$ for all nutrients listed) see Figure 6. Figure 6 shows individual changes within school and packed lunches across the three time points, the p-value derived from an ANOVA denotes change within lunch type. Over the same period mean intakes of carbohydrate, protein and NSP all increased ( $p<0.001$ for all three nutrients). There was also an important reduction in mean sodium intake (from 536 to 466 mg ; $\mathrm{p}<0.001$ ). Mean intakes of all the micronutrients - calcium, vitamin C, iron, zinc, vitamin A (retinol equivalents) and folate were found to be higher post-implementation ( $p<0.001$ for nutrients listed; see Table 2).

## Packed lunches

From 2003-4 to 2008-9 there was a statistically significant decrease in energy, \% energy from fat, saturated fat and NMES from packed lunches post-implementation ( $p<0.001, p<0.001, p=0.04$ and $p<0.001$ respectively). Mean intakes of fat, saturated fat and NMES also decreased ( $p<0.001$ for nutrients listed; see Figure 6). While there was a decrease in carbohydrate ( $p=0.005$ ) there was no change in mean intakes of protein pre and post-implementation. NSP intake increased across the time points $(p=0.02)$; there was an important reduction in mean intakes of NMES and sodium ( $p<0.001$ and $p=0.01$ respectively). With regard to micronutrients - only vitamin $C$ and vitamin $A$ had a statistically significant increase ( $p=0.01$ and $p=0.003$ respectively); there were no changes found in mean intakes of calcium, iron, zinc or folate (see Table 2).

## School and packed lunches

As reported above and as Figure 6 and Table 2 show there have been important changes in both school and packed lunches. However, it is evident that the greatest changes have been in school lunch with the differences between mean daily intakes of many nutrients between school and packed lunch increasing over time. This provides strong evidence of a widening gap between school and packed lunch since the implementation of the school food policy. This will be further elucidated in section 5.2.


Figure 6: Preliminary analysis of changes in mean intakes of \% energy from fat, saturated fat, NMES and fat $(\mathrm{g})$, saturated fat $(\mathrm{g})$ and NMES $(\mathrm{g})$ by lunch type from 2003-4 to 2008-9 in 4-7yr olds

Table 2: Preliminary analyses of change in mean intake of individual nutrients from school and packed lunches in 4-7yr olds from 2003-4 to 2008-9

| Nutrients | School Lunch |  |  |  |  |  |  | Packed Lunch |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{gathered} 2003-4 \\ (n=233) \end{gathered}$ |  | $\begin{aligned} & 2007-8 \\ & (n=321) \end{aligned}$ |  | $\begin{aligned} & 2008-9 \\ & (n=323) \end{aligned}$ |  | p-value | $\begin{gathered} 2003-4 \\ (n=152) \end{gathered}$ |  | $\begin{aligned} & 2007-8 \\ & (n=282) \end{aligned}$ |  | $\begin{gathered} 2008-9 \\ (n=309) \end{gathered}$ |  |  |
|  | mean | SD | mean | SD | mean | SD |  | mean | SD | mean | SD | mean | SD | p-value |
| Energy (kcals) | 448.4 | 103.61 | 508.6 | 105.72 | 497.4 | 111.04 | <0.001 | 539.0 | 128.30 | 487.6 | 120.06 | 499.4 | 116.39 | <0.001 |
| \% energy Fat | 39.2 | 4.54 | 25.7 | 5.80 | 28.3 | 6.00 | <0.001 | 37.1 | 6.42 | 34.6 | 7.01 | 34.4 | 6.69 | <0.001 |
| \% energy Sat Fat | 15.2 | 3.19 | 9.4 | 3.06 | 10.0 | 3.03 | <0.001 | 16.5 | 3.63 | 15.5 | 4.34 | 15.7 | 4.28 | 0.04 |
| \% energy NMES | 16.8 | 5.12 | 14.7 | 4.57 | 14.3 | 4.58 | <0.001 | 19.1 | 4.80 | 16.7 | 4.74 | 16.8 | 4.98 | <0.001 |
| Fat (g) | 19.6 | 5.39 | 14.7 | 4.88 | 15.7 | 4.93 | <0.001 | 22.3 | 6.90 | 18.9 | 6.31 | 19.3 | 6.38 | <0.001 |
| Saturated fat (g) | 7.6 | 2.36 | 5.4 | 2.26 | 5.5 | 2.04 | <0.001 | 9.9 | 3.32 | 8.5 | 3.24 | 8.8 | 3.30 | <0.001 |
| Carbohydrate (g) | 57.2 | 14.31 | 78.2 | 17.61 | 71.6 | 16.77 | <0.001 | 73.7 | 18.85 | 67.9 | 17.79 | 69.7 | 17.38 | 0.005 |
| Protein (g) | 14.3 | 3.68 | 20.0 | 4.19 | 19.3 | 5.03 | <0.001 | 15.4 | 5.22 | 15.6 | 5.57 | 16.1 | 5.08 | 0.37 |
| NSP (g) | 2.9 | 1.02 | 5.1 | 1.56 | 4.7 | 1.59 | <0.001 | 2.5 | 1.09 | 2.7 | 1.15 | 2.8 | 1.25 | 0.02 |
| NMES (g) | 11.4 | 5.62 | 12.5 | 5.12 | 10.7 | 4.73 | <0.001 | 27.9 | 11.50 | 23.5 | 11.53 | 23.9 | 11.34 | <0.001 |
| Sodium (mg) | 536.3 | 168.19 | 512.8 | 186.58 | 466.3 | 166.51 | <0.001 | 765.5 | 242.51 | 697.6 | 213.04 | 723.8 | 222.57 | 0.01 |
| Calcium (mg) | 135.9 | 62.02 | 166.8 | 67.98 | 166.3 | 69.40 | <0.001 | 215.3 | 92.83 | 210.3 | 91.89 | 218.4 | 94.06 | 0.58 |
| Vitamin C (mg) | 14.5 | 8.62 | 64.1 | 32.81 | 60.0 | 38.37 | <0.001 | 25.6 | 16.17 | 29.8 | 22.23 | 31.7 | 22.03 | 0.01 |
| Iron (mg) | 1.8 | 0.51 | 2.5 | 0.76 | 2.3 | 0.77 | <0.001 | 1.9 | 0.59 | 1.9 | 0.56 | 1.9 | 0.58 | 0.54 |
| Zinc (mg) | 1.4 | 0.49 | 1.9 | 0.67 | 1.7 | 0.62 | <0.001 | 1.5 | 0.61 | 1.4 | 0.53 | 1.5 | 0.56 | 0.48 |
| Vitamin A ( $\mu \mathrm{g}$ ) | 105.7 | 86.22 | 160.3 | 177.53 | 138.2 | 136.63 | <0.001 | 64.5 | 57.99 | 83.8 | 98.28 | 97.2 | 108.59 | 0.003 |
| Folate ( $\mu \mathrm{g}$ ) | 45.6 | 16.69 | 66.1 | 20.45 | 59.8 | 21.14 | <0.001 | 40.5 | 14.29 | 42.1 | 16.72 | 42.7 | 15.63 | 0.36 |

### 5.1.2 Compliance with food and nutrient-based standards

All 12 primary schools were assessed for compliance with food and nutrient-based standards for school meals. Food-based standards were fully implemented in all schools, though the standard pertaining to one portion of fruit per day per child was not recorded and observed in all primary schools. Out of the 12 primary schools, 11 were fully compliant with the nutrient-based standards by 2008-9. The nutrient-based analysis was based on information provided on a three week menu cycle. One school was not compliant with energy, saturated fat and sodium; these were all above the nutrient-based standards. Table 3 shows that in 2007-8, that is the interim period for the implementation of the school food policy, with the exception of energy, iron and zinc caterers had already implemented the changes required to achieve the nutrient-based standards. While Table 3 shows the planned provision of school lunch it was equally important to look at children's consumption against the nutrient-based standards. Table 4 shows the actual consumption of a school lunch against the nutrient-based standards; packed lunch has been included for comparison. It is clear that while the average school lunch consumed met the standards required this was not the case for packed lunch which failed to meet 11 of the 14 standards.

Table 3: Compliance with planned nutrient-based standards for school lunches in 2007-8 and 2008-9 in primary schools

| Nutrient-based standards for school lunch |  | 2007-8 |  | 2008-9 |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Value | Compliance | Value | Compliance |
| Energy (kcal) | 503.5-556.5 | 556.9 | $\times$ | 534.2 | $\checkmark$ |
| Fat (g) | 20.6 max | 18.7 | $\checkmark$ | 15.1 | $\checkmark$ |
| Saturated Fat (g) | 6.5 max | 5.6 | $\checkmark$ | 5.8 | $\checkmark$ |
| Carbohydrate (g) | 70.6 min | 80.8 | $\checkmark$ | 78.8 | $\checkmark$ |
| Protein (g) | 7.5 min | 20.9 | $\checkmark$ | 22.0 | $\checkmark$ |
| Fibre (g) | 4.2 min | 6.7 | $\checkmark$ | 5.7 | $\checkmark$ |
| NMES (g) | 15.5 max | 11.8 | $\checkmark$ | 12.6 | $\checkmark$ |
| Sodium (mg) | 499 max | 490.2 | $\checkmark$ | 441.8 | $\checkmark$ |
| Calcium (mg) | 193 min | 199.0 | $\checkmark$ | 284.4 | $\checkmark$ |
| Vitamin C (mg) | 10.5 min | 65.4 | $\checkmark$ | 68.7 | $\checkmark$ |
| Iron (mg) | 3.0 min | 2.8 | $\times$ | 3.5 | $\checkmark$ |
| Zinc (mg) | 2.5 min | 2.4 | $\times$ | 3.1 | $\checkmark$ |
| Vitamin A ( $\mu \mathrm{g}$ ) | 175 min | 380.8 | $\checkmark$ | 211.5 | $\checkmark$ |
| Folate ( $\mu \mathrm{g}$ ) | 53 min | 111.1 | $\checkmark$ | 110.7 | $\checkmark$ |

Table 4: Comparison of actual consumption in an average school lunch with packed lunch against nutrient-based standards in 4-7yr olds

| Nutrient-based standards for school lunch |  | 2008-9 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | School lunch |  |  | Packed lunch |  |  |
|  |  |  | ( $\mathrm{n}=323$ |  |  | ( $\mathrm{n}=309$ ) |  |
|  |  | mean | SD | Compliance | mean | SD | Compliance |
| Energy (kcal) | 503.5-556.5 | 497.4 | 111.04 | $\times$ | 499.4 | 116.39 | $\times$ |
| Fat (g) | 20.6 max | 15.7 | 4.93 | $\checkmark$ | 19.3 | 6.38 | $\checkmark$ |
| Saturated Fat (g) | 6.5 max | 5.5 | 2.04 | $\checkmark$ | 8.8 | 3.30 | $\times$ |
| Carbohydrate (g) | 70.6 min | 71.6 | 16.77 | $\checkmark$ | 69.7 | 17.38 | $\times$ |
| Protein (g) | 7.5 min | 19.3 | 5.03 | $\checkmark$ | 16.1 | 5.08 | $\times$ |
| Fibre (g) | 4.2 min | 4.7 | 1.59 | $\checkmark$ | 2.8 | 1.25 | $\times$ |
| NMES (g) | 15.5 max | 10.7 | 4.73 | $\checkmark$ | 23.8 | 11.34 | $\times$ |
| Sodium (mg) | 499 max | 466.3 | 166.51 | $\checkmark$ | 723.8 | 222.58 | $\times$ |
| Calcium (mg) | 193 min | 166.3 | 69.39 | $\times$ | 218.3 | 94.06 | $\checkmark$ |
| Vitamin C (mg) | 10.5 min | 60.0 | 38.37 | $\checkmark$ | 31.7 | 22.03 | $\checkmark$ |
| Iron (mg) | 3.0 min | 2.3 | 0.77 | $\times$ | 1.9 | 0.58 | $\times$ |
| Zinc (mg) | 2.5 min | 1.7 | 0.62 | $\times$ | 1.5 | 0.56 | $\times$ |
| Vitamin A ( $\mu \mathrm{g}$ ) | 175 min | 138.2 | 136.63 | $\times$ | 97.2 | 108.59 | $\times$ |
| Folate ( $\mu \mathrm{g}$ ) | 53 min | 59.8 | 21.14 | $\checkmark$ | 42.7 | 15.63 | $\times$ |

## Summary

School and packed lunch: Changes in mean nutrient intakes from 2003-4 to 2008-9 in 4-7yr olds

Key findings from preliminary analysis
$>$ Statistically significant decreases were found in \% energy from fat, saturated fat, NMES and sodium in both school and packed lunch.
$>$ A notable difference between school and packed lunches was a statistically significant increase in protein, NSP and all of the micro-nutrients measured in school lunch - a finding not observed in packed lunches.
> Planned school lunch menus were fully compliant with nutrient-based standards in 2008-9.
> Neither school nor packed lunch as actually consumed fully met the nutrient-based standards; the average school lunch did not meet 5 of the nutrient-based standards compared with the average packed lunch which did not meet 11 out of 14 nutrients.
$>$ The extent of change in mean nutrient intakes was greatest in school lunch.
$>$ There was strong evidence of a widening gap between the nutrient content of school and packed lunches post-implementation; with the average school lunch offering a healthier lunch than the average packed lunch.

### 5.1.3 Total diet: Changes in mean daily nutrient intakes 2003-4 to 2008-9

Although there was no change in the mean daily amount (weight g ) of food consumed over the three time points ( $p=0.06$ ), there was a statistically significant decrease in mean daily energy intake and \% energy derived from fat, saturated fat and NMES ( $\mathrm{p}<0.001$ for all) demonstrating a welcome reduction in energy, fat and NMES in children's diet (see Figure 7). Figure 7 shows the change in energy and \% energy from fat, saturated fat and NMES across the three time points, the $p$-value derived from an ANOVA denoting change over time. It should be noted that while there has been a decrease in \% energy from saturated fat and NMES these remain above the DRV of $11 \%$. ${ }^{24}$


Figure 7: Preliminary analysis of changes in mean daily energy intake (kcals), \% energy in fat, saturated fat and NMES in total diet from 2003-4 to 2008-9 in 4-7yr olds

Further changes in the post-implementation period was a statistically significant fall in mean daily intakes of fat, saturated fat, carbohydrate and NMES ( $p<0.001$ for all), while mean daily intakes of protein and NSP increased ( $p=0.02$ and $p<0.001$ respectively; see Table 5). In addition, there was a welcome fall in the mean daily intake of sodium over time (from 1989 to $1851 \mathrm{mg}, \mathrm{p}<0.001$; however, this is still well above the $\mathrm{RNI}^{24}$ of 700 mg ). Mean daily intakes of vitamin C and vitamin A increased
( $\mathrm{p}<0.001$ ). There was no evidence of change in mean daily intakes of calcium, iron or zinc postimplementation (see Table 5). Iron and calcium intakes were above the $\mathrm{RNI}^{24}$ in 2003-4 and remained so. Mean daily intake of zinc was below the $\mathrm{RNI}^{24}$ in 2003-4 and remained below postimplementation. Overall these findings show that in the post-implementation period (2008-9) children consumed a diet which was less energy dense and lower in fat, saturated fat and NMES but had a higher micronutrient intake; that is, children consumed a diet of higher nutrient density or nutrient quality. It must be remembered that change in school food policy affects only those children having a school lunch and is only one of the potential influences for change in children's diet between 2003-4 and 2008-9.

Table 5: Preliminary analysis of change in mean daily nutrient intakes from 2003-4 to 2008-9 in 4-7yr olds

| Nutrients | $\begin{aligned} & \hline 2003-4 \\ & (n=407) \end{aligned}$ |  | $\begin{aligned} & \hline 2007-8 \\ & (n=614) \end{aligned}$ |  | $\begin{aligned} & \hline 2008-9 \\ & (n=641) \end{aligned}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | mean | SD | mean | SD | mean | SD | p-value |
| Energy (kilocalories) | 1580.7 | 311.60 | 1449.0 | 277.67 | 1436.8 | 270.92 | <0.001 |
| \% energy Fat | 33.8 | 3.68 | 31.2 | 3.90 | 31.5 | 3.84 | <0.001 |
| \% energy Saturated Fat | 14.4 | 2.19 | 13.4 | 2.34 | 13.4 | 2.36 | <0.001 |
| \% energy NMES | 17.7 | 5.12 | 15.6 | 4.74 | 15.6 | 4.98 | <0.001 |
| Fat (g) | 59.4 | 13.46 | 50.3 | 12.21 | 50.5 | 11.94 | <0.001 |
| Saturated fat (g) | 25.3 | 6.40 | 21.7 | 6.10 | 21.6 | 5.97 | <0.001 |
| Carbohydrate (g) | 228.2 | 49.94 | 212.8 | 42.78 | 208.5 | 42.39 | <0.001 |
| Protein (g) | 47.4 | 9.72 | 49.1 | 10.51 | 48.9 | 10.03 | 0.02 |
| Non-starch polysaccharides (g) | 8.8 | 2.56 | 9.9 | 3.00 | 9.4 | 2.88 | <0.001 |
| Non-milk extrinsic sugars (g) | 75.9 | 30.97 | 60.8 | 23.38 | 60.0 | 23.80 | <0.001 |
| Sodium (mg) | 1988.9 | 469.08 | 1844.7 | 439.44 | 1850.5 | 452.70 | <0.001 |
| Calcium (mg) | 683.8 | 204.15 | 687.8 | 212.68 | 684.6 | 211.20 | 0.94 |
| Vitamin C (mg) | 81.7 | 41.66 | 107.6 | 50.12 | 105.5 | 49.45 | <0.001 |
| Iron (mg) | 6.8 | 1.62 | 7.0 | 1.72 | 6.8 | 1.71 | 0.21 |
| Zinc (mg) | 4.9 | 1.19 | 5.0 | 1.25 | 4.9 | 1.18 | 0.23 |
| Vitamin A ( $\mu \mathrm{g}$ ) | 300.8 | 157.16 | 369.9 | 201.60 | 358.2 | 191.07 | <0.001 |
| Folate ( $\mu \mathrm{g}$ ) | 163.2 | 46.47 | 172.6 | 48.21 | 166.4 | 44.44 | 0.004 |

### 5.1.4 Effect of gender on total diet

Gender was found to have a statistically significant effect on 14 of the 17 nutrients. Girls were found to have a higher mean daily nutrient intake than boys in \% energy from fat and saturated fat ( $p<0.001$ and $\mathrm{p}=0.005$ ). Girls had less absolute intakes of fat, saturated fat, NMES and sodium - all nutrients where a lower intake is desirable. Aside from this they had lower mean daily intakes in all micronutrients than boys suggesting, on average, girls consumed a less healthy diet than boys. Table 6 shows mean daily nutrient intakes by boys and girls along with individual $p$-values for difference between genders.

Table 6: Mean total daily nutrient intake by gender in 4-7yr olds

| Nutrients | $\begin{gathered} \text { Boys } \\ (n=813) \end{gathered}$ |  | $\begin{aligned} & \text { Girls } \\ & (n=849) \end{aligned}$ |  | $p$-value |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  |
|  | mean | SD | mean | SD |  |
| Energy (kcal) | 1534.4 | 297.86 | 1421.1 | 270.76 | <0.001 |
| \% energy from Fat | 31.6 | 3.91 | 32.3 | 3.99 | <0.001 |
| \% energy from Saturated Fat | 13.5 | 2.41 | 13.8 | 2.28 | 0.005 |
| \% energy from NMES | 15.9 | 4.98 | 16.3 | 5.02 | 0.129 |
| Fat (g) | 54.1 | 13.34 | 51.2 | 12.54 | <0.001 |
| Saturated Fat (g) | 23.2 | 6.65 | 21.9 | 5.94 | <0.001 |
| Carbohydrate (g) | 224.5 | 46.47 | 205.7 | 41.74 | <0.001 |
| Protein (g) | 50.8 | 10.41 | 46.5 | 9.43 | <0.001 |
| NSP (g) | 9.9 | 3.14 | 9.0 | 2.52 | <0.001 |
| NMES (g) | 65.9 | 27.03 | 62.6 | 25.76 | 0.011 |
| Sodium (mg) | 1976.6 | 479.03 | 1791.9 | 412.81 | <0.001 |
| Calcium (mg) | 713.9 | 218.94 | 658.5 | 197.27 | <0.001 |
| Vitamin C (mg) | 103.4 | 51.91 | 97.6 | 46.05 | 0.016 |
| Iron (mg) | 7.2 | 1.82 | 6.5 | 1.48 | <0.001 |
| Zinc (mg) | 5.2 | 1.26 | 4.8 | 1.13 | <0.001 |
| Vitamin A ( $\mu \mathrm{g}$ ) | 356.5 | 192.81 | 340.8 | 185.84 | 0.092 |
| Folate ( $\mu \mathrm{g}$ ) | 176.0 | 49.23 | 160.2 | 42.29 | <0.001 |

## Summary

Total diet: Changes in mean nutrient intakes from 2003-4 to 2008-9 in 4-7yr olds

Key findings from preliminary analysis
> Statistically significant reductions were observed in the mean daily \% energy derived from fat, saturated fat and NMES and in absolute intakes of fat, saturated fat, NMES and sodium.
> Post-implementation children's diets were on average of a lower energy density but had a higher nutrient density; statistically significant increases were found in mean daily intakes of protein, NSP, vitamin C, vitamin A and folate.
$>$ Gender was found to have a statistically significant effect on total diet: girls had less energy but a higher \% energy from fat, saturated fat and NMES; they also had a lower intake of micronutrients suggesting that girls consumed a less healthy diet than boys.
$>$ The school food policy and so change in school lunch can only affect those children consuming a school lunch, therefore, is only one potential contributor to these positive changes observed in total diet of 4-7yr old children.

### 5.2 Modelling analysis

### 5.2.1 The effect of year on total diet

Post-implementation of the school food policy there was a decrease in mean \% energy derived from NMES and in the mean daily absolute intake of fat, saturated fat, NMES and sodium intake when compared with the mean daily intakes recorded pre-implementation in 2003-4. Mean daily intakes of vitamin A increased post-implementation see Table 7 for changes in mean daily intakes by year with mean difference (change), $95 \%$ Confidence Intervals (CI) and p-values for individual nutrients). As there were no statistically significant differences found between 2007-8 and 2008-9 the results from these two time points have been grouped and are presented as 2007-9.

Table 7: Effect of year on total diet: Changes in mean, mean difference, $95 \% \mathrm{Cl}$ and p -value for $\%$ energy NMES, fat (g), saturated fat (g) NMES (g) sodium (mg) and vitamin A $(\mu \mathrm{g})$ in 4-7yr olds

| Nutrient $^{+}$ | Mean $^{\top}$ |  | Mean <br> Difference <br> $(B-A)$ | $95 \%$ Cl | p-value |
| :--- | :---: | :---: | :---: | :---: | :---: |
|  | $2003-4(A)$ | $2007-9(B)$ | -2.3 | $-2.85,-1.74$ | $<0.001$ |
| \% energy NMES | 18.0 | 15.7 | -9.4 | $-10.78,-8.03$ | $<0.001$ |
| Fat (g) | 60.2 | 50.8 | -3.9 | $-4.60,-3.25$ | $<0.001$ |
| Saturated Fat (g) | 25.6 | 21.7 | -16.2 | $-19.03,-13.35$ | $<0.001$ |
| NMES (g) | 77.4 | 61.2 | -143.9 | $-192.37,-95.45$ | $<0.001$ |
| Sodium (mg) | 1996.5 | 1852.6 | 61.4 | $39.92,83.06$ | $<0.001$ |
| Vitamin A ( $\mu \mathrm{g})$ | 299.9 | 361.3 |  |  |  |

+ DRV/RNI's where applicable: \% energy NMES (11\%), sodium ( 700 mg ) and vitamin A ( $400 \mu \mathrm{~g}$ )
${ }^{\dagger}$ Mean adjusted for gender and lunch type


### 5.2.2 The effect of lunch type on total diet

There was a statistically significant difference in mean total \% energy from NMES and mean daily intakes of absolute fat, saturated fat, NMES, and sodium in children who consumed a school lunch compared with those having a packed lunch (see Table 8 for $95 \% \mathrm{CI}$ and p -values); all nutrients for which a reduction in intake is recommended as per the Department of Health (1991) DRV's and RNI's. ${ }^{24}$ Children who consumed a packed lunch had a higher mean daily intake of these nutrients although they also had a higher calcium intake. Table 8 shows mean daily intakes by lunch type along with the mean difference (change), $95 \% \mathrm{Cl}$ and p -values for this difference in each nutrient.

Table 8: Effect of lunch type on total diet: Mean, mean difference, $95 \% \mathrm{Cl}$ and p -values for $\%$ energy NMES, fat (g), saturated fat (g), NMES (g), sodium (mg) and calcium (mg)in 4-7yr olds

| Nutrient $^{+}$ | Mean |  | Mean difference <br> $(P L-S L)$ | $\mathbf{9 5 \% ~ C I}$ | p-value |
| :--- | :---: | :---: | :---: | :---: | :---: |
|  | SL | PL |  |  |  |
| \% energy NMES | 15.1 | 17.5 | 2.4 | $1.94,2.91$ | $<0.001$ |
| Fat (g) | 52.2 | 54.0 | 1.8 | $0.57,2.98$ | 0.004 |
| Saturated Fat (g) | 21.9 | 23.6 | 1.7 | $1.12,2.30$ | $<0.001$ |
| NMES (g) | 61.0 | 70.0 | 9.0 | $6.49,11.47$ | $<0.001$ |
| Sodium (mg) | 1840.2 | 1941.8 | 101.6 | $59.17,144.12$ | $<0.001$ |
| Calcium (mg) | 673.2 | 698.0 | 24.8 | $4.54,44.97$ | 0.016 |

${ }^{+}$DRV/RNI's where applicable: \% energy NMES (11\%), NMES (60g), sodium (700mg) \& calcium (450mg)

### 5.2.3 The effect of year and children's lunch type on total diet

For 10 out of 17 nutrients the effect of lunch type, i.e. the mean difference between school lunch and packed lunch, was statistically significant post-implementation compared with the effect in 2003-4. The following presents changes in the mean daily intake of each of these nutrients.

## Energy

From 2003-4 to 2007-9 there was a decrease in overall mean daily energy intake in children regardless of lunch type, however, the greatest decrease was seen in those children consuming a packed lunch (see Figure 8). Figure 8 shows that in 2003-4, children who consumed a packed lunch had a higher mean daily energy intake compared with children consuming a school lunch; in 2007-9 this was reversed. Post-implementation children consuming a school lunch had a higher mean daily energy intake. In 2003-4 the difference in energy intake between children consuming a packed lunch and school lunch was greater than post-implementation. See Table 9 for mean, mean differences by year and the change in the effect of lunch type with $95 \% \mathrm{Cl}$ and $p$-values.


Figure 8: Interaction between year and lunch type on mean daily energy intake (kcals) in 4-7yr olds

## Percent of energy from fat and saturated fat

Figure 9 (A) shows that from 2003-4 to 2007-9 there was a decrease in \% energy derived from fat in the total diet; children who consumed a school lunch had a greater decrease. It is evident that in 2003-4 children who consumed a school lunch had a higher mean daily \% energy from fat than those consuming a packed lunch; in 2007-9 this reversed. Post-implementation children consuming a packed lunch had a higher mean \% energy from fat than children taking a school lunch. The difference between a school lunch and packed lunch and so the impact of school lunch type on total diet also increased (see Table 9). In 2007-9 children having a school lunch had a total dietary intake that was $2.5 \%$ lower in fat and $1.2 \%$ lower in saturated fat than their peers having a packed lunch. These differences were found to be significant $(95 \% \mathrm{CI} 1.60,3.36 ; \mathrm{p}<0.001$ and $0.65,1.70, \mathrm{p}<0.001$ respectively).

Similar to what has been shown in energy and \% energy from fat, there has been an overall decrease in mean daily \% energy from saturated fat. Figure 9 (B) shows that while there was an overall decrease in the \% energy derived from saturated fat this decrease was greatest in children consuming a school lunch. In 2003-4 children who consumed a packed lunch had a higher mean intake of \% energy from saturated fat and this continues post-implementation. The effect of lunch type on mean daily \% energy intake from saturated fat increased post-implementation (Table 9).


Figure 9: Interaction between year and lunch type on mean daily \% energy from fat and saturated fat in 4-7yr olds

## Carbohydrate and protein

Figure $10(A)$ shows a similar pattern of an overall decrease in mean daily carbohydrate intake from 2003-4 to 2007-9. It is apparent that this decrease was greatest in children consuming a packed lunch compared with those consuming a school lunch. In 2003-4 children who consumed a packed lunch had a higher mean daily intake of carbohydrate in their total diet compared to those consuming a school lunch; post-implementation this reversed; children who consumed a school lunch had a higher mean daily carbohydrate intake than those consuming a packed lunch. There was also a reduction in the difference in carbohydrate by lunch type. This observation in the context of the significant fall in NMES described above and the increase in NSP below ${ }^{24}$ demonstrates that this increase in carbohydrate in school lunch was due to a desirable increase in complex carbohydrate at the expense of NMES and fat.

Figure 10 ( $B$ ) shows that in 2003-4 there was no difference in mean total daily protein intake in children regardless of lunch type consumed. By 2007-9 children who consumed a school lunch had a significant increase in mean total daily protein intake while in contrast for children consuming a packed lunch a decrease was evident. While in 2003-4 there was no difference in protein intake by lunch type by 2007-9 this difference was significant with children consuming school lunch having the higher intake ( $4 \mathrm{~g} 95 \% \mathrm{Cl} 1.82,6.35$; $\mathrm{p}<0.001$ ).


Figure 10: Interaction between year and lunch type on mean daily carbohydrate ( g ) and protein ( g ) intake in 4-7yr olds

## Non-starch polysaccharides

From 2003-4 to 2007-9 there was an increase in overall mean NSP intake in children, the greatest increase being in those children consuming a school lunch (see Figure 11). Figure 11 shows that in 2003-4 children who consumed a school lunch had a higher mean daily intake of NSP compared with children consuming a packed lunch; post-implementation this continued. Post-implementation there was an increase in the difference in mean daily NSP intake by lunch type; this was statistically significant (Table 9).


Figure 11: Interaction between year and lunch type on mean daily NSP intake $(\mathrm{g})$ in 4-7yr olds

## Vitamin C and iron

From 2003-4 to 2007-9 there was an increase in mean daily intake of vitamin $C$ in children regardless of lunch type, however, the greatest increase was in those children consuming a school lunch (see Figure 12 (A)). In 2003-4 mean daily intake of vitamin $C$ was higher in children who consumed a packed lunch; post-implementation this had reversed with children consuming a school lunch having a higher mean daily intake of vitamin C. This difference of 40 mg in mean daily vitamin C intake between a child consuming a school lunch or packed lunch was significant (95\% $\mathrm{Cl} 28.73,50.21$; $\mathrm{p}<0.001$ ).

From Figure 12 (B) it can be seen that in 2003-4 children who consumed a packed lunch had a higher mean daily intake of iron than children who consumed a school lunch. Post-implementation this was reversed with children consuming a school lunch having a higher mean daily intake of iron. The
difference in mean daily iron intake between a child consuming a school lunch or packed lunch was significant ( $0.6 \mathrm{mg}, 95 \% \mathrm{Cl} 0.17,0.92 ; \mathrm{p}=0.005$ ) (Table 9).


Figure 12: Interaction between year and lunch type on mean daily vitamin C ( mg ) and iron ( mg ) intake in 4-7yr olds

## Zinc \& folate

In 2003-4 children who consumed a school lunch had a higher mean daily intake of zinc compared with children consuming a packed lunch. Figure $13(A)$ shows that post-implementation this continued to be true; children consuming a school lunch had an increase in daily zinc intake, in contrast, there has been a decrease for those children consuming a packed lunch. Post-implementation there was an increase in the difference in mean daily zinc intake by lunch type (Table 9).

The same pattern observed in intakes of zinc was observed for mean daily folate intake. In 2003-4 children who consumed a school lunch had a higher mean daily intake of folate compared with children consuming a packed lunch. Figure $13(B)$ shows that post-implementation this continued to be true; children consuming a school lunch had an increase in daily folate intake (pre to postimplementation) while, in contrast, there was a decrease in intake for those children consuming a packed lunch. Post-implementation there was an increase in the difference in mean daily folate intake by lunch type (Table 9).


Figure 13: Interaction between year and lunch type on mean daily zinc ( mg ) and folate $(\mu \mathrm{g})$ intake in 4-7yr olds

Table 9: Effect by year \& lunch type on total diet: Changes in mean, mean difference, difference of the difference, $95 \% \mathrm{Cl}$ and p -value on energy (kcals), $\%$ energy from fat, \% energy from saturated fat, carbohydrate (g), protein (g), NSP (g), iron (mg), vitamin C (mg), zinc (mg) and folate ( $\mu \mathrm{g}$ ) in 4-7 yr olds

| Nutrient ${ }^{+}$ | Mean ${ }^{\dagger}$ |  |  |  | Mean Difference (between lunch type) |  | Difference* of difference(B-A) | 95\% CI | p-value dif of dif |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 2003-4 |  | 2007-9 |  | 2003-4 | 2007-9 |  |  |  |
|  | SL | PL | SL | PL | (PL-SL) (A) | (PL-SL) (B) |  |  |  |
| Energy (kcals) | 1566.9 | 1626.6 | 1465.2 | 1431.9 | 59.7 | -33.3 | -93.0 | -155.63, -30.50 | 0.004 |
| \% energy Fat | 34.1 | 33.4 | 30.4 | 32.2 | -0.7 | 1.8 | 2.5 | 1.60, 3.36 | <0.001 |
| \% energy Saturated Fat | 14.3 | 14.5 | 12.7 | 14.1 | 0.2 | 1.4 | 1.2 | 0.65, 1.70 | <0.001 |
| Carbohydrate (g) | 224.4 | 236.8 | 215.4 | 207.6 | 12.4 | -7.8 | -20.2 | -30.05, -10.34 | <0.001 |
| Protein (g) | 47.8 | 47.8 | 50.8 | 46.8 | 0.0 | -4.0 | -4.0 | -6.35, -1.82 | <0.001 |
| NSP (g) | 8.7 | 8.5 | 10.5 | 8.8 | -0.2 | -1.7 | -1.5 | -2.21, -0.96 | <0.001 |
| Vitamin C (mg) | 75.5 | 88.4 | 117.7 | 91.2 | 12.9 | -26.5 | -39.4 | -50.21, -28.73 | <0.001 |
| Iron (mg) | 6.8 | 6.9 | 7.1 | 6.6 | 0.1 | -0.5 | -0.6 | -0.92, -0.17 | 0.005 |
| Zinc (mg) | 5.0 | 4.9 | 5.1 | 4.8 | -0.1 | -0.3 | -0.2 | -0.56, -0.01 | 0.04 |
| Folate ( $\mu \mathrm{g}$ ) | 165.0 | 162.0 | 178.0 | 159.2 | -3.0 | -18.8 | -15.8 | -26.03, -5.00 | 0.004 |

${ }^{+}$DRV/RNI's where applicable: \% energy fat (35\%), \% energy saturated fat ( $11 \%$ ), protein ( 19.7 g ), vitamin C ( 30 mg ), iron ( 6.1 mg ), zinc ( 6.5 mg ) \& folate ( $100 \mu \mathrm{~g}$ )
${ }^{\dagger}$ Mean for energy, \% energy from fat, saturated fat and carbohydrate adjusted for gender; protein, NSP, iron, vitamin C, zinc and folate adjusted for gender and IMD

* Difference of the difference $=$ mean difference 2007-9 (PL-SL) - 2003-4 (PL-SL)


### 5.2.4 Intermediate effects

As previously mentioned, given the number of analyses performed and the less central role of these effects in the whole analysis, substantial caution should be exercised in the interpretation of these effects. While the items reported may be of interest, independent corroboration should be sought for all but those which are very strongly significant. Keeping that in mind the following interactions are presented with the anticipation that in future work we hope to investigate the possible existence and interpretability of higher order interactions between these variables - lunch type, year and IMD.

## The effect of gender and lunch type on total diet

For only one of the nutrients - vitamin $A$, the effect of lunch type i.e. the mean difference between a school lunch and packed lunch was different in boys and girls. As can be seen from Figure 14 (A), boys consuming a school lunch had a higher vitamin A intake than those eating a packed lunch (mean difference 27 g ). The situation in girls was similar, but here the difference was larger (mean difference 77 g ). The difference between these two changes, 50 mg , was significant ( $\mathrm{Cl} 14.3,86.2 ; \mathrm{p}=0.006$ ).

## The effect of gender and year on total diet

For only one of the nutrients - NSP, gender and year had an effect on total diet. As can be seen from Figure 14 (B) both boys and girls mean daily intake of NSP increased from 2003-4 to postimplementation. The greatest difference between 2003-4 and 2007-9 in mean daily intake of NSP was in boys (mean difference 1.9 g ) compared to girls (mean difference 1.1 g ), the difference between this change, 79 g , was significant ( $0.18,1.40 ; \mathrm{p}=0.01$ ).


Figure 14: Interaction between gender and lunch type on vitamin A $(\mu \mathrm{g})$ and interaction between gender and year on NSP $(\mathrm{mg})$ in 4-7yr olds

## The effect of IMD and year on total diet

For three of the nutrients: energy, fat and NMES there was an interaction between IMD and year. As Figure 15 shows in 2003-4 the mean daily intake for energy, fat and NMES was less in the least deprived quartile (quartile 1) compared with the other three quartiles. Post-implementation while children's mean daily intake from these nutrients have decreased in all four quartiles, children in the least deprived quartile (quartile 1) had more mean daily intake from energy, fat and NMES than those in the most deprived quartile (quartile 4). For each of these nutrients this difference was of borderline significance (see Table 10).


Figure 15: Difference in effect between IMD and year on energy (kcals), fat ( g ) and NMES ( g ) mean daily intake in 4-7yr olds

Table 10: Difference in effect of IMD on energy (kcals), fat (g) and NMES (g) in mean daily total diet intake in 4-7yr olds

| Nutrient | Change 2003-4 to 2007-9 |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: |
|  | IMD quartile 1 | IMD quartile 2 | IMD quartile 3 | IMD quartile 4 | p-value |
| Energy (kcal) | -24.5 | -106.1 | -136.0 | -152.0 | 0.059 |
| Fat (g) | -5.9 | -9.6 | -11.6 | -10.8 | 0.053 |
| NMES (g) | -10.0 | -16.0 | -18.3 | -21.9 | 0.068 |

## Summary

The effect of year, lunch type and IMD from 2003-4 to 2007-9 in 4-7yr olds

Key findings from modelling analysis

Year and lunch type
$>$ The most important finding from this analysis was the interaction between year and lunch type in total dietary intake. This clearly shows that the effect of lunch type on total diet of children changed pre to post-implementation of the school food policy, and so, gives us a measure of the impact of school food policy on change in total diet separate from change in any other factors which influence children's food intake.
> There was a significant interaction by year and lunch type in energy, \% of energy from fat, saturated fat and intakes of NMES, protein, carbohydrate, NSP, vitamin C, iron, zinc and folate. For all these nutrients post-implementation, despite improvements in the nutrient quality of packed lunch, the total diet of children having a school lunch was more in line with recommendations than those children having a packed lunch.
> For some nutrients, notably, \% energy from fat, protein, iron and vitamin C, this represented a reversal of the situation which had previously existed, that is, pre-implementation children having a packed lunch had the more favourable intakes, but by 2007-9 (post-implementation), children having a school lunch had the more favourable diet.
$>$ For other nutrients, notably, \% energy from saturated fat, NSP, zinc and folate, children having school lunch pre-implementation had the more favourable intake, this continued to be the case post-implementation, though, for all of the nutrients the difference between those having school lunch and packed lunch had increased significantly.

Year and IMD
> Also of note, though of borderline significance and so to be treated with caution, is the indication of interaction between year and IMD in total dietary intake. In 2003-4 children from least deprived households had lower intakes of energy but also of fat and NMES; in 2007-9 this had reversed, and suggests that the children from the more deprived households may have reduced their intake of fat and NMES more than their less deprived peers.

### 5.3 Food group analysis

## Primary schools

The analysis thus far has focused on nutrients, of further interest was to examine the changes in certain foods consumed pre and post-implementation. This section provides a descriptive overview of the change in intake of seven food groups (see Figure 16 or Appendix 10.9) in school and packed lunch and in total diet. These food groups were selected as they are important in the overall nutritional quality of children's food intake and they were targets for change in the implementation of the school food policy. Food group data have been presented in two ways. First, by the proportion of children who reported eating any food from any given food group in the four days recorded in 2003-4 and in 2009-10, that is the 'per cent of consumers'. Secondly, we report the mean daily portions of foods in each food group eaten by these consumers. No further statistical analysis has been undertaken.

## School lunch

The pattern of change observed in school lunch from 2003-4 to 2008-9 reflects that observed in nutrient data (section 0 ). There was a fall in percentage of children having fried chips from 63 to $54 \%$ ( 9 percentage points), confectionery (17 percentage points), crisps (1 percentage point), fizzy drinks ( 1 percentage point) and cordial/squash (16 percentage points). These changes indicate adherence of school lunch to the food based standards (section 5.1.2), that is, no child in 2008-9 had a fizzy drink or crisps at school lunch. Along with this decrease in percentage of children having fried chips, confectionery, crisps and fizzy drinks there was a decrease in mean daily portions eaten by those children who did consume food in these groups ( 0.4 to $0.3,0.7$ to $0.5,0.4$ to 0 and 0.3 to 0 respectively). The proportion of children eating both fruit and vegetables increased by $30 \%$ postimplementation of school food policy, mean daily portions of fruit and vegetables consumed also increased ( 0.5 to 0.6 and 0.6 to 0.8 respectively in 2008-9). The exception to these positive changes was cordial/squash, while fewer children in 2008-9 had cordial/squash at school lunch, those children who did had an increase in mean daily portions compared to 2003-4 (increased to 0.7 from 0.4). While fruit intake did increase in a school lunch, both in terms of $\%$ of children having fruit and the mean number of daily portions eaten, this remained less than that consumed in an average packed lunch.

## Packed lunch

Although there are no food based standards for packed lunches, there were improvements in the foods in a packed lunch, reflecting the fact some schools adopt a no fizzy drink or sweets in lunch box rule (see section 7.5.5). The percentage of children having confectionery, crisps, fizzy drinks and cordial/squash in their packed lunch fell ( $24,31,7$ and 14 percentage points respectively). In contrast
to school lunch where there was a decrease in both percentages of children eating these food and mean daily portions consumed by those children eating these foods, in a packed lunch, there was very little change in mean daily portions. The exceptions to this were fizzy drinks and squash; despite a fall of 7 and 14 percentage points respectively in children having fizzy drinks and squash, mean daily portions by those still having these in their packed lunch increased ( 0.6 to 0.7 for both). Both fruit and vegetables increased in terms of percentage of children consuming, though not as much as in school lunch ( 23 and 25 percentage points respectively). Despite packed lunches having less of an increase in fruit than school lunch, there was a greater percentage of children consuming fruit in their packed lunch compared with school lunch ( $77 \% \mathrm{v} 51 \%$ ) and a higher number of mean daily portions consumed ( 0.8 in packed lunch $v 0.6$ in school lunch) in 2008-9. While mean daily portions of fruit increased there was no change in mean daily portions of vegetables in 2008-9.

## Total diet

From 2003-4 to 2008-9 there has been a fall in the percentage of children eating fried chips from 66 to $55 \%$ (a fall of 11 percentage points), confectionery ( 2 percentage points), crisps ( 15 percentage points), fizzy drinks ( 26 percentage points) and cordial/squash ( 6 percentage points) in their total diet reported over 4 days. Fruit and vegetable consumption both increased ( 6 and 16 percentage points respectively). This direction of change was reflected in mean daily portions eaten by those children who consumed food in these groups. For example, for those children who reported eating fried chips the number of portions they consumed reduced ( 0.5 to 0.4 ), and for children reporting eating fruit or vegetables the number of portions consumed increased ( 1.4 to 1.7 and 1.1 to 1.5 respectively; Figure 16).


Figure 16: Preliminary analysis of changes in food groups from 2003-4 to 2009-10 in 4-7yr olds

## Summary <br> Food group analysis: Changes from 2003-4 to 2008-9 in 4-7yr olds

Key findings
School lunch
> In school lunch there was a fall in the percentage of children consuming fried chips, confectionery, crisps, fizzy drinks and cordial/squash and an increase in the percentage of children consuming fruit and vegetables.
> In children consuming these foods there was a reduction in mean daily portions consumed of fried chips, confectionery, crisps and fizzy drinks; this is not the case for cordial/squash where there was an increase observed.
> These findings reflect the adherence to food based standards of the school food policy, that is, no child had a fizzy drink or crisps at lunch time.

Packed lunch
> There were also positive changes observed in packed lunch - the percentage of children consuming confectionery, crisps, fizzy drinks or cordial/squash fell while the percentage of children consuming fruit and vegetables had also increased.
> In contrast to school lunch there was no change in mean daily portions consumed by children having confectionery or vegetables, however, there was a small increase in the mean daily portions eaten by those children consuming fruit, fizzy drinks and cordial/squash and a small decrease in mean daily portions of crisps consumed.
> Although there is no formal policy for packed lunches our findings reflect the fact that some schools adopted a no fizzy drink or 'sweets' in lunch box approach.

Total diet
> In the total diet there was a fall in the percentage of children consuming fried chips, confectionery, crisps, fizzy drinks and cordial/squash and an increase in the percentage of children consuming fruit and vegetables. In children consuming these foods there was also a small reduction in mean daily portions of fried chips, confectionery, crisps and fizzy drinks consumed and a small increase in the mean daily portions of fruit and vegetables.

## 6. Main findings in middle schools

This chapter reports the main findings from middle schools. The chapter begins with a presentation of preliminary analysis of dietary-related changes pre, mid and post-implementation of the school food policy in:
iv. school and packed lunches,
v. compliance of nutrient-based standards (only applicable to mid and post-implementation), and vi. total diet.

This is followed by an in-depth analysis using linear mixed effect models to allow for the simultaneous effect of lunch type, year, gender and IMD (sections 4.7 and 6.2). These analyses consider changes in nutrient intake. In the final section of this chapter we report changes in school lunch, packed lunch and in total by key food groups such as fruit, vegetables, high sugar drinks and crisps.

Throughout this chapter summary boxes are given at the end of key sections.

### 6.1 Middle schools: Preliminary analysis

This analysis included 5,298 days of recorded dietary intake data collected from 883 children to include weekdays (school days) and weekend days. The distribution of days surveyed were similar across the three time points (see Table 11).

Table 11: Distribution of days surveyed in 11-12yr olds from 1999-00 to 2009-10

|  | 1999-00 |  | 2007-8 |  | 2009-10 |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: |
|  | Number | $\%$ | Number | $\%$ | Number | $\%$ |
| Monday | 427 | 17 | 189 | 19 | 287 | 16 |
| Tuesday | 461 | 18 | 173 | 18 | 297 | 17 |
| Wednesday | 371 | 15 | 115 | 12 | 297 | 17 |
| Thursday | 246 | 10 | 60 | 6 | 166 | 9 |
| Friday | 247 | 10 | 80 | 8 | 146 | 8 |
| Saturday | 384 | 15 | 153 | 16 | 293 | 16 |
| Sunday | 408 | 16 | 208 | 21 | 293 | 16 |
| Total | 2544 | 100 | 978 | 100 | 1779 | 100 |

Table 12 shows both the total number of children and numbers of boys and girls included in the analysis at each of the three time points. In 2009-10 children were slightly younger than in the previous surveys; there were no differences found in mean BMI or ratio of boys to girls. There was no difference in mean IMD ( $p=0.06$ ). See Appendix 10.10 for a flowchart detailing percentage of children completing at each time point along with reasons for exclusions in both school lunch and total diet analysis.

Table 12: Study sample characteristics in 11-12yr olds

|  | $\mathbf{1 9 9 9 - 0 0}$ | $\mathbf{2 0 0 7 - 8}$ | $\mathbf{2 0 0 9 - 1 0}$ |
| :--- | :---: | :---: | :---: |
| Total number | 424 | 163 | 296 |
| Boys | 196 | 66 | 135 |
| Girls | 228 | 97 | 161 |
| Mean Age (years) | 12.2 | 12.1 | 11.7 |
| Mean IMD | 25.7 | 21.8 | 23.8 |
| Mean BMI (wt/ht ${ }^{2}$ ) | 19.8 | 19.5 | 19.7 |

### 6.1.1 School, packed and mixed lunch: Changes in mean nutrient intake 1999-00 to 2009-10

In middle schools there were some children at each of the time points who had a combination of both school and packed lunches during the data collection period; they have been grouped as 'mixed lunch' and the analysis has been separated into three groups: school, packed and mixed lunch. In this section we have focused on school lunch and packed lunch but draw attention to any important findings in mixed lunch.

In contrast to primary schools where there were statistically significant changes in both school lunch and packed lunch pre and post-implementation there was less evidence of such universal changes for these older children. However, the main changes observed in mean nutrient intakes at lunch pre and post-implementation of the school food policy were observed in those children consuming a school lunch. Table 13 shows the direction of change in mean nutrient intakes for each of the individual nutrients by lunch type across the three time points with a p-value (derived from an ANOVA) for the change over time.

## School lunch

Energy content from school lunches decreased from 1999-00 to 2009-10 (from 711 to 494 kcals; $\mathrm{p}<0.001$ ). As in primary schools, along with this reduction in energy there have been statistically significant reductions in fat and saturated fat both as a \% of energy intake and as absolute intakes (see Figure 17 and Table 13). Figure 17 shows individual changes within school, packed and mixed lunches across the three time points, the p-value denotes this change within lunch type. Mean intakes from carbohydrate and NSP have fallen; there has been no evidence of change in protein ( $p<0.001$, $\mathrm{p}=0.003$ and $\mathrm{p}=0.22$ respectively). As found in primary schools, there has been a reduction in NMES ( 22 g to $16 \mathrm{~g} ; \mathrm{p}<0.001$ ) and sodium intake post-implementation ( 881 mg to $514 \mathrm{mg} ; \mathrm{p}<0.001$ ). In contrast to the changes observed in primary schools where there was a statistically significant increase in all the micronutrients, in middle schools this has not been the case. Mean intakes of iron, vitamin $A$ and folate all decreased ( $p<0.001, p=0.03, p=0.001$ respectively). There was no evidence of change in calcium, vitamin $C$ and zinc.

## Packed lunch

As shown in Table 13 and Figure 17 there have been few statistically significant changes found in mean nutrient intakes in children having a packed lunch post-implementation in either macro or micronutrients. There has been no change in energy ( 593 to 573 kcals; $p=0.55$ ), fat, saturated fat and NMES either as a \% of energy intake or in absolute intakes. There were only changes in four nutrients: NSP, calcium, vitamin C and vitamin A which increased post-implementation ( $p=0.005$, $p=0.004, p=0.003$ and $p=0.008$ respectively).

## Mixed lunch

As stated above, this group includes children who consumed both school and packed lunches during the data collection period. From 1999-00 to 2009-10 as with school lunch the mean energy content of mixed lunch decreased (from 620 to 541kcals; p=0.001). Along with this fall in energy there have been statistically significant reductions in mean fat and saturated fat (both as \% energy and absolute intakes; Figure 17 and Table 13). There was also a fall in mean sodium intake (from 864 mg to 686mg; p<0.001). These changes in fat and sodium perhaps reflect the influence of school lunch in this group. In contrast to school lunch, but similar to changes observed in packed lunch, there were increases in calcium, vitamin $C$ and vitamin $A$ in mixed lunch ( $p=0.003, p<0.001, p=0.03$ respectively). There was no evidence of change from 1999-00 to 2009-10 in mean intakes of carbohydrate, protein, NSP, NMES, iron or zinc.

Table 13: Preliminary analysis of change in mean intake of individual nutrients from school, packed \& mixed lunches in 11-12yr olds from 1999-00 to 2009-10

| Nutrients | School Lunch |  |  |  |  |  |  | Packed Lunch |  |  |  |  |  |  | Mixed lunch |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\begin{aligned} & 1999-00 \\ & (n=263) \end{aligned}$ |  | $\begin{aligned} & 2007-8 \\ & (n=39) \end{aligned}$ |  | $\begin{gathered} 2009-10 \\ (n=80) \end{gathered}$ |  |  | $\begin{gathered} 1999-00 \\ (n=65) \end{gathered}$ |  | $\begin{aligned} & 2007-8 \\ & (n=87) \end{aligned}$ |  | $\begin{aligned} & 2009-10 \\ & (n=139) \end{aligned}$ |  |  | $\begin{gathered} 1999-00 \\ (n=96) \end{gathered}$ |  | $\begin{aligned} & 2007-8 \\ & (n=27) \end{aligned}$ |  | $\begin{gathered} 2009-10 \\ (n=76) \end{gathered}$ |  | p -value |
|  | mean | SD | mean | SD | mean | SD | p-value | mean | SD | mean | SD | mean | SD | $p$-value | mean | SD | mean | SD | mean | SD |  |
| Energy (kcals) | 711 | 181 | 600 | 238 | 494 | 152 | <0.001 | 593 | 219 | 562 | 170 | 573 | 150 | 0.55 | 620 | 177 | 511 | 174 | 541 | 156 | 0.001 |
| \% energy Fat | 40.3 | 5.4 | 27.5 | 5.4 | 30.8 | 7.9 | <0.001 | 33.3 | 8.8 | 33.1 | 7.8 | 32.2 | 7.5 | 0.60 | 37.7 | 6.6 | 29.0 | 7.4 | 30.8 | 7.9 | <0.001 |
| \% energy Sat Fat | 12.6 | 2.9 | 10.3 | 3.9 | 10.9 | 3.5 | <0.001 | 13.6 | 4.8 | 14.1 | 5.0 | 13.9 | 4.4 | 0.82 | 13.1 | 3.3 | 10.5 | 4.0 | 12.6 | 4.2 | 0.005 |
| \% energy NMES | 13.5 | 7.6 | 12.8 | 7.3 | 13.0 | 8.6 | 0.84 | 17.7 | 8.1 | 18.1 | 9.0 | 16.7 | 8.2 | 0.44 | 15.9 | 9.0 | 15.3 | 7.4 | 17.4 | 9.0 | 0.41 |
| Fat (g) | 33.1 | 9.4 | 18.6 | 7.6 | 17.4 | 6.7 | <0.001 | 23.0 | 11.2 | 21.4 | 9.9 | 21.1 | 8.4 | 0.40 | 27.1 | 9.3 | 17.0 | 7.1 | 19.0 | 7.4 | <0.001 |
| Saturated fat (g) | 10.1 | 3.5 | 6.7 | 2.8 | 6.2 | 2.8 | <0.001 | 9.5 | 5.0 | 9.3 | 5.4 | 9.3 | 4.5 | 0.97 | 9.2 | 3.2 | 6.3 | 3.5 | 7.8 | 3.4 | <0.001 |
| Carbohydrate (g) | 89.1 | 24.2 | 76.1 | 23.4 | 66.7 | 22.1 | <0.001 | 83.8 | 30.5 | 77.7 | 20.7 | 82.4 | 22.5 | 0.23 | 81.3 | 23.3 | 70.9 | 17.8 | 76.9 | 24.3 | 0.09 |
| Protein (g) | 19.2 | 5.5 | 20.2 | 7.6 | 18.3 | 5.8 | 0.22 | 17.0 | 7.1 | 19.5 | 9.2 | 18.4 | 7.1 | 0.17 | 17.4 | 6.0 | 16.8 | 6.8 | 18.2 | 5.5 | 0.53 |
| NSP (g) | 3.7 | 1.4 | 3.6 | 1.4 | 3.1 | 1.2 | 0.003 | 2.8 | 1.5 | 3.6 | 1.8 | 3.4 | 1.5 | 0.005 | 3.1 | 1.2 | 3.4 | 1.4 | 3.1 | 1.3 | 0.62 |
| NMES (g) | 22.2 | 11.4 | 19.5 | 11.9 | 16.1 | 11.1 | <0.001 | 27.3 | 14.4 | 26.2 | 12.9 | 25.5 | 13.5 | 0.68 | 23.2 | 11.6 | 19.9 | 9.8 | 25.1 | 13.2 | 0.41 |
| Sodium (mg) | 881 | 264 | 530 | 210 | 514 | 191 | <0.001 | 949 | 410 | 820 | 311 | 882 | 300 | 0.06 | 864 | 282 | 634 | 216 | 686 | 260 | <0.001 |
| Calcium (mg) | 197 | 83 | 208 | 103 | 182 | 95 | 0.28 | 219 | 121 | 304 | 191 | 291 | 167 | 0.004 | 209 | 98 | 218 | 98 | 269 | 140 | 0.003 |
| Vitamin C (mg) | 25.4 | 18.1 | 30.5 | 31.5 | 30.6 | 25.1 | 0.09 | 26.5 | 27.2 | 42.3 | 32.4 | 37.2 | 26.3 | 0.003 | 22.9 | 16.6 | 32.7 | 29.4 | 37.4 | 27.5 | <0.001 |
| Iron (mg) | 2.8 | 0.9 | 2.3 | 0.9 | 2.1 | 0.8 | <0.001 | 2.5 | 1.0 | 2.2 | 0.9 | 2.4 | 1.0 | 0.12 | 2.4 | 0.8 | 2.3 | 0.9 | 2.4 | 1.2 | 0.71 |
| Zinc (mg) | 1.8 | 0.7 | 1.9 | 1.0 | 1.9 | 1.0 | 0.68 | 1.6 | 0.8 | 1.9 | 0.9 | 1.9 | 0.9 | 0.62 | 1.7 | 0.7 | 1.7 | 0.9 | 1.9 | 1.1 | 0.20 |
| Vitamin A ( $\mu \mathrm{g}$ ) | 150 | 136 | 159 | 124 | 109 | 94 | 0.03 | 65.2 | 70.7 | 129 | 200 | 117 | 97.2 | 0.008 | 111 | 91 | 176 | 213 | 120 | 90 | 0.03 |
| Folate ( $\mu \mathrm{g}$ ) | 58.6 | 20.8 | 51.3 | 21.6 | 46.8 | 23.5 | <0.001 | 47.2 | 26 | 51.6 | 37.9 | 51.6 | 24.2 | 0.57 | 49.5 | 19.7 | 52.8 | 30.8 | 50.4 | 26.4 | 0.82 |



Figure 17: Preliminary analysis of changes in mean intakes of \% energy from fat, saturated fat, NMES and fat $(\mathrm{g})$, saturated fat $(\mathrm{g})$ and NMES $(\mathrm{g})$ by lunch type from 1999-00 to 2009-10 in 11-12yr olds

### 6.1.2 Compliance with food and nutrient-based standards

Middle schools were assessed for compliance with food and nutrient-based standards. There were a number of challenges posed and will be addressed in the discussion on page 124. With regard to food based standards these were not fully met in all five schools. Observations noted and recorded included children still had the opportunity to buy crisps in two of the schools during the school day. There was also a greater selection of drinks available in all schools - these did not meet the foodbased standards and in one school sugar was also available at break-time for cups of tea.

The nutrient-based compliance presented is derived from the three-week menu information made available from three out of the five schools. As shown in Table 14 full compliance was not achieved in middle schools by 2009-10. However, it is important to note this may also be explained by discrepancies in menu items provided, that is, some menu items may have been missing in information obtained and so do not fully reflect the actual provision, equally, the portion numbers stated in menus obtained may differ from provision.

Table 14: Compliance with planned nutrient-based standards for school lunches 2009-10 in middle schools

| Nutrient-based standards for school lunch |  | 2009-10 |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Catering Provider 1 |  | Catering Provider 2 |  |
|  |  | Value | Compliance | Value | Compliance |
| Energy (kcal) | 579.5-640.5 | 670 | $\times$ | 564 | $\times$ |
| Fat (g) | 23.7 max | 23.2 | $\checkmark$ | 21.2 | $\checkmark$ |
| Saturated Fat (g) | 7.5 max | 7.7 | $\times$ | 6.6 | $\checkmark$ |
| Carbohydrate (g) | 81.3 min | 68.8 | $\times$ | 68 | $\times$ |
| Protein (g) | 12.5 min | 23.7 | $\checkmark$ | 29.6 | $\checkmark$ |
| Fibre (g) | 4.9 min | 5.6 | $\checkmark$ | 6.7 | $\checkmark$ |
| NMES (g) | 17.9 max | 15.4 | $\checkmark$ | 3.2 | $\checkmark$ |
| Sodium (mg) | 714 max | 512.8 | $\checkmark$ | 691 | $\checkmark$ |
| Calcium (mg) | 350 min | 272 | $\times$ | 274 | $\times$ |
| Vitamin C (mg) | 12.3 min | 31.2 | $\checkmark$ | 47.6 | $\checkmark$ |
| Iron (mg) | 5.2 min | 4.1 | $\times$ | 4.6 | $\times$ |
| Zinc (mg) | 3.2 min | 3.4 | $\checkmark$ | 3.7 | $\checkmark$ |
| Vitamin A ( $\mu \mathrm{g}$ ) | 210 min | 385 | $\checkmark$ | 445 | $\checkmark$ |
| Folate ( $\mu \mathrm{g}$ ) | 70 min | 91.2 | $\checkmark$ | 108 | $\checkmark$ |

Table 15 below shows the actual consumption of a school lunch against the nutrient-based standards; packed lunch has been included for comparison. What is evident is neither the average school lunch nor packed lunch consumed meets the nutrient-based standards - the average school lunch fails to meet 8 ; the average packed lunch fails to meet 9 . This is of interest when compared with our findings for the primary schools - school lunch failed to meet 5; packed lunch failed to meet 11 and will be further elucidated in the discussion.

Table 15: Comparison of actual consumption in an average school lunch with packed lunch against nutrient-based standards in 11-12yr olds

| Nutrient-based standards for school lunch |  | 2009-10 |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | School lunch$(n=80)$ |  |  | Packed lunch$(\mathrm{n}=139)$ |  |  |
|  |  | mean | SD | Compliance | mean | SD | Compliance |
| Energy (kcal) | 579.5-640.5 | 494 | 152.04 | $\times$ | 573 | 159.85 | $\times$ |
| Fat (g) | 23.7 max | 17.4 | 7.62 | $\checkmark$ | 21.1 | 8.39 | $\checkmark$ |
| Saturated Fat (g) | 7.5 max | 6.2 | 2.85 | $\checkmark$ | 9.3 | 4.58 | $\times$ |
| Carbohydrate (g) | 81.3 min | 66.7 | 22.10 | $\times$ | 82.4 | 22.48 | $\checkmark$ |
| Protein (g) | 12.5 min | 18.3 | 5.75 | $\checkmark$ | 18.4 | 7.06 | $\checkmark$ |
| Fibre (g) | 4.9 min | 3.1 | 1.22 | $\times$ | 3.4 | 1.51 | $\times$ |
| NMES (g) | 17.9 max | 16.1 | 11.09 | $\checkmark$ | 25.5 | 13.45 | $\times$ |
| Sodium (mg) | 714 max | 513.9 | 191.07 | $\checkmark$ | 881.9 | 299.71 | $\times$ |
| Calcium (mg) | 350 min | 182.4 | 94.59 | $\times$ | 290.6 | 167.13 | $\times$ |
| Vitamin C (mg) | 12.3 min | 30.6 | 25.12 | $\checkmark$ | 37.2 | 26.29 | $\checkmark$ |
| Iron (mg) | 5.2 min | 2.1 | 0.83 | $\times$ | 2.4 | 0.97 | $\times$ |
| Zinc (mg) | 3.2 min | 1.9 | 0.95 | $\times$ | 1.9 | 0.88 | $\times$ |
| Vitamin A ( $\mu \mathrm{g}$ ) | 210 min | 109.3 | 93.77 | $\times$ | 116.7 | 97.15 | $\times$ |
| Folate ( $\mu \mathrm{g}$ ) | 70 min | 46.8 | 23.58 | $\times$ | 51.6 | 24.23 | $\times$ |

## Summary

School, mixed and packed lunch: Changes in mean nutrient intakes from 1999-00 to 2009-10 in 11-12yr olds

Key findings from preliminary analysis
$>$ Mixed lunch choices (children switching between school lunch and packed lunch) were a feature in these older children not observed in primary schools.
$>$ There was a statistically significant fall in \% energy from fat and saturated fat and in absolute intakes of fat, saturated fat and sodium from school lunch; this was not observed in packed lunch.
$>$ There were statistically significant increases in NSP (fibre), calcium, vitamin C and vitamin A in packed lunch. There was no evidence of improvements in micronutrient intakes from school lunch; intakes of iron, vitamin A and folate from the average school lunch all fell.
> Planned school lunch menus were not fully compliant with nutrient-based standards in 200910.
$>$ Neither school nor packed lunch as consumed fully met the nutrient-based standards; the average school lunch did not meet 8 of the nutrients-based standards compared with the average packed lunch which did not meet 10 out of 14 nutrients
$>$ The overall change in the average school lunch consumed by 11-12yr olds was generally less positive than observed in the 4-7yr olds.

### 6.1.3 Total diet: Changes in mean daily nutrient intakes 1999-00 to 2009-10

Although the changes in lunch, particularly school lunch, observed in younger children were not observed to the same extent in children aged 11-12yrs there was evidence of change and improvement in total diet from 1999-00 to 2009-10.

Between 1999-00 and 2009-10 there has been a statistically significant reduction in mean daily energy intake and \% energy from fat ( $35.7 \%$ to $32.2 \%$; $\mathrm{p}<0.001$ ); this is an important change as intakes are now below the DRV of maximum 35\% of energy to be derived from fat. ${ }^{24}$ There was no evidence of change in \% energy from saturated fat or NMES (Figure 18 and Table 16). Figure 18 shows the change in energy and \% energy from fat, saturated fat and NMES across the three time points, the pvalue derived from an ANOVA denoting change over time. Per cent energy from saturated fat was 12.9 \% pre-implementation and has not changed, remaining above the DRV of $11 \%$, this is also the case for \% energy from NMES - it remains above the DRV of $11 \%$. ${ }^{24}$


Figure 18: Preliminary analysis of changes in mean daily energy intake (kcals), \% energy from fat, saturated fat and NMES in total diet from 1999-00 to 2009-10 in 11-12 yr olds

From 1999-00 to 2009-10, there was a reduction in mean intakes of absolute fat, saturated fat, NMES and sodium ( $p<0.001$ for all nutrients listed) in line with DRV and RNI recommendations ${ }^{24}$ and similar to that seen in the younger children. As with the primary school children, although there has been a
fall in sodium intake, this remains well above the RNI of $1,600 \mathrm{mg} .{ }^{24}$ The mean daily intake of NMES reached the current DRV recommendation ${ }^{24}$ of no more than 60 mg in primary school children, in middle schools although this has had a statistically significant decrease from 83 g to 73 g it remains above the current recommendation. ${ }^{24}$ Four of the micronutrients - calcium, vitamin C, zinc and vitamin A increased from 1999-00 to 2009-10 ( $p<0.001$ for all), these are important changes in improving the nutrient quality of children's diet. There were some changes which were not in line with current recommended DRV and RNI guidelines; ${ }^{24}$ mean daily intakes from iron and folate fell from 1999-00 to 2009-10 ( $p<0.001$ and $p=0.002$ respectively); it is important to note these were both below the $\mathrm{RNI}^{24}$ in 1999-00 and remain so in 2009-10. Table 16 shows changes in mean daily nutrient intakes in total diet pre, mid and post-implementation of the school food policy with individual $p$-values derived from an ANOVA.

As discussed the mean changes by lunch type across the three time-points have not had the same improvements as seen in primary school children, however, there remains the potential for school food to influence total diet in children consuming school lunch.

Table 16: Preliminary analysis of change in mean daily nutrient intakes from 1999-00 to 2009-10 in 11-12yr olds

| Nutrient | $\begin{aligned} & \hline 1999-00 \\ & (n=424) \end{aligned}$ |  | $\begin{aligned} & \hline 2007-8 \\ & (n=163) \end{aligned}$ |  | $\begin{aligned} & \hline 2009-10 \\ & (n=296) \end{aligned}$ |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | mean | SD | mean | SD | mean | SD | p-value |
| Energy (kilocalories) | 1899.0 | 427.63 | 1800.3 | 427.55 | 1632.9 | 344.85 | <0.001 |
| \% energy Fat | 35.7 | 3.77 | 32.9 | 4.55 | 32.2 | 4.05 | <0.001 |
| \% energy Saturated Fat | 12.9 | 1.84 | 13.2 | 2.49 | 12.9 | 2.41 | 0.44 |
| \% energy NMES | 16.3 | 4.13 | 16.6 | 5.20 | 16.8 | 5.03 | 0.40 |
| Fat (g) | 75.7 | 19.97 | 66.4 | 19.26 | 58.6 | 15.46 | <0.001 |
| Saturated Fat (g) | 27.4 | 7.85 | 26.5 | 8.48 | 23.6 | 7.26 | <0.001 |
| Carbohydrate (g) | 262.0 | 60.45 | 249.6 | 60.91 | 232.5 | 51.24 | <0.001 |
| Protein (g) | 57.7 | 14.60 | 64.1 | 18.58 | 56.8 | 13.34 | <0.001 |
| Non-starch polysaccharides (g) | 10.7 | 2.99 | 11.3 | 3.63 | 9.6 | 2.80 | <0.001 |
| Non-milk extrinsic sugars (g) | 83.1 | 30.15 | 80.2 | 32.89 | 73.3 | 27.87 | 0.001 |
| Sodium (mg) | 2592.0 | 679.30 | 2362.4 | 665.30 | 2147.1 | 536.75 | <0.001 |
| Calcium (mg) | 669.1 | 200.67 | 872.0 | 307.70 | 806.9 | 266.12 | <0.001 |
| Vitamin C (mg) | 76.5 | 42.72 | 114.0 | 57.05 | 96.3 | 48.99 | <0.001 |
| Iron (mg) | 9.3 | 2.88 | 9.2 | 2.83 | 8.4 | 2.33 | <0.001 |
| Zinc (mg) | 6.1 | 1.82 | 6.9 | 1.98 | 6.3 | 1.81 | <0.001 |
| Vitamin A ( $\mu \mathrm{g}$ ) | 363.4 | 241.45 | 550.9 | 359.62 | 403.2 | 246.90 | <0.001 |
| Folate ( $\mu \mathrm{g}$ ) | 200.6 | 60.86 | 208.8 | 72.23 | 185.2 | 60.40 | 0.002 |

### 6.1.4 Effect of gender on total diet

As found in the younger children, gender was found to have a statistically significant effect on 13 of the 17 nutrients. In the 11-12 year olds there was no evidence of any difference between boys and girls in \% energy from fat, saturated fat or NMES. Girls had lower mean daily intakes of fat, saturated fat, NMES and sodium than boys ( $\mathrm{p}<0.001$ for all); as previously mentioned, these are nutrients where a lower intake is desirable. Girls also had lower intakes of NSP and micronutrients than the boys - a reflection of their lower energy intake. Table 17 shows the mean daily intakes of nutrients by gender with individual $p$-values for difference.

Table 17: Mean total daily nutrient intake in 11-12yr olds by gender

|  | $\begin{gathered} \text { Boys } \\ (n=397) \end{gathered}$ |  | $\begin{gathered} \text { Girls } \\ (n=486) \end{gathered}$ |  | $p$-value |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | mean | SD | mean | SD |  |
| Energy (kcal) | 1891.5 | 435.15 | 1709.9 | 385.87 | <0.001 |
| \% energy from fat | 33.8 | 4.19 | 34.2 | 4.44 | 0.141 |
| \% energy from saturated fat | 12.9 | 2.17 | 13.1 | 2.16 | 0.203 |
| \% energy from NMES | 16.6 | 4.61 | 16.4 | 4.69 | 0.691 |
| Fat (g) | 71.6 | 21.97 | 65.5 | 18.62 | <0.001 |
| Saturated fat (g) | 27.3 | 8.55 | 24.9 | 7.27 | <0.001 |
| Carbohydrate (g) | 263.0 | 61.29 | 239.0 | 54.86 | <0.001 |
| Protein (g) | 63.3 | 15.32 | 54.7 | 14.06 | <0.001 |
| NSP (g) | 10.9 | 3.43 | 10.0 | 2.81 | <0.001 |
| NMES (g) | 84.1 | 31.76 | 75.4 | 28.35 | <0.001 |
| Sodium (mg) | 2599.4 | 685.53 | 2238.0 | 595.57 | <0.001 |
| Calcium (mg) | 802.6 | 263.38 | 712.1 | 248.95 | <0.001 |
| Iron (mg) | 9.7 | 2.81 | 8.4 | 2.54 | <0.001 |
| Zinc (mg) | 6.9 | 1.94 | 5.9 | 1.68 | <0.001 |
| Vitamin C (mg) | 89.1 | 47.69 | 90.9 | 51.55 | 0.591 |
| Vitamin A ( $\mu \mathrm{g}$ ) | 446.2 | 329.12 | 382.9 | 222.41 | 0.001 |
| Folate ( $\mu \mathrm{g}$ ) | 209.2 | 64.21 | 186.9 | 61.19 | <0.001 |

## Summary

Total diet: Changes in mean nutrient intakes from 1999-00 to 2009-10 in 11-12yr olds

Key findings from preliminary analysis
$>$ There was a statistically significant and welcome reduction in \% energy from total fat to less than 35\% of energy but no change in \% energy from saturated fat or NMES both of which remained above recommendations.
$>$ Similarly there has been a welcome reduction in intakes of sodium and positive improvements in intakes of calcium, vitamin $C$ and zinc but intakes of iron and folate fell and were lower than desirable, particularly in girls.
> Gender was found to have a statistically significant effect on total diet; girls consumed less energy overall, and had a lower \% energy from fat, saturated fat, NMES and sodium than boys indicating a healthier diet in some respects, but girls also had lower intakes of micronutrients and NSP (fibre) - a reflection of their lower energy intake with no increase in nutrient density.
$>$ Overall the changes observed in the total diets of 11-12yr olds were less positive than those observed in the 4-7yr olds.

### 6.2 Modelling analysis

This section follows the same rationale as stated previously (section 4.7). It will start by presenting Class A effects: (1) year, (2) lunch type and (3) year and lunch type interactions, no intermediate effects will be presented in middle schools in line with our approach of only reporting these if statistically significant or close to significance (p close to 0.05 ) (section 4.7).

### 6.2.1 The effect of year on total diet

In contrast to primary schools where there were no statistically signficant differences found between the mid and post-implementation phase, in middle schools this was not the case, therefore, modelling results are presented for (pre) 1999-00, (mid) 2007-8 and (post-implementation) 2009-10 (see Table 18).

## Changes in 2007-8

In 2007-8, year was found to affect ten of the 17 nutrients. There were statistically significant decreases in mean daily intakes from energy, fat, carbohydrate, and sodium ( $p=0.03, p<0.001, p=0.02$ and $p<0.001$ respectively), mean daily intakes of protein, NSP, calcium, vitamin C, zinc and vitamin A all increased (Table 18); these changes are in line with recommendations. There was no evidence of change found between the pre and mid-implementation period in mean daily intakes of saturated fat, NMES, iron or folate.

## Changes in 2009-10

By 2009-10, 11 of the 17 nutrients were affected by year - not all of these changes were in line with recommendations. In 2009-10 there continued to be a fall in mean daily intake from energy; there were also decreases in absolute mean daily intakes from saturated fat, fat and NMES ( $p<0.001$ for all) which were not found in 2007-8. Mean daily intake of sodium continued to decrease (485mg) from 1999-00 to 2009-10 (95\% CI -583, -387; p<0.001). Calcium, vitamin C and vitamin A continued to increase - these were statistically significant (Table 18). In contrast to 2007-8, post-implementation saw a fall in mean daily intakes of NSP, iron and folate ( $p<0.001$ for all); nutrients for which an increase in intake is desirable. Although there was a decrease in mean daily intakes of zinc and protein these were not found to be statistically significant (Table 18).

Table 18: Effect of year on total diet: Changes in mean, mean difference, $95 \% \mathrm{Cl}$ and p -values for energy (kcals), $\%$ energy from saturated fat \& NMES, carbohydrate (g), protein (g), NSP (g), NMES (g), sodium (mg), calcium (mg), iron (mg), vitamin C (mg), zinc (mg) vitamin A ( $\mu \mathrm{g}$ ) and folate ( $\mu \mathrm{g}$ ) in 11-12yr olds

| Nutrient ${ }^{+}$ | Mean ${ }^{\dagger}$ |  |  | Mean difference (07/08-00) | 95\% CI | p-value | Mean difference (09/10-00) | 95\% CI | p-value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 2000 | 2007/08 | 2009/10 |  |  |  |  |  |  |
| Energy (kcals) | 1895.3 | 1810.2 | 1634.3 | -85.1 | -161.56, -8.78 | 0.03 | -261.0 | -323.45, -198.64 | $<0.001$ |
| \% energy Saturated Fat | 12.9 | 12.9 | 12.7 | 0.0 | -0.43, 0.41 | 0.96 | -0.2 | -0.50, 0.18 | 0.36 |
| \% energy NMES | 16.5 | 16.6 | 16.7 | 0.1 | 0.79, 1.02 | 0.80 | 0.2 | -0.56, 0.92 | 0.63 |
| Carbohydrate (g) | 263.0 | 249.4 | 231.5 | -14.0 | -24.58, -2.54 | 0.02 | -31.5 | -40.47, -22.47 | <0.001 |
| Protein (g) | 57.5 | 63.9 | 56.9 | 6.4 | 3.63, 9.21 | <0.001 | -0.6 | -2.91, 1.67 | 0.60 |
| NSP (g) | 10.7 | 11.3 | 9.6 | 0.6 | 0.06, 1.23 | 0.03 | -1.1 | -1.58, -0.61 | <0.001 |
| NMES (g) | 83.5 | 80.2 | 72.8 | -3.3 | -9.05, 2.48 | 0.26 | -10.7 | -15.41, -5.98 | <0.001 |
| Sodium (mg) | 2609.1 | 2342.7 | 2123.8 | -266.4 | -385.71, -147.10 | <0.001 | -485.3 | -583.02, -387.65 | <0.001 |
| Calcium (mg) | 682.3 | 847.6 | 795.7 | 165.3 | 119.36, 211.20 | <0.001 | 113.4 | 75.84, 151.04 | <0.001 |
| Iron (mg) | 9.4 | 9.2 | 8.3 | -0.2 | 0.67, 0.35 | 0.54 | -1.1 | -1.48, -0.64 | <0.001 |
| Vitamin C (mg) | 77.6 | 112.7 | 95.6 | 35.1 | 26.02, 44.19 | <0.001 | 18.0 | 10.59, 25.48 | <0.001 |
| Zinc (mg) | 6.1 | 6.9 | 6.3 | 0.8 | 0.50, 1.20 | <0.001 | 0.2 | -0.22, 0.54 | 0.07 |
| Vitamin A ( $\mu \mathrm{g}$ ) | 356.4 | 542.4 | 403.3 | 186.0 | 138.16, 233.87 | <0.001 | 46.9 | 7.73, 86.10 | 0.02 |
| Folate ( $\mu \mathrm{g}$ ) | 202.4 | 206.4 | 183.6 | 4.0 | -8.08, 15.96 | 0.52 | -18.8 | -28.65, -8.97 | <0.001 |

${ }^{+}$DRV/RNI's where applicable (boy/gir): \% energy saturated fat (11\%), \% energy NMES (11\%), protein (42.1/41.2g), NMES (60g), sodium ( $1,600 \mathrm{mg}$ ), calcium ( $1,000 / 800 \mathrm{mg}$ ),
iron ( $11.3 / 14.8 \mathrm{mg}$ ), vitamin C ( 35 mg ), zinc ( 9.0 mg ), vitamin A $(600 \mu \mathrm{~g})$ and folate $(200 \mu \mathrm{~g})$
${ }^{\dagger}$ Mean adjusted for lunch type and gender; saturated fat, protein, NSP and micronutrients also adjusted for IMD

### 6.2.2 The effect of lunch type on total diet

As was mentioned in section 6.1.1 the changes observed by lunch type in middle schools across the three time points were not to the same extent as those observed in primary schools. One of the primary aims of this study was to measure the effect of lunch type on total diet, with this in mind, all nutrients have been reported in this section regardless of level of significance. Table 19 shows mean daily intakes by lunch type along with the mean difference (change), $95 \% \mathrm{Cl}$ and p -values for this difference in individual nutrients. Per cent energy from fat was affected by year and lunch type and is discussed under the effect of year and lunch type.

As can be seen from Table 19 although children consuming a packed lunch had a trend towards a higher \% energy from saturated fat, NMES and absolute intakes of saturated fat and NMES in total diet - there was no evidence of these being statistically significant (see Table 19). Similarly, children consuming a packed lunch had $99 \mathrm{mg}(95 \% \mathrm{Cl} 3.98,201.86 ; \mathrm{p}=0.06)$ more sodium in their total diet than children consuming a school lunch - while it is evident school lunch contained less sodium at all three time points (Table 13); there was no evidence of statistical significance in total diet.

Calcium is the only nutrient where there was a statistically significant difference in mean daily intakes in children who consumed either a packed lunch or mixed lunch in comparison with a school lunch. Children having a packed lunch had on average 57 mg more than those having a school lunch $(95 \% \mathrm{Cl}$ $17.08,96.31, \mathrm{p}=0.005$ ), children having a mixed lunch had $45 \mathrm{mg}(95 \% \mathrm{Cl} 3.68,86.88 ; \mathrm{p}=0.03$ ) more than school lunch.

There was a trend for mean daily intakes of zinc, vitamin A and folate to be lower in children consuming a packed lunch compared with those consuming a school lunch; this was not statistically significant (Table 19).

Table 19: Effect of lunch type on total diet: Changes in mean, mean difference, $95 \% \mathrm{Cl}$ and p -values for energy, $\%$ energy from saturated fat \& NMES, carbohydrate (g), protein (g), NSP (g), NMES (g), sodium (mg), calcium (mg), iron (mg), vitamin C (mg), zinc (mg), vitamin A ( $\mu \mathrm{g}$ ) and folate ( $\mu \mathrm{g}$ ) in 11-12yr olds

| Nutrient ${ }^{+}$ | Mean ${ }^{\dagger}$ |  |  | Mean difference (PL-SL) | 95\% CI | p-value | Mean difference (ML-SL) | 95\% CI | p-value |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | SL | PL | ML |  |  |  |  |  |  |
| Energy (kcals) | 1810.1 | 1784.0 | 1770.0 | -26.1 | -91.58, 39.41 | 0.44 | -40.0 | -108.79, 28.66 | 0.25 |
| \% energy Saturated Fat | 12.7 | 13.0 | 12.7 | 0.3 | -0.04, 0.68 | 0.08 | 0.0 | -0.37, 0.38 | 0.98 |
| \% energy NMES | 16.1 | 16.8 | 17.1 | 0.7 | -0.06, 1.49 | 0.07 | 1.0 | 0.11, 1.74 | 0.03 |
| Carbohydrate (g) | 248.5 | 252.5 | 248.7 | 4.0 | -5.50, 13.39 | 0.41 | 0.2 | -9.69, 10.14 | 0.96 |
| Protein (g) | 59.2 | 57.9 | 57.8 | -1.3 | -3.67, 1.15 | 0.30 | -1.4 | -3.89, 1.16 | 0.29 |
| NSP (g) | 10.5 | 10.5 | 10.2 | 0.0 | -0.51, 0.51 | 1.00 | -0.3 | -0.74, 0.32 | 0.44 |
| NMES (g) | 78.2 | 80.2 | 80.3 | 2.0 | -2.96, 6.93 | 0.43 | 2.1 | -3.03, 7.35 | 0.41 |
| Sodium (mg) | 2357.2 | 2456.1 | 2385.9 | 98.9 | -3.98, 201.86 | 0.06 | 28.7 | -79.36, 136.89 | 0.60 |
| Calcium (mg) | 721.1 | 777.8 | 766.4 | 56.7 | 17.08, 96.31 | 0.005 | 45.3 | 3.68, 86.88 | 0.03 |
| Iron (mg) | 8.9 | 9.1 | 9.0 | 0.2 | -0.27, 0.61 | 0.45 | 0.1 | -0.32, 0.61 | 0.53 |
| Vitamin C (mg) | 88.8 | 90.4 | 92.1 | 1.6 | -6.27, 9.42 | 0.69 | 3.3 | -4.91, 11.51 | 0.43 |
| Zinc (mg) | 6.4 | 6.3 | 6.2 | -0.1 | -0.37, 0.23; | 0.63 | -0.2 | -0.44, 0.19 | 0.43 |
| Vitamin A ( $\mu \mathrm{g}$ ) | 412.2 | 396.2 | 411.3 | -16.0 | -57.27, 25.31 | 0.45 | -0.9 | -44.25, 42.44 | 0.97 |
| Folate ( $\mu \mathrm{g}$ ) | 193.8 | 201.7 | 195.2 | 7.9 | -2.45, 18.29 | 0.13 | 1.4 | -9.51, 12.27 | 0.80 |

+ DRV/RNI's where applicable (boy/girl): \% energy saturated fat (11\%), \% energy NMES (11\%), protein ( $42.1 / 41.2 \mathrm{~g}$ ), NMES ( 60 g ), sodium ( $1,600 \mathrm{mg}$ ), calcium ( $1,000 / 800 \mathrm{mg}$ ), iron $(11.3 / 14.8 \mathrm{mg})$, vitamin C $(35 \mathrm{mg})$, zinc $(9.0 \mathrm{mg})$, vitamin A $(600 \mu \mathrm{~g})$ and folate $(200 \mu \mathrm{~g})$
${ }^{\dagger}$ Mean adjusted for year and gender; protein, NSP and micronutrients also adjusted for IMD


### 6.2.3 The effect of year and lunch type on total diet

Figure 19 shows that between 1999-00 and 2009-10 there was a decrease in the \% energy derived from fat in the total diet. It is evident that children consuming a school lunch in 1999-00 had a higher \% energy from fat than children consuming a packed lunch (36\% v 33\%). Post-implementation this gap between school lunch and packed lunch had decreased, the difference between this change pre and post-implementation was found to be significant (2.92\%, 95\% CI 1.39, 4.45; p<0.001).


Figure 19: Interaction between year and lunch type on mean daily \% energy from fat in 11-12yr olds


#### Abstract

Summary

The effect of year and lunch type from 1999-00 2009-10 in 11-12yr olds

Key findings from modelling analysis

Year and lunch type > In contrast to the findings in the 4-7yr olds, there was little evidence found of any statistically significant effects by year and lunch type on total diet in the 11-12yr olds. The only statistically significant finding was in \% energy derived from fat. Children consuming a school lunch in 1999-00 had had a significantly higher \% energy from fat than children consuming a packed lunch (40.3 to 30.8\%), by 2009-10 this difference between lunch type had decreased and the difference in this change was significant. Post-implementation there was no significant difference in \% energy in the total diet of children by lunch type reflecting the significant fall in \% energy from fat in school lunch.


### 6.3 Food group analysis

## Middle schools

As with primary schools the analysis thus far has focused on nutrients, of further interest is to examine changes in certain foods consumed pre and post-implementation. This section follows the same approach as used in primary schools and provides a descriptive overview of the seven food groups (see Figure 20 or Appendix 10.11). As for primary schools the food group data have been presented in two ways. First, by the proportion of children who reported eating any food from a given food group in the six days recorded in 1999-00 and in 2009-10, that is, the 'per cent of consumers'. Secondly, we report the mean daily weight $(\mathrm{g})$ of food from food group eaten by these consumers. This differs from the data presented for primary school where the mean daily portions were reported rather than weight; this difference is due to the difference in the methods used to collect dietary data in the two age groups (section 4.4.2). No further statistical analysis has been undertaken.

## School lunch

There was a substantial reduction in percentage of children having fried chips from $72 \%$ to $46 \%$ ( 26 percentage points) along with a reduction in confectionery (11 percentage points), crisps (2 percentage points), fizzy drinks ( 9 percentage points) and cordial/squash (7 percentage points); an additional finding, not observed in primary schools, was no change in the proportion of children having fruit (1 percentage point). In contrast to our findings in primary schools, these changes reflect the fact that the food based standards were not fully adhered to in all middle schools, that is, while there was a fall in the proportion of children having crisps, children could still purchase crisps in two schools, and the drinks available did not fully comply (17\% of children had a fizzy drink purchased at school). However, a welcome observation was that the proportion of children consuming fried chips decreased by 26 percentage points. As percentage of children having chips, confectionery and crisps decreased so did the mean daily weight eaten by those children that did have these foods. However, while percentage of children consuming cordial/squash and fizzy drinks decreased; the mean daily weight eaten by those children still consuming these foods as part of school lunch increased. In 2009-10 the percentage of children having vegetables increased by 4 percentage points from 1999-00, but, the mean daily weight eaten by these children decreased by 10 g .

## Packed lunch

As with primary schools there are no regulations in middle schools which apply to packed lunches. There have been improvements in packed lunches in middle schools - more so than those observed in school lunches. From 1999-00 to 2009-10 there was a fall in percentage of children having confectionery from $74 \%$ to $56 \%$ (18 percentage points), crisps ( 9 percentage points), fizzy drinks (17
percentage points) and cordial/squash (3 percentage points). In contrast to school lunch there was an increase in the percentage of children having fruit and vegetables ( 33 and 6 percentage points respectively) and also the mean daily weight eaten by the children consuming these food increased ( 6 g and 7 g respectively). In those children consuming confectionery, fizzy drinks and cordial/squash, mean daily weight has decreased by $7 \mathrm{~g}, 41 \mathrm{~g}$ and 14 g respectively.

Despite these positive changes in 2009-10 many more children had crisps and cordials/squash in their packed lunches than those having a school lunch, and more children having school lunch had vegetables. However, more children having packed lunch had fruit as part of their lunch.

## Total diet

From 1999-00 to 2009-10 there was a fall in percentage of children having fried chips at any time over the six days reported from $88 \%$ to $62 \%$ ( 26 percentage points), confectionery ( 3 percentage points), crisps (14 percentage points) and fizzy drinks (16 percentage). Similarly, the mean daily weight eaten by those children consuming these foods decreased by $38 \mathrm{~g}, 29 \mathrm{~g}, 4 \mathrm{~g}$ and 32 g respectively. The proportion of children eating fruit and vegetables increased (9 and 2 percentage points respectively) as did the proportion of children having cordial or squash (4 percentage points) which may in part have replaced some of the fall in fizzy drinks (16 percentage points). For children consuming cordial/squash and fruit, mean daily weight increased by 60 g and 28 g respectively; in contrast mean daily weight of vegetables fell by 13 g .


Figure 20: Preliminary analysis of changes in food groups from 1999-00 to 2009-10 in 11-12yr olds

## Summary

## Food group analysis: Changes from 1999-00 to 2009-10 in 11-12yr olds

Key findings from preliminary analysis

## School lunch

$>$ There was a fall in the percentage of children consuming fried chips, confectionery, crisps, fizzy drinks and cordial/squash in school lunch; the percentage of children consuming vegetables increased. There was a reduction in the proportion of children consuming fruit in school lunch from 1999-00 to 2009-10; a finding not seen in the 4-7yr olds.
$>$ In children consuming these foods was a reduction in mean daily weight of fried chips, confectionery and crisps eaten; this was not the case for fizzy drinks and cordial/squash where an increase in weight consumed was observed. Further, those children consuming either fruit or vegetables as part of their school lunch had a lower mean weight in 2009-10.
$>$ These findings perhaps reflect our finding of less adherence to food-based standards in the middle schools than primary schools, that is, children could still purchase fizzy drinks and crisps in some middle schools.
$>$ One important finding for school lunch is the fall in percentage of children consuming fried chips - this fell from $72 \%$ to $46 \%$ (26 percentage points) - and reflects adherence to the foodbased standard pertaining to the number of times deep fried foods can be served and suggests a move towards adherence in middle schools.

## Packed lunch

$>$ There was a fall in the percentage of children consuming confectionery, crisps, fizzy drinks and cordial/squash as part of their packed lunch as well as an increase in the percentage of children consuming fruit or vegetables.
> In contrast to school lunch, in packed lunch there was a decrease in mean daily weight eaten by those children still consuming confectionery, crisps, fizzy drinks and cordial/squash and an increase in the mean daily weight of fruit and vegetables consumed.
$>$ Although there is no formal policy for packed lunches these findings indicate there have been improvements in packed lunches eaten by the 11-12yr olds.

Total diet
$>$ There was a fall in the percentage of children consuming fried chips, confectionery, crisps and fizzy drinks and an increase in the percentage of children consuming fruit and vegetables but also cordial/squash increased.
$>$ In children consuming fried chips, confectionery, crisps and fizzy drinks there was a reduction in mean daily weight eaten as well as an increase in the mean daily weight of fruit. In contrast the mean daily weight of vegetables eaten by consumers decreased.

## 7. Evaluation of the process of implementation of school food policy

### 7.1 Aim and objectives

The aim of the process evaluation was to study the process of implementing the new school food requirements. The process evaluation addressed the following research questions:
a) To what extent were the school food requirements fully implemented in the schools?
b) What was the process of this implementation?
c) What factors influenced implementation, both positively and negatively?
d) How were the changes regarded by key stakeholders, including catering staff, teaching staff, parents and children?

The process evaluation sought to describe and analyse the process of implementing the food policy change at school level over the period leading up to, and immediately following, the compliance deadlines of September 2008 and September 2009 for primary and secondary schools respectively. Schools were given a period of two years (primary) and three years (secondary) to be fully compliant with the school food requirements. This was intended to allow schools time to make changes to current food service and for the requirements to imbed into schools. Consequently, it was acknowledged that the speed and process of implementation in schools were likely to vary. It was also anticipated that the ease or difficulty with which schools embraced the new changes were likely to be affected by a wide range of factors, including the existing structures and resources for school food provision; the knowledge, commitment and skills of key staff; the views and involvement of parents and pupils, and so on.

Critical to the success of any new policy in terms of achieving its objectives will be how it is perceived and experienced by key stakeholders - for example, do they approve of what it is trying to achieve, do they feel it goes far enough, and so on. This is particularly important in relation to school food, where, if parents and children do not approve of or like the food provision, they can choose packed lunches rather than school lunch. The policy impact of providing nutritionally advantageous meals is reduced or undermined if children choose not to eat them. Therefore the process evaluation also explored how four key stakeholder groups - catering managers, headteachers and other staff, parents and children - perceived the new standards and the new school lunches in particular.

### 7.2 Method

To enable these issues and perspectives to be fully explored, we conducted a mixed methods process evaluation combining both breadth and depth. We examined implementation at two levels, firstly across the larger sample of schools taking part in the cross-sectional element of the study (13 primary schools and 5 middle schools), and secondly in a smaller sub-sample of schools in which implementation could be examined in more detail. The first level of data collection assessed progress towards implementation across all participating schools by contacting the policy lead in each school prior to, and following, the implementation deadline. At the second level of data collection, a case study approach was used to provide more detailed insights into the implementation process within selected individual schools, and the main factors hindering and facilitating implementation. The case study schools were selected to represent communities with differing levels of (dis)advantage, different cultural profiles and different forms of school lunch provision (i.e. Local Authority and opted-out provision arrangements).

Structured brief observations of school dining halls were also conducted by the researchers conducting the dietary assessments. The observation pro forma recorded aspects of the dining experience that might impact on children's response to and consumption of meals, including dining room appearance, noise, pupil behaviour, speed of queuing and service, number of supervisory and teaching staff present, and the extent to which staff encourage children to choose and eat healthy options.

Figure 21 provides an overview of the process evaluation methods. The methods and sample for each strand of the evaluation are described in more detail below.


Figure 21: Overview of process evaluation methods

## Interviews with policy leads

Two to three months before the policy implementation deadline of September 2008 for primary schools and September 2009 for middle schools, interviews were conducted with policy leads (typically the head teacher or member of staff responsible for Personal Social and Health Education (PSHE)) in each of the study schools. Interviews were conducted largely by telephone in the primary schools, and by a mixture of telephone and face-to-face in the middle schools. Interviews lasted between 20 and 60 minutes, and were digitally recorded with interviewees' consent.

In total, eleven policy lead interviews were conducted in primary schools and four in middle schools. It was not possible to conduct policy lead interviews in two of the primary schools and one of the middle schools because of prolonged staff absence during the fieldwork period.

At the same time as the policy lead interviews in schools, four interviews were conducted with stakeholders with cross-school responsibility for school catering and for supporting schools in meeting school food standards.

## Self-completion questionnaires

Following the policy implementation deadlines of September 2008 and 2009 respectively, a selfcompletion questionnaire was sent to each school to clarify and update information provided in the policy lead interviews. The research team filled in part of the questionnaire with data from the policy lead interview, and asked schools to clarify, expand on and update any information as appropriate. The questionnaires were sent to and completed by one representative in each school (usually the policy lead). In the primary schools, the questionnaires were sent out in November-December 2008, and in the secondary schools in November-December 2009. Questionnaires were returned by seven (of 11) primary schools and by three middle schools (of four- one of the middle schools closed during the fieldwork period as part of an impending merger to form a larger academy).

## Interviews with key implementers

In the selected case study schools (4 primary and 3 middle), further interviews were conducted with key implementers, including catering staff, teachers and teaching assistants, dining supervisory staff, administrators and governors. The aim of these interviews was to explore in more detail awareness of, and attitudes towards, the new food standards, progress towards implementation, barriers or facilitators to the implementation process, and actions taken to assist implementation. Interviews were conducted face-to-face in school and lasted between 20 and 60 minutes. They were digitally recorded with interviewees' consent.

The sample of interviewees varied from school to school to reflect different food provision structures (i.e. whether the school was part of Local Authority catering provision or had opted-out to provide its own meal service) and the different levels of involvement of staff in aspects of food provision. Interviewees were selected on a cascading basis by talking first to the policy lead on the telephone to establish which staff and others were most involved in food provision in each school. The intention was to conduct an average of 3 interviews per school but also to be flexible in response to the situation in each school; for example, in schools with particularly distinctive issues to explore, more interviews were conducted.

In total, interviews were conducted with 15 key implementers in case study primary schools and 9 key implementers in case study middle schools. The composition of the interview sample, including the Stage 1 interviews with policy leads and Local Authority stakeholders and the Stage 2 case study interviews, is illustrated in Table 20.

Table 20: Composition of interview sample, stages 1 and 2 combined

| Job title | No. of people interviewed |  |  |
| :--- | :---: | :---: | :---: |
|  | Primary | Middle | Total |
| Head teacher | $9 *$ | 2 | 11 |
| Assistant/Deputy Headteacher | - | 3 | 3 |
| Other school management/administrative role | 2 |  | 2 |
| PSHE/Healthy Schools Co-ordinator | 4 | $* *$ | 4 |
| Catering Manager/School Cook | 4 | 3 | 7 |
| Other (non-PSHE) teacher | 2 | 2 | 4 |
| Teaching/Learning Assistant | 2 | 1 | 3 |
| Dining supervisor | 1 | $2 * * *$ | 3 |
| Other school role (eg. governor) | 2 | - | 2 |
| Cross-school role (Local Authority support, catering) | $\mathrm{n} / \mathrm{a}$ | $\mathrm{n} / \mathrm{a}$ | 4 |
| TOTAL | 28 | 15 | 43 |

* One of the Primary heads was interviewed twice, making 11 interviews with Head teachers in all.
** One Middle School Assistant Head also had the role of Healthy Schools Co-ordinator
***One Teaching Assistant also had a lunch supervisory role


## Focus groups

Focus groups were conducted with parents in selected primary and middle schools, and also with children in the case study middle schools (year 7).

## Parents

The parents' focus groups explored parents' awareness and understanding of school food provision and associated school policies, their experiences of and response to communication from and with the school on the subject of food, their motivations for and experiences of children attending school lunches or taking packed lunches, and their attitudes towards healthy eating. Each group comprised 4-8 participants and was conducted in a local community venue. The groups lasted around 60 to 90 minutes, and were digitally recorded with participants' consent.

The original intention had been to conduct parent focus groups in each of the case study schools (i.e. seven focus groups in total). While this was achieved in the middle schools, it was only possible to arrange parent focus groups in two of the case study middle schools. To make up for this, parent
focus groups were conducted with two non-case study primary schools, making four parent focus groups in total.

## Children

The main issues addressed in children's focus groups were the dining experience (for school dinners and packed lunches), responses to sample dishes (using show cards naming typical school food dishes), views on school food provision, awareness of changes to school food, understanding of school food policies, and healthy eating within the curriculum. Children's focus groups comprised 6-8 participants and were conducted in their schools during the school day.

The focus group sample is illustrated in Table 21 below.

Table 21: Focus group sample

| Group number | Composition |  |
| :---: | :--- | :--- |
| 1 | Parents | Case study primary school |
| 2 | Parents | Case study primary school |
| 3 | Parents | Non-case study primary school |
| 4 | Parents | Non-case study primary school |
| 5 | Parents | Case study middle school |
| 6 | Parents | Case study middle school |
| 7 | Children | Case study middle school |
| 9 | Children | Case study middle school |
| 10 | Children | Case study middle school |

## Recruitment and informed consent

An information sheet about the opportunity to participate in a focus group was issued to all children who were participating in the dietary assessment, to take home and share with their parents along with their food diary. A consent form was attached to the information sheet allowing parents and/or children to opt-in to this aspect of the study. Parents who indicated that they and/or their children were interested in participating in a focus group were then contacted by an ISM research consultant to discuss and set up the focus group arrangements. Participants were selected to include parents of children having a school lunch and those of children having a packed lunch. As a token of appreciation for their participation, parents and children received a payment of $£ 20$ and $£ 5$ respectively for taking part in the focus groups.

## Analysis

All interviews and focus group discussions were digitally recorded with respondents' permission, and were transcribed in full. Transcripts were coded thematically, with verbatim extracts entered into a framework which could be sorted by main and sub-themes, school type and interviewee role. The thematic analysis drew on both deductive and inductive approaches to thematic analysis ${ }^{44}$ : themes and sub-themes relating to the pre-specified research questions (for example, steps in the implementation process, positive and negative factors influencing implementation) were actively sought in the data, whilst further themes evolved from the coding process itself (for example, issues around catering staff's job satisfaction, the tensions and pressures on the school dinner experience and how these related to children's experiences of the new meals).

### 7.3 Findings

Findings are presented in five sections. Section 7.3.1 examines the extent and process of implementation in the schools. Section 7.4 examines factors that influenced implementation. Section 7.5 examines additional actions undertaken by the schools to enhance the impact of the standards. Section 7.6 examines the views of key stakeholder groups - senior management and other teaching staff, catering managers and cooks, parents and children - on the new standards. Finally, section 7.7 summarises and discusses the implications of these findings.

Note on terminology throughout this section: 'LA' or 'opted-out', when used in sources for verbatim quotes, refers to the school meal provision structure, not to the schools' wider status.

When describing job titles in sources for verbatim quotes, we use general titles such as 'Senior management' (to include Headteachers, Deputy Heads, Assistant Heads and other senior management roles), 'Teacher' (to cover teachers of all subjects), 'Assistant/supervisor' (to cover teaching and learning assistant and dining room supervisors), 'Catering manager/cook' (to cover school kitchen staff) and 'Cross-school role' (to cover Local Authority staff and external contractors). These general labels are used to reduce the likelihood of individuals being identified.

### 7.3.1 Extent and process of implementation

In this section we give a brief overview of schools' overall level of compliance with the standards (7.3.2) before outlining the roles and responsibilities of different implementers and the processes involved in implementation (7.3.3). We then discuss in more detail the issues involved in achieving compliance in relation to school lunch (7.3.4) and other areas covered by the standards (7.3.5). In section 7.5 we discuss the additional actions and processes schools engaged in to enhance the impact of the standards in schools.

### 7.3.2 Overview of compliance

At the time of fieldwork (i.e. the months leading up to the compliance deadlines in 2008 and 2009), interviews with policy leads and key implementers suggested that most schools appeared already to have met food-based standards (Appendix 10.2) in the six key areas or to be on course for full compliance in the next few months, and were getting to grips with nutrient-based standards (Appendix 10.2). In Local Authority provision schools, menus had already been developed by the Local Authority and its contractors, and software was in place to conduct analysis of the menus' compliance with nutrient-based standards. In contrast, in opted-out schools, catering managers were aware that menu design and nutritional analysis were the schools' own responsibility, and while most were welladvanced in the first area, varying degrees of progress had been made in terms of analysis, as we discuss in more detail below. Policy leads and key implementers in schools were aware also of the need to ensure that foods served at breaktime and sold through tuck shops, where applicable, complied with food-based standards, and had recently made or were making appropriate changes. An analysis of the school lunch menus in primary and middle schools has been presented previously in sections 5.1.2 and 6.1.2.

This relatively advanced stage of readiness in relation to the standards could be attributed to two factors: the local authorities having already made several improvements to school meal menus in recent years, such as removing heavily processed items, and schools' participation in recent years in healthy schools initiatives. These initiatives had encouraged schools to pay attention to the healthiness of food and drink provided in the school, with several having banned fizzy drinks, removed vending machines, overhauled tuck shops and so on.
"We haven't had to make many big changes. Banning sweets, which l'd done anyway - we are part of the healthy schools award. It has basically been in the kitchen where the change has been made, but obviously the changes have been made by the company that we use."
(Teacher, Primary, LA - Interview 23)

## "Do you know whether many changes are necessary from the previous meals that were provided?"

"I wouldn't imagine a lot would have been because it is something that is quite high on the priority of the school anyway and has been for quite a while now. Off the top of my head I wouldn't have thought there would have been many changes necessary."
(Senior Management, Primary, LA - Interview 41)

In addition, as part of their Healthy Schools status, several of the study schools were already committed to encouraging healthy eating throughout the school through, for example, involvement of school councils, gardening clubs, themed events and PHSE and food technology lessons. For these schools, the school food standards could be seen as both complementing and reinforcing an existing direction of travel.

Interviewees' perceptions that local authorities and so [primary] schools with Local Authority provision were generally well advanced in their implementation of the school food policy are generally supported by the nutritional data particularly from primary schools (sections 5 and 6), which suggest that most improvement was evident in 2007.

### 7.3.3 Responsibility, roles and processes

Responsibility for implementing the standards locally rested with several groups of people: the local authorities, headteachers and other senior management in the schools, school catering managers/cooks and their staff, and other school staff.

The local authorities and their contractors were responsible for devising compliant menus for their schools, analysing the nutrient composition of menus, training and supporting school kitchen staff in the preparation of the new menus, and more generally supporting the promotion of healthy eating in schools. While local authorities did not necessarily expect schools to concern themselves with detailed compliance issues they did expect schools to promote the new menus and to win children and parents over to them.
"We'll give them the menus and we'll give them the recipes, but that introduction and actually getting the kids on board with it, they need to do in school."
(Cross-school Role - Interview 52)

Local Authorities were particularly keen to develop the role of school kitchen staff (who, in Local Authority provision schools, were employed by the authority), to "build up their confidence so they can come out of that kitchen into the school" (Cross-school Role) to explain and champion the new meals.

To this end they provided various types of support and training for kitchen staff, including regular 'cooks' meetings' for catering staff and catering contractors, training in the food preparation skills needed for the new menus, and supporting staff studying for NVQ catering qualifications. Local authorities also provided training for staff with a supervisory role within the school dining area to develop their role in encouraging children to eat more healthily, and basic information and awareness raising training for teaching staff on the new standards, based around the Food in Schools toolkit.

Opted-out schools could not access Local Authority training relating to school meals, and had to arrange their own. In one, the headteacher had arranged various training courses for him and other staff, including food hygiene and fish filleting; in another, the catering manager had organised her own training in nutrient analysis, while in the third, no training appeared to have been organised by or offered to any staff involved in school meals at the time of fieldwork.

Overall responsibility for understanding, disseminating and ensuring compliance with the standards within schools generally rested with headteachers. Although all headteachers interviewed recognised this notional responsibility, several admitted that in practice they were not familiar with the detailed requirements or monitoring processes, and tended to assume that the Local Authority and catering manager would 'keep the school on track':
> "That's her area really - I don't need to know anything about it...she more or less tells us what we're trying to do."
> (Senior Management, Middle, Opted-out - Interview 19)
> "To be honest, without having it in front of me I'm not sure if we are fully compliant, but I do know, if we are not fully compliant there can't be many...I can't imagine that there are many more or more that you can do. I'm not aware of anything huge."

(Senior Management, Primary, LA - Interview 27)

Catering managers confirmed this, with many assuming ownership of the task of ensuring that the meals were compliant and acting as the repository within the school for all written information and guidance relating to the standards. In contrast, a few headteachers took a much more proactive role, familiarising themselves with the detail of the standards, attending training alongside staff, and driving through supporting improvements such as refurbishments to the school kitchen or dining area. One headteacher explained how he perceived the division of responsibility:
"The caterers draw up the menus which meet the standards. My role has been in communicating menus to parents and ... my role is to get the best possible facilities and the best ambient atmosphere. I also negotiate changes in the menu after the first time through, when we find that some things are deeply unpopular and other things are really popular. But we still meet the standard. I was meeting with the head of music this morning, talking about arranging recitals in the dining hall, during some
lunch breaks [I'm responsible for] everything that surrounds it, but the actual food is the responsibility of the catering manager."
(Senior Management, Middle, LA - Interview 30)

Responsibility for ensuring compliance in relation to areas of the policy other than school meals tended to fall to the members of staff responsible for those initiatives, although they were not necessarily aware of the detailed content of the standards and sometimes relied on the catering manager/cook to provide them with a list of permitted and disallowed food and drink. Generally, apart from catering managers and those heads that were actively involved and interested, awareness and knowledge of the standards among other school staff appeared patchy and limited. Even among our implementer interviewees, all of whom were identified by schools themselves as having some involvement in food provision or healthy eating within the school, there was very variable awareness of the content, and even sometimes the existence, of the two sets of standards.
"Teachers are barely aware of it. Other than the importance of healthy food in the curriculum, I think they are barely aware of the changes at lunch time. The staff don't have anything to do with school meals."
(Senior Management, Primary, LA - Interview 31)

One or two schools had held meetings to brief staff on the new standards when they were first introduced, but processes for checking ongoing progress towards meeting the standards tended to be informal, typically an occasional conversation between the headteacher and the catering manager/cook. Two schools mentioned having set up action groups to consider aspects of school food and healthy eating. In one case this was led by the PHSE Co-ordinator and was focused on work towards the Healthy School standard, while in another a School Nutrition Action Group was set up to guide the school in taking over responsibility for running its own kitchen. There was no reference made to caterers and cooks involvement in senior management meetings.

### 7.3.4 School meals

The tasks involved in implementing the standards for school meals differed for Local Authority schools and opted-out schools in the study, and so findings for each school type are discussed separately in this section.

## Local Authority schools

In Local Authority schools, menus were developed centrally by the authority's catering contractor, and responsibility for analysing compliance with the nutritional standards fell to the contractor and the

Local Authority, not the school. Menus were devised around a three-week cycle, with up to three meal choices a day. Within this framework, schools had a degree of flexibility, in that they could select fewer than the offered three choices per day and could also vary the number of servings of each particular menu choice that they provided, although there was a compulsory minimum. Some schools preferred fewer than three meal options a day because they believed that restricting children's choice made it easier for them to choose appropriately; however, Local Authority staff noted that restricting its choices might limit a school's ability to meet the nutritional standards. Schools also provided regular feedback to the catering contractor, through a menu monitoring process, on which dishes and ingredients were popular, unpopular and so on.
> "You don't do it [menu monitoring] your first three weeks. You do it your second three weeks. If you do it your first three weeks, the kids aren't that sure anyway, but if you do it the second time then they recognise it and they will take it. You just fill that in and send it off and when it comes to doing the next menus you get them to check - oh, that was a great success so therefore we'll put that back on the winter menu, or that wasn't quite so successful so maybe they'll change it"
> (Catering Manager/Cook, Primary, LA - Interview 33)

The menus developed for primary and middle schools were intended to reflect the changing needs and preferences of the age groups. Where primary school menus tended to be more traditional and restrictive, typically based around one hot meal a day, middle school menus incorporated more options and cafeteria-style elements, including sandwiches and other items that could be 'taken away' to eat outside or alongside those children with packed lunches. These features were intended to retain the interest of older children in school meals by allowing them more freedom of choice. One of the local authorities involved in the study had develop a menu for middle and secondary schools branded as 'Fuel to Go', intended to offer a "more sophisticated", "grown-up" and "exciting" menu for older children. 'Fuel to Go' was intended to engage children as "a brand with the feel of the High Street" and to be able to compete on appeal and attractiveness with popular sandwich shops and takeaway outlets. The menu was structured around the three-item flat rate 'meal deal' concept (for example, a sandwich/panini/carbohydrate-based dish plus a drink (fruit juice/smoothie/milk/milk shake) and a sundry item (fruit/salad/raw veg). Items were traffic-light colour-coded to reflect healthiness, and while no rules were imposed on permitted colour combinations, dining area staff were meant to encourage healthier selections, and this was meant to be reinforced in curriculum activities on healthy eating.

One primary school with a large Bangladeshi population served $100 \%$ halal meals. This meant that the cook had to modify the Local Authority menus to accommodate the halal meat, which could be accessed locally. This meant, for example, that roast chicken would be substituted in a roast beef and Yorkshire pudding dish, or lamb mince in a lasagne or bolognaise dish.

Generally, staff in Local Authority provision schools felt that, having already removed heavily processed and high fat items in recent years and satisfied the food-based standards the previous year, the shift to nutrient-based standards was not particularly onerous. The main tasks involved were the extra preparation work in the kitchen and ensuring the provision of healthy options such as salad, vegetables and fruit. Several schools introduced a salad bar in response to the standards, incorporating raw vegetables, and several also offered baked potatoes and soup as an alternative to the main meal option.
> "I think we have done quite a bit. For the dining room we have less choice happening now at lunch time. We operate a vegetarian option and a couple of others. We have got the salad bar, which is always very popular, and there is always fresh fruit. Since the fruit project, the children are more likely to have a piece of fruit now for their pudding."

(Senior Management, Primary, LA - Interview 9)

Interviews with catering staff suggested that, while they felt they did generally comply with the menus and preparation guidance, they felt it was justified sometimes to depart from prescribed menus in order to appeal better to children's tastes; the quotation below illustrates how fruit was sometimes left out of dessert items in order not to put children off eating them:
> "The sponge cakes - you should really put fruit in it - they'll not have it. We just leave [it] out. We shouldn't but we do. ...Apricot sponge -we get the apricots and just put them on the top, so if they don't like the apricots they just take them off. The cookies we don't put the fruit in it cos we just find it on the floor."

(Catering Manager/Cook, Primary, LA - Interview 5)

## Opted-out schools

Schools that had opted out of Local Authority meal provision had full responsibility themselves for all aspects of school meal provision. Therefore, in addition to food preparation, schools had also to devise their own menus, ensure that menus complied with the standards, source ingredients, select and enter into contracts with their own suppliers, handle payment systems and manage their budgets.

Reflecting this greater autonomy, menu development processes and the resulting meals were more varied in these schools. In the two opted-out middle schools, the catering manager more or less had sole responsibility for menu development and for ensuring that the menus complied with nutrient standards. Catering managers constructed their menus based on a combination of what they had previously served, advice from catering suppliers and informal discussion and sharing with other opted-out schools. One catering manager felt that assuming autonomous control over menu design
had allowed her to be responsive to local tastes, which were perceived to be for 'traditional' meatbased dinners.
"I was putting on what these children wanted. A lot of the things that were on the old menus, the kid were turning their noses up. And then they were putting it in the bin. So I think it's because of the children that come to this school as well, because of the area that we are in, I have a lot of free school meal children...And they wanted roasts, they wanted proper dinners."
(Catering Manager/Cook, Middle, Opted-out - Interview 29)

In the other opted-out middle school, the catering manager perceived that packed lunches were a powerful competitor to school meals, and had developed, in addition to the hot meals, a range of 'grab bags' that could be eaten outside, comprising a sandwich or burger, plus drink and sundry items such as [examples given: brownies, crisps and fruit]. In contrast to the tightly planned three-week menu cycle in Local Authority schools, menus were decided in this school in a more ad hoc way, shaped by day-to-day factors such as ingredient availability and the weather:

> I think you are supposed to [issue menus in advance] but I like to come in and - ‘oh I fancy making that today'. If I've got the stuff in, I can. I know I'm supposed to give them a thingy, every three week cycle. But then I always think, what if that doesn't come in that day? Then I can't put it on anyway, so what is the point in saying you can come in that day cos ...l've got to figure out first thing in the morning, read the weather - is it going to rain or is it not? If I think it's going to rain I don't put as many [Grab bags] on. If it's hot and sunny, I think the most I've ever done is 90. ."

(Catering Manager/Cook, Middle, Opted-out - Interview 11)

The two catering managers in the opted-out middle schools had different approaches to the task of nutrient analysis. One had, at the time of fieldwork, sourced a supplier of nutrient analysis software and training, and was preparing to spend some of her holidays being trained in its use. She was looking forward to the challenge of learning a new process, and felt reasonably confident and wellsupported by other staff in the school. The other catering manager, in contrast, had not at the time of fieldwork identified how meals would be analysed. Interviews with others at this school suggested that there was limited awareness among senior staff of the nutrient standards, and the catering manager appeared to feel somewhat unconfident and unsupported within the wider school.
"I stay within the guidelines I hope. But I haven't got anybody to tell me that I'm not in the guidelines. I don't always have time to go on the Internet and look to see if it is in the guidelines."
"...Are the food police suddenly going to knock on the door or break it in? I don't know. Is someone going to come in and say I'll need to have a look at your menus. You haven't got that written down."

## "Have you been getting any help from anyone in the school?"

"Not so far. I'm hoping that in September they will confront me with a boat load of information."
(Catering Manager/Cook, Middle, Opted-out - Interview 11)

The third opted-out school, a primary school, adopted a different approach again. Here, the headteacher was very involved with and committed to healthy school food, and had set up a food action group including parents and local businesspeople "who were empathetic with the notion of serving locally sourced food, cooked daily on the premises" (Senior Management, Primary, Optedout), members of which group had taken on responsibility for different areas such as procurement, financial management, menu development and nutrition. Part of the impetus for opting-out of Local Authority meal provision in this school had been a desire to develop a more "sustainable" relationship with food in the school, using local and organic suppliers where possible. In this school, the menu was restricted to one main meal choice with a vegetarian option, plus alternatives of baked potatoes, soups and salad bar items. Menus were developed collaboratively by three members of the action group, and then submitted to nutritionists for analysis. This meant that nutrition analysis was not the responsibility of the catering manager, as in the other two opted-out schools; however, the catering manager was expected to take on other responsibilities, such as regularly meeting with a group of pupils to discuss feedback on the menus (see section 7.5.4).

Staff and members of the School Nutrition Action Group described the process of taking over responsibility for lunches and for meeting the standards as having been challenging at times, although by the time of fieldwork, systems and procedures appeared to be well-established. The headteacher attributed progress to the quality of the action group that had been assembled, in particular its mix of expertise, good team-working and shared commitment to the goal.

### 7.3.5 Other areas of the policy

The other five areas covered by the school food standards are breaktime snacks sold in tuck shops, breakfast clubs, vending machines, after-school clubs and drinking water provision.

Tuck shops were found only in middle schools in the study, and most had already removed fizzy drinks and sweets in recent years, meaning that relatively minor changes were needed to ensure compliance with the food standards. One middle school tuck shop sold pizza, Panini, scones and toast, while another sold fruit, carrots baguettes, flapjacks, pizza, baked crisps, fruit shoots and
flavoured milk. A third offered a "deliberately bland selection" (Senior Management, Middle, LA) of soup with French bread, toast, toasted tea cakes, orange juice and tea. Staff running tuck shops felt that they generally complied with the food standards, but some were unsure about specific aspects, "such as whether pizza dough was permitted" this demonstrating some misunderstanding of compliance, which applies to overall menus rather than individual foods.

Most schools that had a tuck shop offered fruit, and some had experimented with different ways of presenting food so that it would be both appealing and more affordable, such as chopping into smaller slices/pieces and selling in little pots.
> "There is carrots, fruit. I put half apples on so it is only 10 pence. I keep the healthy stuff like that to 10 pence. Hopefully anybody can afford 10 pence - half an orange, half an apple."
> (Catering Manager/Cook, Middle, Opted-out - Interview 11)

In primary schools, breaktime snack provision tended to be restricted to the free National School Fruit and Veg Scheme fruit entitlement for Key Stage 1 children plus milk, juice or smoothies, with parents being encouraged to supply a break snack from home if required. One primary school had a few months previously attempted to sell a range of fruit including strawberries and peaches, but had subsequently had to scale back to basic "apples and bananas" because the costs and wastage made it unsustainable.

Breakfast clubs in Local Authority schools were often run by the Local Authority, rather than the school, meaning that the authority took on responsibility for ensuring compliance. Where schools had internal responsibility for the breakfast club, the catering manager generally managed or advised on suitable menus. One middle school breakfast club provided toast, crumpets, cereal, oven-baked bacon, yoghurt, fruit, and orange juice.

None of the schools had vending machines, and few provided food at afterschool clubs, the exception being social events such as school parties or discos, where there was a feeling that bending the rules to provide "treats" (sweets or chocolate) was permitted. Exceptions also seemed to be made for occasional curriculum activities, such as French-themed lessons at which croissants might be served.

In the final policy area, water provision, schools were generally already compliant. All schools already provided water through various means, including dispensers, fountains, water jugs on the table at lunch time, taps in classrooms, and encouraging pupils to bring in water bottles from home. However, water provision arrangements were sometimes perceived by schools as less than ideal. Fountains and dispensers were sometimes not distributed evenly throughout the school, or were located in or near toilets, which was felt to be unsatisfactory. Taps in classrooms could be problematic because of
a shortage of cups/glasses, and some staff expressed reservations about the hygiene and safety aspects of re-using plastic bottles.

### 7.4 Factors influencing implementation

Factors that may have influenced schools' ability to implement the standards, both positively and negatively, can be seen as relating to four broad areas: meal provision structures, leadership, skills and resources. These are now discussed in turn.

### 7.4.1 Meal provision structures

The largest difference between schools in terms of the burden of implementation for the new standards was related to whether schools were within Local Authority provision or had opted out to provide their own meals. As outlined in the previous section, in Local Authority provision schools, responsibility for devising menus and conducting nutritional analysis fell to the Local Authority and its contractors, with the school's role being to prepare and promote the meals. Schools recognised and welcomed that the burden of menu development and analysis did not fall on them:
> "We use the authority. We actually cook it on the premises...[the Local Authority] supply everything. All the information, they now do the menus. They're nutritionally analysed up at County Hall, so they can tell you the fat content, everything. They use CRISp."

(Catering Manager/Cook, Middle, LA - Interview 24)
"Making sure the menus are balanced, again someone has done that for me. Their nutritionists have done that, so I haven't had to think too much about that either."
(Senior Management, Primary, LA - Interview 45)

Opted-out schools, in contrast, bore full responsibility for all aspects of the process, including not just preparation and promotion, but also devising menus, conducting nutrient analysis, sourcing ingredients, entering into contracts with suppliers, dealing with financial aspects, and so on. This meant a substantially increased workload, primarily for the catering manager, who also had to master new skills (see 'Skills', below). In addition, because of their opted-out status, staff in these schools could not access Local Authority support and facilities, although staff did describe benefiting from informal support from other opted-out schools and from suppliers (for example, two catering manager described how particular suppliers had facilitated the ordering process by coding products according to healthiness, and one had accessed nutritional analysis training via a supplier). Caterers in both opted-out and Local Authority schools found the School Food Trust materials particularly helpful.

While opted-out schools faced a heavier burden of implementation with regard to meals, they also had relatively more autonomy in how they implemented the standards, for example, having more choice over suppliers, the range and content of menus, the numbers of each dish that they prepared, and so on. In contrast, Local Authority schools, although having less responsibility, were more constrained in these aspects. A key frustration in some Local Authority schools was the requirement to produce a minimum number of each dish on that day's menu, even if staff perceived that the dish would be unpopular, resulting in wastage and demoralisation among the catering staff.

### 7.4.2 Leadership

Another factor which influenced implementation of the standards was the amount of commitment to school food issues at senior management level. Involved and interested headteachers tended to have more involvement with the catering function within the school, for example having regular contact to check on progress, familiarising themselves with policy requirements, discussing menus, identifying or promoting training opportunities, and so on.
"I have been a head for twenty years, but l've never managed or led a process that I haven't understood."
(Senior Management, Primary, Opted-out - Interview 14)

In contrast, other headteachers were less involved or proactive, tending to assume that catering managers were coping with implementation unless informed otherwise. Where headteachers or other senior managers were more proactively involved, catering managers tended to feel better supported and valued, and vice versa. One slight exception was an opted-out primary school where the headteacher had implemented major changes to the school meal service by setting up a food action group committed to locally sourced food provision (see section 7.3.4 above); here, the catering manager had initially felt apprehensive and anxious about the re-configuration of her role and the potential insecurity, although at the time of fieldwork, these concerns were abating.

Senior managers who were strongly committed to and involved in school food issues tended to see school meals not simply as a functional service provided by the school but as integral to children's education, in that children were more likely to learn better in an environment where healthy eating was promoted and valued. Local Authority interviewees endorsed this view, perceiving that an enthusiastic and championing headteacher was instrumental in signalling to children, parents and staff that school food mattered:
"I think if you look at all the schools that are successful as far as food is concerned, it is where the headteacher has a commitment to food. They encourage the staff to eat in the dining room with the children, not in a supervisory capacity but in a social
capacity. They will use the lunch time as an extension of the day. Or they will use the lunch time as a lesson."
(Cross-school Role - Interview 52)

Committed headteachers tended not only to involve themselves proactively with school meal provision, but also to initiate additional actions to enhance the school meal experience and promote a healthy eating ethos in school, such as dining room refurbishment, curricular initiatives, and providing guidance to parents on healthy eating (see section 7.5 below). These sorts of actions also indirectly facilitated the implementation of the standards, in that they made catering staff's working environment more pleasant and communicated messages to the wider school and parent community about the importance of school meals and healthy eating.

### 7.4.3 Skills

The skills, knowledge and confidence of key implementers were important in determining the ease with which schools got to grips with the new standards. In terms of school meals, this primarily meant the catering managers/cooks and their kitchen staff.
"When we first started looking at that this, what we thought was the core issue was really the staff - a good cook and a good support cook that want to do it, it is very possible. If they don't want to do it, there is no way it is going to succeed."
(Senior Management, Primary, Opted-out - Interview 8)

A key challenge for catering staff was adjusting to the more time-consuming preparation methods required by the new menus. For some these did not necessarily require new skills more a return to methods of food preparation they had used in the past before school meals had become strongly reliant on processed ingredients. Some catering staff had originally been employed when there was little 'cooking' involved in preparing school meals, meaning that they had had to adjust to a role involving both more preparation and a knowledge of nutrition. A Local Authority catering contractor representative perceived that most catering staff had adapted well to the new skills and knowledge required:
"I think they have taken to it very well actually. They have done a lot of training and we've sent them on to the NVQ training. They now understand a whole lot more. They now look at packaging themselves."
(Cross-school Role - Interview 37)

In opted-out schools, where staff also had to design and analyse the menus, catering managers found themselves having to master new skills such as searching the internet for information and using
software to analyse their menus. While some experienced the new standards as an opportunity to develop skills and expertise, others were less enthusiastic about adapting to new approaches or lacked confidence in their ability to do so.
"It is percentage this and percentage that. I'm just simple in the head. I can't take all that in...Maybe I'm too set in my ways."
(Catering Manager/Cook, Middle, Opted-out - Interview 11)

There was a feeling among some catering managers particularly those who had been employed for several years, that the nature of the job had changed with the new standards, to become more technical and less creative, requiring a shift from intuitive common sense ways of working - "a little bit of this, a handful of that" - to a more prescriptive approach in which every ingredient was weighed out and no deviation permitted.
"They've taken all the fun out of cooking."
(Catering Manager/Cook, Middle, LA - Interview 24)

Interestingly, while some catering managers perceived the new standards to have diminished their feelings of creativity, control and autonomy, others perceived the reverse. This was particularly the case in opted-out schools, where the new standards could mean a significantly altered and enlarged job role for the catering manager. Although two opted-out catering managers had some ambivalence about the increased workload and responsibility (see section 7.3.4 above), the third had positively embraced the challenges involved in this expanded role,
> "Thoroughly enjoyed it. Plus it gave me experience on the computer - although I was doing the same thing - because I'm not used to a computer and keyboard and you know - I was away."

(Catering Manager/Cook, Middle, Opted-out - Interview 29)

### 7.4.4 Resources

Human and physical resource factors - staffing levels, time, facilities and funding - also influenced the ease or difficulty with which schools implemented the standards. In Local Authority provision schools, kitchen staff were employed by the Local Authority and staffing levels were linked to school meal uptake; if meal numbers fell, staffing levels were cut accordingly and vice versa. However, the new meals required extra preparation time because of the greater amount of cooking from scratch and the increased quantities of fruit and vegetables to be prepared. This was particularly challenging where staffing levels had remained at the same level or even dropped because of falling uptake.
"I'm shattered when I get home. I'm tired honestly. It has only been the last week and this week, but you are just shattered when you get home. You are under more pressure. You are rushing all the time, just to get finished on time... Today - the pies and the chicken to get everything ready - you've got all your mixed fruit to cut and your salad bar, your pasta and rice to cook and everything and cut all your lettuce up. You haven't got the time to do it. You have got to cook it and then wash all the dishes as well."
(Catering Manager/Cook, Primary, LA - Interview 5)

The kitchens in the study schools were of two types - production kitchens, which prepared all food onsite, and regeneration or 'regen' kitchens, which had originally been designed for a combination of cooking and re-heating pre-prepared ingredients and were equipped only with ovens. The introduction of the standards, combined with schools' own self-initiated changes as part of Healthy Schools and other initiatives, had seen a move towards more on-site preparation of fresh ingredients, such that all school kitchens in the study area now prepared some if not all meal elements from scratch. This was a substantial challenge in regen kitchens.
> "Obviously with the emphasis on freshly prepared food and everything being cooked on site, what they [catering staff] are having to do at the moment is use these regen ovens because that is all we've got. We've got no hobs, no steamers. Very very limited, and bless them, they are doing the best with what they have got...they are supposed to be making things like custard from scratch without a hob. It is not that easy."

(Senior Management, Primary, LA - Interview 45)

Even in schools with full production kitchens, equipment was often perceived to be inadequate. In one opted-out kitchen, the catering manager described how potatoes were all peeled by hand because the kitchen did not have a commercial peeler/tumbler, adding hours onto meal preparation time and producing excessive wastage.

Kitchen refurbishments were perceived as expensive with costs having to be met either from within existing school budgets or covered from external grants. One headteacher noted that with an annual budget of only $£ 25-30,000$ for all structural and refurbishment work within the school, converting the school's regeneration kitchen to a fully cooking kitchen, at an estimated $£ 75,000$ cost, was simply unrealistic. One school which went in to Special Measures during the study noted that kitchen and dining room refurbishments inevitably fell lower down the school's priorities.

### 7.5 Enhancing the impact of the new standards

A key theme to emerge from across the interviews was that it was not sufficient simply to ensure that the food and drink provided in schools met the new standards; children and parents needed to be encouraged to try the new meals and to appreciate the importance of healthy eating in schools. Attempts to promote the meals and healthy eating in general can be seen as taking place at the serving counter, in the school dining room, throughout the wider school environment, through involving children, and through engaging parents. Each of these settings is now discussed.

### 7.5.1 At the serving counter

Several interviewees emphasised the importance of making food look attractive and helping children make appropriate selections at the serving counter. Strategies included displaying menus and attractive posters at and on the way to the serving counter, paying attention to how food was presented on the serving counter, investing in new serving trolleys and display units, colour-coding items to indicate their relative healthiness or permitted combinations, and offering free samples of dishes and unfamiliar ingredients.
> "Yes - salad bar, pasta bar, chill cabinet, dishwasher and then new tables, chairs, plates, trays, knives, forks, spoons, beakers ... Yes just get rid of everything that is left from the 1960s really. It should be a really good place to go - a place where you choose to eat ...

> There will be a new clear away and a new queuing system. We'll buy a new till. The one that is there was in shops when Noah was a boy. So it is going to be much better all round".

(Senior Management, Middle, LA - Interview 30)

The visual appearance of foods was recognised to be important because "like everybody, [children] eat with their eyes" (Catering Manager/Cook, Middle, Opted-out - Interview 29). Similarly, interviewees commented that children were easily put off by things that were unfamiliar and so dishes with "difficult" names were renamed to make them more recognisable and appealing: 'spaghetti bolognaise' to 'mince and pasta', 'frittata' to 'potato and egg', 'chicken chow mein' to 'chicken noodly doodly' and so on.

There was a feeling among some interviewees that the key to winning children over to the new menus was direct personal contact; staff at the serving counter and in the dining area helping children to choose appropriately and encouraging them to try new foods. Local Authority interviewees commented that they encouraged cooks "to be on the serving hatch all of the time or in the hall talking
to the students" (Cross-school Role - Interview 37), and the catering manager described how she was often present at the serving counter offering children tasters of unfamiliar dishes and vegetables such as spicy potatoes and roast parsnips. For her, having a good relationship with the children and building their confidence was essential to overcoming their reluctance to try unfamiliar foods:
> "You give them little tasters if you've got something new on. You know you put a little corner of something on the side of their plate and ask them to come back, you know: when you've eaten it come back and let me know what you think of it. They might forget that day but they will come back and say 'yes L---, that was lovely, I would buy that'. You know? 'I would pick that up for me lunch' or, 'no.""
> (Catering Manager/Cook, Middle, Opted-out - Interview 29)

However, catering staff were often too busy in the kitchen to interact with children at the serving counter - one catering manager commented that she did not know any of the children in the school other than by sight - and the feeling among catering staff was that it was the role of dining room supervisors and assistants to help children in this way (see next section below)

### 7.5.2 In the dining room

The logistics and ambience of the school dining experience was a key factor in shaping children's and parents' perceptions of school meals. Large numbers and limited time meant that the experience was often noisy, rushed and stressful (see also section 7.6.4 below). In addition, dining areas were sometimes physically unappealing spaces, with ugly or inappropriate furniture, old equipment and so on.

School and kitchen staff recognised that children were more likely to choose and to enjoy the new meals if the dining area was more attractive and conducive to a pleasant, sociable dining experience. One primary school held occasional live music performances and put up children's artwork in order to create "a nice dining room experience for the children" (Senior Management, Primary, LA); another instituted a reward system whereby selected children received special treatment in the dining room, having their meals served to them at a special table for a week.

Several schools had redecorated or otherwise improved the dining room to coincide with the implementation of the standards. One primary school had bought new circular tables with seats attached, to reduce the time that kitchen staff spent on setting up the dining area and to encourage more interaction. Some primary schools had replaced compartmentalised airline-style trays with 'proper' crockery and trays, partly to make the dining experience more attractive and partly to avoid younger children being confused about the order in which to eat items (however, catering staff did comment that this involved more washing-up for them).
"When we've moved onto plates and bowls I think you can see a difference. It improves their social skill and it makes them eat their lunch rather than leave their lunch and move onto their dessert, which is what a lot of them do."
(Cross-school Role - Interview 37)

Dining area refurbishment involved costs: one school had spent $£ 9000$ on tables alone, and another had applied for and received external funding of $£ 70,000$ to upgrade its kitchen and dining facilities. While recognising the desirability of an attractive dining area, several schools felt that such costs were simply prohibitive. Local management of schools meant that unless a school secured an external grant, any costs for upgrading facilities came out of the school budget and meant less to spend in other priority areas. In addition, several schools felt there was limited scope for improvements because of physical constraints such as the dining area sharing functions with the rest of the school.

Some headteachers emphasised the importance not just of improving the dining area but of being present within it: putting into practice the school's commitment to healthy eating by having staff lead by example:
"I eat it as well and so do the staff, that is quite a powerful advert to the children as well and to the families. If parents come in and [criticise the lunches]... I say, 'no actually I had that for dinner and it wasn't like that at all'."
(Senior Management, Primary, LA - Interview 9)

Many staff, however, avoided the dining area and ate in the staff room. Both teaching and catering staff felt that the main responsibility for encouraging children to choose and eat appropriately fell to dining room supervisors and assistants (sometimes called 'dinner nannies') see section 7.3 .3 for information on training of supervisory staff. While in several schools supervisors were proactive in this way, in others there was a perception that dining room staff were largely focused on maintaining order and cleanliness rather than on encouraging healthy eating. Instances were given of dining room staff "shouting" at children or not engaging with them, or paying little attention when children left food on their plates. Supervision staff and kitchen staff sometimes had little to do with one another, partly as a result of different employment structures (supervisory staff tending to be employed by the school rather than the Local Authority) and tensions were sometimes evident.
"It is their job to encourage them. I'm don't have time to come off the hatch and encourage them to eat. If they are stuck with the least choice - well I don't like that Miss. There is nothing I can do, cos I can't come in and cook something else at the end of the day. You have just got to say, just try it. It is up to them to make them try it, but they are not doing their job anyway - the nannies."
"In what sense are they not doing it?"
"They are not encouraging them. They are just letting them throw it away. It all goes in the bin."
(Catering Manager/Cook, Primary, LA - Interview 5)

### 7.5.3 In the wider school environment

As noted in section 7.3 above, several schools were already promoting healthy eating through the curriculum and through participation in Healthy Schools and other initiatives. Healthy eating was covered in Personal Social and Health Education (PSHE), food technology and other lessons as appropriate. The focus on healthy eating education was ongoing in most schools, but several felt that efforts had been intensified with the introduction of the new meals. Examples of healthy-eating themed lessons and activities included alphabet learning based around foods, food-based language lessons, and themed events or weeks involving food, such as Valentine's Day or Chinese New Year. In one primary school, such activities might involve the catering manager going into the classroom and working alongside the teacher. Conversely, two primary schools encouraged teachers and pupils into the school kitchen, with each class being allotted a period to use the kitchen for cooking. Although most schools appeared to have continued with or stepped up food-themed activities and lessons, in one school uncertainty was expressed as to whether such activities would be permitted "under the new regime", i.e. with the introduction of nutritional standards (Teacher, Middle, LA)

Several schools, particularly primary, had gardening clubs in which pupils were taught to grow herbs and salad vegetables. Staff involved with these initiatives noted that growing food not only helped pupils to understand the connections between food production and consumption, but also made them more likely to eat those foods, both in the classroom and when they encountered them in the dining room: "Because they have grown it they love to eat it" (Catering Manager/Cook, Primary, LA). Children themselves appeared to enjoy such initiatives, in one school showing the researchers their herb and vegetable plots. A primary school that had opted-out to provide its own locally sourced meals was working with the Soil Association to develop its own gardens, with a view to growing some of its own meal ingredients.

Several schools had participated in a Local Authority initiative involving demonstration chefs going into schools to show children and parents how to prepare interesting dishes. Parents who had participated, or whose children had participated, noted that the event had exposed children to more adventurous tastes and had given them as parents additional leverage for encouraging children to eat healthily.
"After the Expo Chef it gave me the tools to go, hang on a minute, you tried it at school. So I could really push the - do you remember what those chefs said about
trying something, even if you have one mouthful and you don't like it. I was able to crack that whip over their heads."
(Parents, Primary, LA - Group 16)

### 7.5.4 Involving children

Another way of promoting the new meals in the wider school environment was to involve children actively in decisions regarding school food. Instances were given of conducting pupil surveys on the meals, having a school vote on a favourite end-of-term food treat, involving pupils in decisions regarding new furniture or crockery for the dining area and children helping to run the breakfast club by counting the money and conducting surveys of pupils' preferences.

In one school, children on the school council had been involved in monitoring their fellow pupils' packed lunches for healthiness (see also section 7.5 .5 below). School councils were also involved in several schools in soliciting pupils' views on the menus through surveys and feedback forms. In one opted-out primary school, children were encouraged to provide immediate feedback on the meals via a flipchart in the school dining rooms. At the time of fieldwork, plans were underway to develop this further by setting up a regular forum between a group of children and the school cook to discuss the flipchart comments and make recommendations for the menus.

### 7.5.5 Informing, engaging and providing guidance to parents

Most schools provided some information to parents about the new meals. Some proactively sent out information on the new menus or requested parents' feedback on them, while others simply made the menu information available on the school website for parents to view if they chose. Parents' evenings sometimes featured a stall or presentation at which parents could learn about the school's approach to healthy eating or try samples of the new meals; in one or two schools, the catering manager/cook was actively involved in these kinds of activities. One perceived value of such activities was that they could help correct parents' misperceptions about the quality and size of a typical school meal:
> "[They say] 'Oh you didn't tell me you could get that. That looks lovely’. But they don't believe that that is what they can get for $£ 2.05$."

(Catering Manager/Cook, Middle, Opted-out - Interview 11)

Several schools had invited parents to come in to school, in most cases at the start of the school year mid-implementation, to try the new meals for themselves, with mixed success: one or two primary schools reported quite a good response while others had very little. There was a widely held feeling
that it was difficult to interest and involve parents generally, particularly in middle schools, where one catering manager described receiving not a single reply to a mailing of all parents asking for their views on the new menus. Catering managers' perception was that it was fairly normal to get less response from parents in middle schools than in primary; this concurs with parents focus groups where parents of primary school children were more concerned than parents of middle school children.

School and kitchen staff had concerns about the unhealthiness of some of the packed lunches being brought into school (examples were given of children coming to school with leftover fast food, an Easter egg, nothing but confectionary, and so on). The lack of regulation of packed lunches, contrasted with the stringent guidelines for school meals, was perceived to undermine the new meals by making packed lunches much more attractive in children's and parents' eyes. Consequently, several schools also attempted to encourage healthier lunches by producing leaflets for parents illustrating an ideal packed lunch, or by talking about and showing examples of packed lunches at school events. Several staff also spoke of occasions when they had "had a quiet word" with a parent who repeatedly sent a child to school with an inappropriate packed lunch. Beyond this kind of information or guidance, few of the schools in our study had formal policies on packed lunches, perceiving that it would be inappropriate to encroach on parents' territory in this way and impractical to "police".

While middle schools tended to feel that packed lunches were "too challenging" and "too delicate" an issue to tackle in any more robust way, some of the primary schools were prepared to be more interventionist. Actions undertaken included giving stickers or merits for healthy packed lunches, using school council pupils to monitor packed lunches, putting notes in lunch boxes to go home suggesting alternatives, and, in one or two schools, confiscating inappropriate items and replacing those items with healthier alternatives such as fruit. Generally, the school's approach in this area was determined by the headteacher and the extent to which he or she was committed to taking a robust and potentially unpopular stance; in the absence of this kind of lead from the top, kitchen and other staff felt that there was little they could do to enforce healthier packed lunches.

### 7.6 Views of key stakeholders

As we note above in the methodology section, the effectiveness of any new policy will depend partly on how it is perceived and experienced by key stakeholders. This is particularly important in relation to school food, where, if parents and children do not approve of or like the new food provision, they can choose packed lunches rather than school meals, thereby, potentially reducing the policy impact of providing nutritionally advantageous food and drink in schools. Similarly, school and kitchen staff can choose to implement only the minimum requirements, or can engage enthusiastically with the wider issue of healthy eating, through the types of complementary actions outlined in the previous
section. In this section, therefore, we explore the views and perceptions of four stakeholder groups headteachers and other school staff, catering managers, parents and children - on the standards in general, on the effect they perceived the standards had on school meals and on how children are responding to the new school food.

### 7.6.1 Headteachers and other school staff

Headteachers were generally supportive of the overall goal of the new standards. For several, the standards formalised a direction they were already travelling in, in terms of the school's commitment to healthy eating. There was a recognition that this was not a policy that would have instant success but that over time, with each new intake of children, healthier food and drink in school would become the norm.
"I applaud the new standards, even though it has driven some people away to start with. But the children who have come through have got used to the taste now, and not having the salt content, say. So in helping to implement it I think the Local Authority has been on the ball and they have been quite proactive with it and they helped us with the bid for the money. My ambition would be that everyone in school would have a proper dinner - simple as that."
(Senior Management, Middle, LA - Interview 30)

Headteachers in primary schools tended to welcome the greater restrictiveness of the new menus, feeling that "taking things out of the equation" for young children generally resulted in less waste, more appropriate meals and a smoother selection and serving process. In this respect they were in broad agreement with primary school parents (see section 7.6 .3 below).

That said, headteachers also had some concerns and frustrations. A few noted that schools were only one source of children's food intake and should not be expected to bear the full weight of responsibility for driving up dietary standards, a view shared by some catering managers. Several noted that the standards had increased the workload pressure on kitchen staff, often without any accompanying increase in resources. They also noted that school meal numbers had tended to drop when the new meals were introduced, although in several cases these were now stabilising or increasing again (see economic evaluation short report at http://phrc.Ishtm.ac.uk). Falling meal uptake was recognised as problematic not only in terms of nutritional impact of the policy but also in terms of quality of service; if fewer children had meals, income fell, resulting in less flexibility to offer an attractive range of choices in the menu (thereby reducing the appeal of meals further) and a smaller budget for kitchen staffing and facilities (meaning more pressure on existing staff). Some argued that failure to recognise these economic dimensions of implementation was a weakness in the school food policy:
"My biggest challenge is the lack of facilities in school and the lack of funding to do something about it. There are many schools in Newcastle who have similar problems....there are many schools in Newcastle where all they have got is a scullery and a sink - what could they do really to improve the quality of the food that they are getting?... I think it's all very well having these policies if we are all on a level playing field. After years and years of Local Authority putting money into those schools that have, now we're told if you want something different you'll have to pay for it... So yes I think it is admirable that we are striving towards these goals, but I think that perhaps it would have been sensible to have some money so that schools, so that the burden wouldn't be totally on schools. Given that our main reason for being here is education and not for feeding children, there should have been some outside funding to implement the changes."
(Senior Management, Primary, LA - Interview 45)

Turning specifically to perceptions of the standards impact on school meals, headteachers and other teaching staff's views were mixed. In several schools there was a perception among some headteachers that the new menus were somewhat restrictive and could be culturally inappropriate, in the sense both of not catering to minority ethnic group food cultures (which tended to favour spicier foods than those in the new menus) and of not particularly reflecting the working class food cultures in the areas (which tended to favour traditional roast dinners, pies and so on). Staff in a small number of schools felt that quality of the meals had declined with the new menus, and suggested that this could have been because of the constraints now placed on the school cook or because of cost-cutting measures. Staff in one school described the food on some days as "horrible" and "awful" (Middle, LA), while in another school, criticisms were expressed of recipes that were perceived to have gone so far in a healthy eating direction as to be tasteless:
"I think generally the quality has improved, but some of it just doesn't come off very well. Some of it doesn't make any sense. They are providing puddings with no sugar in, so they taste foul. There is no point to the pudding whatsoever. To me, some of the standards, on a personal point of view, I think they have gone to the extreme - sugar is wrong and it's bad and my personal opinion is it's not and you can have a small amount of it. If you give me a biscuit and take out all the sugar, it is totally pointless. Some of the quality foods have improved, but it's very hit and miss."
(Teacher, Primary, LA - Interview 23)

PSHE and food technology teachers had a number of specific criticisms, including; the standards were perceived to promote a notion of 'good' and 'bad' foods rather than an overall balanced diet, that some of the requirements were in their view inappropriate for children, such as the stipulation that dairy products be low fat and that the combinations of items that were permitted in a school meal appeared
in their view to be carbohydrate-heavy or inconsistent with healthy eating advice taught in the classroom.
"I don't agree with having the slices of bread in the same choice that you can get potato, because I feel that's a wrong message...There's things like that that I find difficult, that they put the pasta in the same section as the vegetables and the salads, and that's wrong in my opinion, that's not what I'm teaching. Yes, and they're got other carbohydrates along the line as well, it's a bit of a mixture to be honest - they've got the fajita wraps and this sort of thing, which is again another form of carbohydrate."
(Teacher, Middle, LA - Interview 1)

Positive reactions to the new meals were also, expressed. One headteacher in a Local Authority school noted that the meals in his school had always been good and had continued to be of the same quality under the new standards and another Local Authority school headteacher chose to sit with the children every day having a school meal as a sign of his endorsement. In one opted-out middle school, where the cook made a fresh soup every day and take-away salads for pupils and staff, several school staff enthused about the variety and quality of the meals, again illustrating their support by opting to have school dinners themselves. The quality of the meals in this school was perceived to speak for itself, as the quote below illustrates.
> "This week we've our new intake of year fours from first school, who are very impressed with the school lunches. In fact there was so many came with packed lunches on Monday that we were really worried that they weren't going to have proper meals. And then on Tuesday when they'd seen what [the catering manager] was serving on Monday, there was a good 40, 50 went on to school meals."

(Senior Management, Middle, Opted-out - Interview 35)

In the opted-out primary school, the headteacher described how a recent meal he had eaten, comprising organic meat and fresh local vegetables, "wasn't a school dinner, it was just a good dinner. It was worthwhile." (Senior Management, Primary, Opted-out). This same headteacher regularly weighed the waste from school meals. His perception was that the waste had decreased in the months prior to fieldwork, indicating that a greater proportion of the food served was now being eaten rather than left.

## "You weigh the waste?"

"Just to see where it is going. Since April, 40\% more food gets over our counter out to the children, including big increases in bread - different types of bread and salads and pastas on top of their main meal. So the additions are going out. We looked at size of portion and the portions are the same if not more generous. Then the waste is
significantly down. So that means people are taking more and eating more. That is quite reassuring."
(Senior Management, Primary, Opted-out - Interview 14)

### 7.6.2 Catering managers

Catering managers' views of the standards were closely influenced by how the standards had impacted on their job satisfaction and on their experiences of children's response on a day-to-day level. Although some, as we have shown above, coped with the increased amount of cooking from scratch and enjoyed the challenge of winning children round to new healthier foods, several felt that the standards had made their life more difficult and had resulted in them having to prepare meals which they felt were unappealing and unpopular.
> "I think he's [Jamie Oliver] made it worse hasn't he. Why couldn't he just leave it alone? He's made it worse for us as well. There is two of us in the kitchen for everything now. It is all the cooking, all the washing the dishes, all the serving has to be done by the two of us."

(Catering Manager/Cook, Primary, LA - Interview 5)

One or two objected to what they perceived as the attempt to impose an agenda on children's eating, particularly where there was a risk that children would reject the meals entirely and go hungry; and resented the implication that schools alone were responsible for addressing a problem with wider social causes.
"They are over the top and I'm getting absolutely fed up with them, blaming school meals for the state of their children. I only give them one meal a day. I don't give them the other three. I just feel as if we are getting penalised for doing it. It should be the parents. They are going overboard with this nutrition lark."
(Catering Manager/Cook, Middle, Opted-out - Interview 11)

Another felt that the standards had been introduced too suddenly, without sufficient time to win over children and parents, resulting in a drop in meal uptake:
"I've lost nearly a hundred...Well I mean the meals have dropped, [although] they haven't gone down any more...I think they done it too quickly. It was just, whomp, you can't have that. Everything just stopped immediately instead of phasing it in more slowly...you might have kept them from walking away and not trying it."
(Catering Manager/Cook, Middle, LA - Interview 24)

Wasting food was felt to be both wrong in its own right and also undermining of their own job satisfaction and professionalism. There was particular irritation at the requirement in Local Authority schools to provide a stipulated minimum number of each dish on the menu regardless of its likely popularity.
"At one time I would do three or four pies, but like today, I'm doing nine pies. Whether they want them or not - that's the percentage I've got to put on."
(Catering Manager/Cook, Middle, LA - Interview 24)

Conversely, one catering manager commented on the perceived miserliness of some of the requirements regarding portion size, particularly for the protein element of a meal or sandwich, which made her feel she was "ripping people off" and providing poor value. Another criticism was that the range of permitted ingredients and combinations was somewhat narrow - as one catering manager expressed it, "if you don't like tomatoes and cheese, you're stuck!" (Catering Manager/Cook, Middle, LA - Interview 24) - and that the new meals "seem to have gone boring, because they're so limited" (Catering Manager/Cook, Middle, LA - Interview 24).

However, others were more positive. One catering manager commented that just before the fieldwork period, the school had invited parents to try the new meals and reported that parents "really enjoyed it" and gave "fantastic" feedback. This catering manager, who had won a Local Authority catering award and was also involved in training other cooks, felt that both parents and children had responded well to the meals after an initial period of uncertainty:
"They were a little bit unsure but once they knew they could help themselves and see what was there, they would try it. They are quite good here at trying things, especially the younger ones. I think what you find with Reception is that they are really good eaters. They love all the dinners and curries and chillies, which is quite surprising for the size of them...Everything seems to be fine, especially more so since the parents have been in to see what they actually get. Some parents are quite willing to pay out three or four pounds for Macdonald's. They get a substantial meal here, fresh vegetables, salad bar, fresh bread every day. On some of the comments the parents said 'can I come every day?'...To be honest I'm really happy with them and the children are really happy with them."
(Catering Manager/Cook, Primary, LA - Interview 33)

Another caterer felt that the standards had encouraged her to be creative and to introduce children to foods and ingredients they might never have previously encountered. Furthermore, her experience suggested that this effort was paying off, in that, after initial reluctance, children were now becoming more confident about adventurous foods (examples included red cabbage, beetroot and parsnips), and meal numbers were going up.
"We try to do the biggest variety we possibly can of vegetables. It takes you a long time. I think I've, what is it, it takes nine - nine times of you having a certain thing on before they start noticing it, and then after that they might ask what it is....yes, it took me just over a year to get them to eat roasted parsnips. And now I can't make enough of them in the winter ...l'm very pleased with the outcome. I'm very pleased with the results and, my meal numbers have gone up."
(Catering Manager/Cook, Middle, Opted-out - Interview 29)

### 7.6.3 Parents

Parents' awareness of the school food standards was limited apart from among those who were closely involved with schools through governing and other bodies. While most were aware that the past few years had seen a move towards healthier school food, in the form of less processed food and restrictions on fizzy drinks and confectionery, these changes were largely attributed to Jamie Oliver or to local initiatives, with little awareness that a national school food policy had been implemented.

In general, parents supported the notion of schools providing healthier meals, particularly compared with the heavily processed meals that some remembered from their own school days, although there were differences in parents' views related to socio-economic background and also to the age of children. The parents in more affluent areas tended to place a stronger emphasis on healthy eating and to be supportive of the policy; however, this sometimes translated into relative unconcern about school meals because lunch was not their child's main meal of the day and they were confident that overall their child ate well.
"If on one particular day they are unhealthy it doesn't really matter, well to me anyway because on the whole as long as they eating enough fruit and enough protein, enough vegetables across a week, or a fortnight, or whatever it happens to be, that's more important than on one particular day."
(Parents, Middle, Opted-out - Group 36)

For less affluent parents, however, the school dinner could sometimes be the child's main hot meal of the day, and this was reflected in concerns about sufficiency and value for money.
"When your child is having something to eat at school, a proper meal, you would expect when they came home that all they would want is a sandwich or some beans on toast. .... She will say Mum, I'm hungry, so you still have to give her another meal. So, you're not saving, in fact you're spending out more I think. I mean if you're putting £15 a week on a card for one child, that could serve you a good two weeks for packed lunches and you know they are going to eat it."
(Parents, Middle, Opted-out - Group 46)
For this reason, many less affluent parents preferred to provide packed lunches which they felt were cheaper and better value because the child was more likely to eat what was provided; this was also the view of some more affluent parents whose children were 'fussy' or 'nervous' about unfamiliar foods. Given these concerns, some less affluent parents felt that it was more important for schools to provide food that children would eat and enjoy rather than "going overboard" with unrealistic rules.
"I say well, do they not have a selection, even if it's just chips - I know chips are supposed to be bad for you - but if there's nothing else for the children to eat, if there's nothing else the person won't eat, why can't they just put chips on? Even that's all that they have, at least you know they're going to have something."
(Parents, Middle, Opted-out - Group 46)

Differences were also evident between parents of primary and middle school children. Primary school parents tended to welcome the greater restrictiveness of the new meals, feeling that reducing choice and normalising the healthy option made it easier to inculcate healthy eating among young children:
"If they haven't got a choice they will eat what they are given."
"Yeah."
"If I was in the house making a meal then I wouldn't give them a choice."
"From the school's perspective, things in terms of waste has gone down considerably. It is much better for the school. And they went down the more nutritious route. It is a much more balanced diet."
(Parents, Primary, LA - Group 51)

Some primary school parents said they preferred their child to have a school meal rather than a packed lunch because it would be more nutritionally varied - "There are only so many ham sandwiches they can eat" (Parents, Primary, LA) - and would expose the child to new foods. In contrast, middle school parents, while supporting healthier meals in principle, felt that it was harder to influence food preferences and habits as children got older and asserted their growing independence. This reflected a wider ambivalence surrounding children and food. On the one hand, parents welcomed that school meals were more responsive to children's tastes than when they themselves had been children, that children were no longer "forced" to eat food which they did not want; on the other, they felt that there was insufficient guidance offered to children and that they could not handle or make appropriate choices when faced with too much freedom.
"I know they're trying to treat them like young adults because really that's what they are; they're trying to prepare them to go on up to High School and what have you but..."
> "They're still children."
> "They're still children at the end of the day, they still need to push them in the right direction to make sure that they're actually doing something they want them to be doing."

(Parents, Middle, Opted-out - Group 46)

This translated into concern among some that children did not seem to be helped to make appropriate choices, because of a lack of clear rules on what was recommended and limited face-to-face encouragement from serving and dining room staff
"There doesn't seem to be any regulation or anyone standing there saying this complements that, or you've got perhaps too much of that."
(Parents, Middle, Opted-out - Group 36)
"F--- came home the other day and I said what did you have for lunch? He said I had pasta and I had some bread. That was basically just carbohydrates. You just think, yeah all quite healthy but maybe all in one...To me there was no fruit or veg. I do wonder how much guidance they get when they get to the counter and whether they people who are handing out the food are going, maybe you should have some salad with that."
(Parents, Primary, LA - Group 16)

Yet, when specific guidance or restrictions were imposed, some parents chafed at these, feeling that they were unfair. One particular example of this was the stipulation that children should only bring water into school rather than juice; a rule which some parents colluded with children on evading

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"What annoyed me was I was giving C-- the bottled water, the flavoured one and they
wouldn't let him take it in; I said why? It's just spring water. No, it's got to be proper
water or nothing."
"Yes, plain water."
"It's a bit pathetic, isn't it, really?"
"But some children don't like plain water, my daughter doesn't."
"You see what I used to do is I just used to get a bottle of Evian or something like that, used to drink the water and then just fill it up with flavoured water and they never knew the difference, unless the child went, oh it's lovely flavoured water this, they would never know the difference."
(Parents, Middle, Opted-out - Group 46)
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Parents' perceptions of the new meals were strongly mediated by children's own accounts, which they recognised could be negative and unreliable. Some were aware that schools sent out menus at the start of term or year or that menus were available on the school website, but not all had read the information and some of those who had felt that the menus did not necessarily reflect what was served in practice. In one school where menus were not routinely sent to parents in advance, one parent felt that knowing the menus might increase the likelihood of children choosing to have dinners, because they would be able to identify days on which particular dishes that they liked were being served (in this school, children could choose between dinners and packed lunches on a day-to-day basis, rather than choosing a week or term in advance as in other schools)

Based on their partial and incomplete perceptions of the meals, parents had mixed views. Generally they recognised that the new meals used fewer processed items than in the past, although some felt that meals could improve still further in this regard. Some felt that, from what they had heard, the meals seemed to be carbohydrate-heavy (for example, pasta and bread, or pizza and jacket potato), and some queried the combinations which their children reported having been allowed to select, such as "potato, bread and cucumber" or "fish and gravy".

Parents' perceptions of how children were responding to the new meals were similarly varied. Some described children coming home hungry and claiming that there was nothing to eat or nothing that they liked; others felt the meals were being reasonably well received by children.
"He'd rather have like frozen meals and stuff like that, ready cooked and he hates the way it's all been done now."
(Parents, Middle, Opted-out - Group 46)
"Mine seems to be quite happy. She's not complained that she doesn't like it." "You just think well it cannot be bad because if it was horrible she'd remember."
(Parents, Primary, LA - Group 51)
"Actually my son loves them I should say because there are quite a lot of negative comments coming out, but my son thinks they are fantastic. He loves them, apart from the mashed potato ... He likes things like Sweet and Sour Chicken and Chilli, and Spaghetti Bolognaise. In fact the other night he wanted to make Sweet and Sour Chicken because he'd had it at school and said it was nice, so there are a few things he has probably tried that he hasn't had."
(Parents, Middle, Opted-out - Group 36)

Some dissatisfaction was expressed at the pricing of school meals, where the rules regarding what was included in the flat rate charge ( $£ 2.05$ at the time of fieldwork; this compares with $£ 1.95$ in LA schools) were felt to be confusing and unfair; a particular focus for criticism was the requirement to
pay extra for juice with a meal: "I think well, you're paying $£ 2.05$ for a meal, you should get a drink of juice with it. So, I think that's wrong" (Parents, Middle, Opted-out - Group 46).

Moving beyond issues concerning school meals, several parents picked up on the lack of clear and consistent guidelines for packed lunches perceiving the ad hoc systems of guidance and occasional monitoring which operated in most schools (see section 7.5 .5 above) to be arbitrary and unhelpful.
> "J--- comes home and says oh so and so's had crisps and you told me I'm not allowed to have crisps in my packed lunch. They are not allowed crisps. [The headteacher] banned crisps. But loads of kids have crisps."
> "I know they are not supposed to have chocolate but I've always put crisps in."
> "We got a list home once - no crisps, no chocolate, no sweets. We got a list - these rules. But I think anything goes now."
> "Do you think the school should be more ..."
> "Yeah try to police it for sure..."
> "The uniform rule would be fine if they put in some guidelines."

(Parents, Primary, Opted-out - Group 49)

One or two parents also queried aspects of tuck shop provision, including the inclusion of items that seemed not particularly healthy and the lack of any monitoring of what children bought; an example given in one group concerned a girl who had bought "ten packets of crisps" (Parents, Middle, Optedout Middle - Group 36) from the tuck shop to give out to friends.

### 7.6.4 Children

Focus groups were conducted with three groups of middle school children (two in opted-out schools, one in a Local Authority school). As children had been 'opted-in' to this element of the study by parents, it is possible that the children who participated were from families with a particular interest in food issues, and not representative of the wider pupil population in the schools. Two of the middle schools (one opted-out and one Local Authority) were in a relatively affluent semi-rural area, while one was in a more disadvantaged area with a higher proportion of free school meals; again, this may have limited the representativeness of the groups. It is also important to note that not all the children who participated in the focus groups currently had school dinners, and therefore their comments on the meals are not necessarily based on recent first-hand experience.

Children had little awareness of the school food policy, although, most were aware that healthy eating was taught and promoted in schools and of a general expectation that they themselves should try to eat healthy. Most found it difficult to assess whether school meals had changed in recent years, apart from in the middle school which had introduced the Local Authority 'Fuel to Go' brand (see section 7.3.4 above), where children knew that this was a new initiative (some recalled participating in a
survey prior to its implementation). However, they did not particularly identify healthy eating as the impetus behind the scheme, with some assuming that because the packaging was labelled ecofriendly it was intended to reduce the amount of non-recyclable packaging waste.

Children's views and experiences of school meals are shaped by a wide range of factors not solely restricted to the perceived quality of the food. Having a school meal requires children to master quite a complex set of procedures, including knowing which sitting their class is on, what combinations of items are permitted in a meal, what is covered by the flat rate school meal charge and what has to be paid for separately, and so on. It was perhaps unsurprising therefore that children's views of school meals were strongly coloured by the logistics, pressures and rules surrounding the whole dining experience. Dislike of the sittings system, which in children's eyes meant less choice for later sittings; having to "queue for ages" while packed lunch children could "just go in", not being able, in some schools, to sit with friends who were having packed lunches, the perceived abruptness of some "scary" serving and supervisory staff, the worry about being "late for classes" when on last sitting - all contributed to rather negative perceptions of school meals for many. Given these factors and the anxiety of not knowing whether they would like the meal when they did get served, several preferred the reduced stress and increased autonomy associated with having a packed lunch.
"I started off with dinners, went to packed lunch and packed lunch is well better. You get your food and get what you, get whatever you want in your packed lunch and the dinner nannies can't tell you what you can have. You just tell your parents what you want and then they'll do it for you."
(Children, Middle, Opted-out - Group 12)

Like parents, children commented on the perceived unfairness of having to pay extra for some items and on having to pay the same price or more for healthy extras (such as fruit) compared with less healthy alternatives such as biscuits.

Concerns about cost and value for money were particularly salient in terms of response to the 'Fuel to Go' branded items. Children were critical of the size of the portions which they felt did not reflect the glossy promotional posters and compared poorly to the size of non-'Fuel to Go' meal items:
"They [the drinks] are 85mls and they are like that big."
"They are tiny pots like that."
"It's the same [price] but you get more stuff in a normal school dinner."
(Children, Middle, LA - Group 38)

Beyond these concerns, 'Fuel to Go' elicited mixed reactions. Some felt that items such as the panini were "quite nice", and several commented on the attractive packaging. However, the way that sandwiches and wraps were packaged meant that the filling was not always visible and might turn out
to be something which a child did not like. There was therefore a risk involved in selecting the 'Fuel to Go' meal deal
"You get like a pot of stuff, and then you get cucumber and stuff, and a little pot of drink, but if you don't like the main meal you don't really get anything to eat."
(Children, Middle, LA - Group 38)

Children's general reactions to the meals tended to be negative rather than positive (see section 7.5), a tendency perhaps exacerbated by the group setting. Where they did acknowledge that some meals and dishes "weren't bad", these tended to be those towards the less healthy end of the spectrum such as chips, cheese, biscuits and cheesecake. The 'grab bags' developed in one opted-out middle school to make school meals appealing to children who wanted to take food away rather than sit in the dining room were quite popular, although children also felt that they were "quite unhealthy" (Children, Middle, Opted-out - Group 25).
"Yes I had chips, and cucumber and carrot, and what else was it? A biscuit."
"Okay what about the rest of you?"
"Cheese rolls, chips and beans and I had cheesecake."
"Cheesecake sounds quite popular."
"Yes."
"I had some fish and I had chips and beans and I had cheesecake."
(Children, Middle, Opted-out - Group 25)

Some also expressed a liking for meat-based dishes such as "plain chicken" (confirming the perception of catering managers that some local food cultures favoured traditional meals and roast dinners), and felt there was too much "processed meat". Several complained about vegetables being tasteless and overcooked, and mashed potato was singled out for particular criticism across all the schools.
> "It was weird because once I saw them actually peeling some real, you know proper carrots and baked potatoes and everything, but you wonder what they do to them to make them all soppy and strange."

(Children, Middle, Opted-out - Group 25)

While cooked vegetables elicited a mixed response, salads and raw vegetables seemed to be universally popular, a perception echoed by dining room and kitchen staff.
"Well in the summer I think they did like a plate that was full up of salad. Instead of little bits like cucumber and tomatoes they did like plates full of salad."
"Yes like a mixed salad."
"Were they popular?"
"I had that quite a lot."
(Children, Middle, Opted-out - Group 25)
"And they love the portions; they love the fact that they can have salady things. In fact l've never, ever known children to pick so much salad stuff, like you know if there's couscous or tomatoes and cucumbers they'll have that instead of having the vegetables. But you know it's not a choice I was aware of before, that the children would make."
(Assistant/Supervisor, Middle, Opted-out - Interview 35)

## "How does the salad bar work? Does it go down well?"

"It is quite good now. It never used to in the beginning. But we've only had the salad bar the last few years. But it has started to go. It has started to take off now - the salad bar."
(Catering Manager/Cook, Primary, LA - Interview 5)

Children's comments on the process of being served suggested that there were some areas where clearer guidance and more positive encouragement could be provided to facilitate selection of healthy choices. In one school, there appeared to be confusion over whether there was an expectation that every meal should include vegetables, with some children being under the impression that bread was a permitted alternative:

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"And then in the middle you get the sweetcorn and peas, and broccoli."
"Do you have to have one of those?"
"No."
"You do, you have to."
"Well there is bread as well if you don't like those."
"Yes."
"You can get bread instead of a vegetable?"
"Yes."
"Well kind of."
"What do you mean kind of?"
"You can't choose between them."
    (Children, Middle, Opted-out - Group 25)
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In another school, children echoed parents' concerns that some apparently permitted combinations of items were rather odd, commenting that "The main things don't really go with the side thing" (Children, Middle, LA - Group 38) and that combinations such as quiche and bread or quiche and gravy were allowed. In the same school, one child suggested that "if you have like a pasta dish you couldn't have
pasta with it because you've already got too many carbohydrates" (Children, Middle, LA - Group 38), implying some awareness of expectations regarding the balance of a healthy meal. However, experiences of clear guidance or actually receiving face-to-face advice when selecting food appeared mixed. The general impression was that guidance and advice were somewhat ad hoc and inconsistent, and children often interpreted interventions from staff, when these did occur, as being concerned as much with ensuring that a child was getting good value for money as with encouraging healthy eating.

## "Are there any rules that say you've got to choose salad or you've got to have some vegetables, or can you ignore those bits?"

"Yes there is."
"They sort of recommend you have them."
"But there aren't any rules."
"Yes, because if you have just got a main course, like a sandwich, they make you have something else."
"You have to have something else, whether it is beans or whatever."
(Children, Middle, Opted-out - Group 25)
"The lady at the till normally says "Do you want to go back and have something else?"
"Okay, so she might send you back."
"They don't force you though."
"Because sometimes you don't really get like, they might be thinking that you are not getting your money's worth if you just have a bit."
(Children, Middle, Opted-out - Group 25)

### 7.7 Summary of findings

Overall, the process evaluation suggests that schools in the study coped well with the challenges involved in implementing the school food policy. At the time of fieldwork - a few months before the compliance deadlines of 2008 and 2009 for nutritional standards in the two types of school - schools appeared to have implemented the food-based standards across meals, breakfast clubs, break-time snacks and other policy areas as relevant and seemed to be on course for meeting the nutritional standards. This relatively advanced stage of readiness could be partly attributed to local authorities having already made several improvements to school meal menus in recent years and partly to schools' participation in initiatives such as Healthy Schools. In Local Authority provision schools, school meal menus were developed and nutritionally analysed centrally, meaning that the main challenges for schools were adjusting to the increased amount of preparation involved and promoting the new meals to parents and children. In contrast, schools that had opted-out of Local Authority meal provision (three in our study) had also to develop and analyse their own menus for compliance. Here,
differences emerged, with catering staff in the schools having varying degrees of understanding and confidence in relation to the new skills and processes they had to master.

Responsibility within schools for day-to-day implementation largely fell to the catering manager or cook. Many headteachers had only limited awareness of the detailed policy requirements, assuming that the Local Authority and/or the school's catering manager would keep the school on track. A few, however, were more strongly involved, such as the headteacher in an opted-out school who had set up a food action group to work with local suppliers and catering experts to develop menus based around locally sourced and organic ingredients. The amount and nature of leadership shown within a school on food issues appeared to influence how well supported the catering staff felt and how enthusiastically the school implemented the standards and promoted the new meals. The knowledge and skills of catering staff themselves, and their ability to adapt to new processes and ways of working, were also important implementation factors; our findings suggest that most adapted well, although some struggled with some aspects. Resource issues - school kitchen staffing levels (which were strongly related to meal uptake) and the state of kitchen equipment - impacted on catering staff's ability to cope with the increased amount of preparation involved in the new menus. While one or two schools had been able to secure funding for substantial kitchen refurbishments, others had not, and a few were equipped only with 'regeneration' ovens, that is, ones without hobs. Preparing the new meals was particularly challenging in these kitchens.

Most schools in the study can be seen to have gone beyond the compulsory aspects of the policy in terms of instituting additional actions and changes to promote the new meals and healthy eating in general. Such actions included making serving areas and dining rooms more attractive (for example, through replacing old counters or crockery, decorating the walls, increasing the sociability of the dining experience), offering tasters of new dishes to children and inviting parents in to sample the meals, addressing healthy eating across the curriculum (for example, in lessons, themed events and foodgrowing initiatives), inviting children's feedback on the meals and involving them in decision-making relating to food provision and communicating with and engaging parents. One area where it was felt to be particularly challenging to engage with and influence parents was in relation to encouraging healthy packed lunches; most schools fought shy of implementing a strict policy, but the absence of such a policy was felt potentially to threaten the impact of the policy changes to school meals, by allowing children to opt for an alternative that was often less healthy. The impact of the school meal standards may be strengthened by helping schools to overcome the powerful competing appeal of unhealthy packed lunches, either through comparable policy measures or through more effective approaches for influencing parents.

Most stakeholder and implementer interviewees supported the school food policy, where they were aware of it, although some catering managers and cooks felt that the speed and extent of change were excessive and that it was wrong to provide meals that many children would not eat and which would potentially be wasted. Parents tended to support the notion of restricted choice for primary
school children, feeling that this helped to facilitate and normalise healthy eating, but there was more ambivalence surrounding middle school children, for whom growing autonomy and more firmly developed preferences were recognised as important considerations. While more affluent parents tended to place more value on healthy eating, less affluent parents were more concerned about value for money and children getting enough to eat. Some preferred to give their child packed lunches feeling that these were cheaper and less risky.

Opinions of the new meals varied. While some interviewees were pleased with the new meals, others felt that taste and quality could be inconsistent, that meals appeared to be carbohydrate-heavy, and that there was a lack of variety and sometimes appropriateness for local food cultures and tastes. Certain aspects of how meals were served could potentially be improved to facilitate healthier and more appropriate choices. For example, there appeared to be differing interpretations among children as to whether all meals had to include vegetables or whether particular combinations were permitted and how foods were laid out on the serving counter could contribute to confusion, such as placing carbohydrates and vegetables in the same section. A recurring issue across several schools and interviewees was the importance of providing face-to-face guidance and encouragement to children at the point of choosing their meal and while eating. Where serving staff and dining supervisory staff were able to engage children in this way, children were perceived to respond well, particularly in terms of overcoming reluctance to try unfamiliar dishes or vegetables. However, the demands of quickly processing and maintaining order among large numbers of diners reduced the capacity and perhaps willingness of serving and supervisory staff to provide this kind of encouragement.

Although in the focus groups children tended to be more negative about the meals, several catering and teaching staff felt that they were responding reasonably well to the meals. Salad bars appeared to be particularly popular. Children's reactions to school meals were not based solely on the food but were strongly coloured by negative aspects of the whole dining experience, such as queuing, being rushed, and the perception that children on packed lunches had more choice and preferential treatment (for example, in several schools they did not have to queue). The strength of feeling around these issues and their potential to deter children from having meals, particularly as they become older and more concerned with the social aspects of food, underline again the importance of reducing the competing appeal of packed lunches and of addressing the whole dining experience.

## 8. Discussion

## Summary of main findings

There were significant and important improvements in the dietary intake of children in the period from pre to post-implementation of the school food policy. There were statistically significant differences found in the mean nutritional intake from school and packed lunch. Post-implementation lunch time food choice was found to have a significant effect on the total diet in children aged 4-7yrs. In contrast, there was little evidence of an effect of lunch type on total diet in the 11-12yr olds.

Considering first the change in dietary intake of 4-7yr olds between 2003-04 and 2008-09, there were significant improvements in the nutrient content (\% energy from total fat, saturated fat and sugars) of both school lunches and packed lunches; however, the extent of change was greatest in school lunch. School lunches were higher in NSP and micronutrients (iron, calcium and vitamin C) and lower in sodium than packed lunches. There was evidence of a widening gap between school and packed lunches with school lunch offering the healthier option. There were encouraging changes in the food choices at lunchtime; in school lunch there was a fall in the proportion of children having chips, confectionery, crisps and sugared drinks along with an increase in the proportion of children having fruit and vegetables reflecting the food based standards of the school food policy. These changes were also observed in packed lunches though to a lesser extent (); this reflected our finding that some schools had adopted policies restricting foods in packed lunches. There were significant improvements in total dietary intake: in 2008-09 children had diets lower in fat, saturated fat, sugars and sodium but higher in protein, NSP and micronutrients than in 2003-04. In food terms, there was a fall in the proportion of children eating chips, confectionery, crisps and sugared drinks and an increase in the proportion eating fruit or vegetables over the four days reported.

Clearly children's food choice is influenced by many factors other than school lunch type. Despite this, we found that there was a significant interaction between year and lunch type; that is, the effect of lunch type on total dietary intake changed from pre to post-implementation of the school food policy. Post-implementation children having a school lunch had a lower \% of energy from fat, saturated fat and sugars and intake of sodium and a higher intake of protein, NSP, vitamin C, iron, zinc and folate in their total diet than children having a packed lunch. For some nutrients this was a reversal of intakes prior to the school food policy, when children having packed lunches had more favourable diets. This clearly demonstrates the impact of the school food policy, not only on lunch time intake, but also on the total dietary intake of primary school children.

Considering the change in dietary intake of 11-12yr olds from 1999-00 to 2009-10, there were significant improvements in the content of some nutrients in both school and packed lunch. There was a fall in the \% energy from fat, saturated fat and sodium in school lunches consumed by these older
children. These improvements were not observed in packed lunches. Conversely, there were increases in NSP, calcium, vitamin C and vitamin A in packed lunches, which were not observed in school lunches. Rather, there was evidence of a fall in intake of iron, vitamin A and folate from a school lunch. In food terms, the picture was also mixed; in school lunch there was a fall in the proportion of children having chips, crisps, confectionery and sugared drinks; for chips this fall was particularly striking. While there was an increase in the proportion having vegetables, the proportion choosing fruit as part of their school lunch fell. While these findings reflect a move towards implementation of the school food policy in these schools it was evident they were not fully compliant with the policy, in that children still had the opportunity to buy sugared drinks and crisps in some schools. In packed lunches there were also positive changes with fewer children having crisps, confectionery and sugared drinks and an increase in the proportion having fruit and vegetables. In total diet there were significant improvements in \% energy from fat but no change in saturated fat or sugars; both remained above recommendations. There was a reduction in sodium, an increase in calcium and vitamin C , but also and importantly, there was a significant reduction in intakes of iron and folate; intakes of these nutrients, particularly in girls, is a concern. There were some positive changes in food choices. The proportion of children having chips, crisps and sugared carbonated drinks fell and the proportion consuming fruit and vegetables increased. In contrast to our findings in 4-7yr olds, there was limited evidence of the effect of school day lunch type on the total diet of these 11-12yr olds. The exception was in \% energy from fat, in 1999-00 children having school lunch had had a higher total fat intake than those having packed lunch, by 2009-10 this difference was no longer apparent.

The process evaluation suggested that schools in the study had coped well with the challenges involved in implementing the school food policy. In Local Authority school meal provision schools, menus were developed and nutritionally analysed centrally, meaning that the main challenges for schools were adjusting to the increased amount of preparation involved and promoting the new meals to parents and children. In contrast, schools which opted out of Local Authority meal provision had to develop and analyse their own menus for compliance. Here differences emerged, with catering staff in the schools having varying degrees of understanding and confidence in relation to the new skills and processes. Responsibility within schools for day-to-day implementation largely fell to the catering manager or cook while many headteachers had only limited awareness of the detailed policy requirements. The amount and nature of leadership shown within a school on food issues appeared to influence how well supported the catering staff felt and how enthusiastically the school implemented the standards and promoted the new meals. The knowledge and skills of catering staff themselves, and their ability to adapt to new processes and ways of working were also important implementation factors; our findings suggest that most adapted well, although some struggled with certain aspects.

There was evidence of additional actions undertaken by schools to enhance the impact of the policy. Most schools in the study had gone beyond the compulsory aspects of the policy in terms of instituting additional actions and changes to promote the new meals and healthy eating in general. Such actions included making serving areas and dining rooms more attractive (for example, through replacing old
counters or crockery, decorating the walls, increasing the sociability of the dining experience), offering tasters of new dishes to children and inviting parents in to sample the meals, addressing healthy eating across the curriculum (for example, in lessons, themed events and food-growing initiatives), inviting children's feedback on the meals and involving them in decision-making relating to food provision, and, communicating with and engaging parents. However, these activities were more common in primary schools.

One area where it was particularly challenging to engage with and influence parents was in relation to encouraging healthy packed lunches. However, failing to do so potentially threatens the impact of the school food policy to school meals, by allowing children to opt for an alternative which was often less healthy.

Most stakeholder and implementer interviewees supported the school food policy, but some catering managers and cooks felt that the speed and extent of change were excessive and that it was wrong to provide meals that many children would not eat and could potentially be wasted. Parents tended to support the notion of restricted choice for primary school children feeling that this helped to facilitate and normalise healthy eating, but there was more ambivalence surrounding middle school children for whom growing autonomy and more firmly developed preferences were recognised as important considerations. Opinions of the new meals varied. While some interviewees were pleased with the new meals, others felt that the taste and quality could be inconsistent and that there was a lack of variety and sometimes appropriateness for local food cultures and tastes. A recurring issue across several schools and interviewees was the importance of providing face-to-face guidance and encouragement to children at the point of choosing their meal and while eating.

## Strengths and limitations of the study

## Strengths

The main strengths of this study are the mixed method approach and the range of assessment methods applied to understanding both the process of implementation of the school food policy and its consequences. A further strength is the large sample size of children aged 4-7yrs and 11-12yrs who consented and completed both dietary and anthropometric aspects of the study. The availability of baseline data in dietary intake identified by food source (school, home etc) enabled comparisons to be made pre and post-implementation of the school food policy. At each stage identical methods were used to collect dietary data from children in the same year groups attending the same schools. This consistency in data collection methods was critical in the assessment of change to avoid introducing new methods and inconsistent measurement bias.

The process evaluation used a range of qualitative methods to ensure that we captured data from a large number of key stakeholders and also that we gathered in-depth data from case studies.

## Limitations

This study was restricted to two areas in the North East of England, areas in which baseline preimplementation data were available and so it is possible that our findings may differ from other areas of the UK; this potentially limits generalisability though we have no reason to assume the areas included in the study are atypical in any way. Schools were originally identified to include schools from areas of a range of socio-economic deprivation, determined from the Free School Meal index. At baseline all schools were supplied with lunchtime meals by the Local Authority caterers but by midimplementation and post-implementation there was a range of school meal providers from Local Authority to in-house provision reflecting a national shift away from Local Authority provision as schools gain more autonomy.

There were numerous challenges to obtaining menus, especially in middle schools. It was only possible to obtain this information from two out of the four providers despite numerous attempts to collect this information from the others. From the two providers where information was obtained it was equally difficult to assess full compliance. This was mainly due to issues such as missing recipes in the menu information, differences between menu information obtained and provision at a school level, and differences between portion numbers stated with those served. This ultimately has made assessment of nutrient-based compliance difficult and, therefore, there may be small discrepancies between these findings and what is actually served/provided in individual schools. However, the analysis was based on information provided by the schools after numerous communications between providers and research staff.

A potential limitation with regard to the food and nutrient-based standards was the variation in the data collection period spent in primary and middle schools. In middle schools the three week menu cycle will have been captured during the data collection period as more than three weeks were spent collecting data in each school, In primary schools most were collected over two weeks. Food and nutrient standards are based on the average school lunch over a three-week menu cycle. This potentially means the days surveyed for each child may not have captured the food-based standard for oily fish which is required only to be served once over three weeks. However, it is important to note is there are a selection of items available each day and children choose what they want to eat. This study has therefore presented findings on 'actual nutrient consumption' against planned menu cycles and also has reported change in average consumption of specific foods in school lunch.

A further challenge in middle schools during the period of this study was the restructuring of two schools. Two of the original schools which took part in 1999-00 and 2007-8 merged to form an academy just prior to the 2009-10 data collection period. We overcame this by recruiting children from
the original schools prior to the merge. However the merging of schools to become an academy also meant that some children moved to different schools and this may have had an impact on their food choice and selection. Such changes and challenges are inevitable in research in a school environment.

In 2009-10 the recruitment method used in middle schools was changed from opt-in to opt-out due to the poor response rate in 2007-08. While this was effective in that it increased both the response and the final number of children taking part, it is possible this had an effect on completion of dietary records (i.e. more misreporting either in terms of under or over-reporting). This study found a statistically significant reduction in mean energy intake from 1999-00 to 2009-10. Further analysis is required on this reduced energy intake and possible mis-reporting in 2009-10.

A limitation of this study is that we are not able to identify the children either eligible for or consuming free school meals. It is known that uptake of free school meals is not $100 \%$ and varies between schools. In fact during the course of this study one of the Local Authorities commissioned a qualitative study to explore why children entitled to free school meals do not take these. It would have been useful to explore the role of the school lunch in the total diet of children taking a free school meal; this was not possible. We chose not to elicit this information from parents at recruitment as this may have had an adverse effect in response and due to confidentiality schools were not able provide this information. It is important to acknowledge that along with the implementation of the school food policy there were other national and local public health initiatives running in parallel, such as the Change4Life campaign, as the shift in public health focused on children's diets and the crisis of childhood overweight and obesity. This is a longitudinal, repeat cross-sectional study and as such the cause and effect of changes in total diet cannot be fully attributed to the implementation of the new school food policy; the positive changes in packed lunches without a universal policy is evidence of the effectiveness of other initiatives to promote healthy diets. However, our analysis clearly demonstrates the effect of lunch type not just on lunchtime nutrient intake but also on the total diet, particularly in the younger children.

## Relationship of findings to existing knowledge

Although this study has shown positive changes in both school and packed lunch in the 4-7 year olds, it also provides evidence of a widening gap between school and packed lunches. This finding that packed lunches continue to contain more fat, saturated fat, sodium and NMES than school lunch is similar to findings in previous studies. ${ }^{45,46,47,48}$ The widening gap between school and packed lunch has also been identified in a review by Evans et al (2010) ${ }^{49}$ of seven studies conducted between 19902007 which measured lunchtime intake in children aged 5-11 years having school or packed lunch. They noted that for all nutrients, the differences between school and packed lunches were greater after the introduction of food-based standards. However, in contrast to this study, their findings pre
and post-implementation of the standards were not statistically significant. This may be due to the fact that, at this point, schools were still in the interim period and were not required to be fully compliant with nutrient-based standards.

It is acknowledged that nutrient-based standards are only applicable to school lunch and not packed lunch. While schools are encouraged to have a packed lunch policy there are no regulations to enforce this. As sections 5.1.2 and 6.1.2 showed there is evidence of a difference in terms of planned nutrient-based provision versus actual consumption in children consuming either a school or packed lunch in both age groups. The finding that what children actually consume does not meet the standards has also been identified in previous studies. ${ }^{50,48}$ This needs to be addressed through more encouragement and supervision of children at lunch time with their selection of foods, more time to eat and more child friendly dining environments. These findings were reflected in the process evaluation (Chapter 7), where a recurring issue across several schools and interviewees was the importance of providing face-to-face guidance and encouragement to children at the point of choosing their meal and while eating. It is imperative that attention is given to what both 4-7 and 11-12 year olds actually consume, and not just focus on compliance of nutrient and food based standards.

Recent comparable dietary data on total diet for children are available from the National Diet and Nutrition Survey (2008-2009) ${ }^{51}$. Our findings are similar to those of the NDNS and show some very positive changes in children's food intake and nutrient intake over recent years. The NDNS collected dietary data by a 4-day estimated food diary and reported mean daily intakes, which can be compared with data collected by 4-day records from 4-7yr olds and 6-day records from 11-12yr olds in this study. As detailed in Chapters 5 and 6, this study has shown that while there has been a positive and welcome decrease in \% energy from fat, NMES and sodium intake in both age groups these remain above the DRV for these nutrients; ${ }^{24}$ this was also found in the NDNS. Similarly to the NDNS this study found girls aged 11-12yrs had a mean daily iron intake of 8.4 mg , which is below the RNI and this remains of particular concern at a time when girls are reaching or approaching menarche and their requirement for iron is increased.

The percentage of the younger children (4-7yr olds) having any fruit over the 4 days recorded in this study was similar to the NDNS ( $92 \%$ and $97 \%$ respectively). The difference may be accounted for by the methods used to code fruit intake. Although in the younger children there was an increase in mean daily portions of fruit and vegetables consumed, this is still well under the recommended 5 a day.

In summary, the key findings from this study are consistent with others, that is, nutritional differences exist between school and packed lunches and there is a widening gap between these. In total diet, despite some encouraging increases, there remains an under-consumption of fruit and vegetables by children. While \% energy from saturated fat, NMES and mean daily intake of sodium has decreased
these remain above current guidelines. Perhaps part of the explanation is that products that are advertised and seen to be healthy are misleading to parents. Therefore, a continued effort is required in the area of manufacturing and labelling to ensure correct information is provided even for products that are perceived to be 'healthy'.

This study adds to our understanding of how lunch type affects total diet. This study has examined the effect of lunch type on total diet over the period of implementation of the school food policy. It shows both the impact and the potential wider impact that school lunch can have on total diet.

## Interpretation and conclusions

The impact of the school meal standards may be strengthened by helping schools to overcome the powerful competing appeal of unhealthy packed lunches, either through comparable policy measures or through more effective approaches for influencing parents.

Although in the focus groups children tended to be more negative about the meals, several catering and teaching staff felt that they were responding well to the changes. Salad bars appeared to be particularly popular. Children's reactions to school meals were not based solely on the food, but were strongly coloured by negative aspects of the whole dining experience, such as queuing, being rushed, and the perception that children on packed lunches had more choice and preferential treatment (for example, in several schools they did not have to queue), demonstrating that school children should be regarded as astute consumers making active choices based on the whole school food experience. The strength of feeling around these issues and their potential to deter children from having school meals, particularly as they become older and more concerned with the social aspects of food, underline the importance of reducing the competing appeal of packed lunches and of addressing the whole dining experience of a school lunch.

The extent of change and the impact of school lunch on total diet in the younger children were not evident to the same extent in the older children in this study. Middle and secondary schools are larger and more complex organisations than primary schools, and as such, it may be that the new school food policy will take longer to embed in these schools. Systems take longer to change and the older children are perhaps less willing to accept the change in school food from that which has been available to them for the first 6 years of school life (pre-implementation). It may simply be a matter of more time and support, especially in schools where analysing menus for nutrient compliance falls on catering managers and staff. There may be a cohort effect as the younger children who have been exposed only to the new school meals move through to secondary schools. There is some evidence to support this as local authorities report increased uptake of school meals, particularly in primary schools. Older children perhaps need more persuasion and encouragement to move from packed
lunches and to try school meals; this is a role for schools, catering providers and the School Food Trust.

## Implications for policy, practice and future research

There are few studies to date in the UK that have been able to examine the impact of school and packed lunch on total diet; to our knowledge this is the only study to examine this during the time of change in school food policy and across different age groups.

While it is acknowledged that school food is only one factor influencing children's diet, this study has demonstrated the effect school lunch can have on children's total diet. The extent of this change appears to be different between 4-7 and 11-12 year olds. Perhaps fundamental is that school lunch should be seen as more than simply food provision and aspects such as food choice and the dining room experience should not be treated as separate entities. Schools have made efforts to improve the dining experience of children but this was cited by children as a reason not to have a school lunch. A priority should be to ensure the positive changes in the diet of the younger children and the positive influence of school lunch on this change are maintained as they move to middle and secondary schools.

In addition, when considering the potential school lunch has on total diet, school meals should continue to be promoted to both parents and children. Perhaps there needs to be a concerted effort to change perceptions of school lunch given both previous research findings and media headlines prior to the introduction of the school food policy. However, while there is an effort to encourage children to have a school lunch, for various reasons not all children will. Ultimately, the endeavour is to improve children's diets; as part of this packed lunch must equally be addressed. Furthermore, there continues to be a need for collaboration at national and local levels as highlighted in the 'Healthy lives, Healthy people: Update and way forward', ${ }^{52}$ between various stakeholders and policy makers to continue in this pursuit to provide children with the best start. An aspect of this is surely the need to continue to improve children's diets; this study shows that a school lunch post school food policy can contribute to this improvement.

## Areas for future research

Reduction of inequalities in health is a public health priority. The data available from the current study requires further analysis to examine in more detail children's lunch type by IMD and the influence of school food on total diet, and, to further explore total diet for boys and girls from different school backgrounds. This would address questions such as which children have school lunch rather than packed lunch and may also elucidate why the effect of lunch type was less in middle schools than in primary schools. Uptake of school lunch by older children was generally lower than in primary
schools, and it is possible that a larger proportion of the older children taking school lunch had free school meals and that outside of school their diets were of poorer nutritional quality than other children.

Further analysis is required to examine changes in total diet in middle school children. This study has examined only the effect of lunch type on total diet. There are further data available on all food consumed by these children over the six days, separated into food source, for example home, school, friends, other to include take-away/restaurant etc. It would be of particular interest to examine this as these sources may contribute more to their total diet than school lunch and so limit the effect of lunch type. This is of particular relevance when considering policies, public health initiatives and nutritional education/advice provided in school curricula for this age group.

We have seen positive changes in the total diet in both age groups, but particularly in younger children where there was a clear effect of lunch type on total diet; this was not evident in the older children. This warrants further study. It would be of particular interest to examine the influence of the school food policy on food choice in a cohort of children in year 2 (aged 7yrs) from this longitudinal study to measure how their diets/food choices change in their transition to secondary school. This would increase our understanding of the influences on children's food choice as they move into adolescence and also the role that school food has, or could have, on total diet; that is, the longer-term effect of the school food policy on food choice outside of the school/family/home setting. This would assist with targeting of future policies to promote school food in particular and total diet in general to this age group.

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## 10. Appendices

### 10.1 Dietary reference values

1. Estimated Average Requirements (EAR's) for energy. These are the amounts of energy estimated to be adequate for each age and gender group. It would be expected that in a group of individuals $50 \%$ would require less and $50 \%$ would require more energy than the EAR

Table 22: Estimated Average Requirements for energy by age and gender

| Age | EAR's kcal/d |  |
| :--- | :---: | :---: |
|  | Boys | Girls |
| 4 to 6 years | 1,715 | 1,545 |
| 11 to 14 years | 2,220 | 1,845 |

2. Dietary Reference Values for per cent energy from fat, saturated fat and non-milk extrinsic sugars: independent of age and gender. These are reference values for the maximum proportion of total energy which should be derived from these nutrients.

Table 23: Dietary Reference Values for $\%$ energy from fat, saturated fat and non-milk extrinsic sugars

| Nutrient | DRV (\% of food energy) |
| :--- | :---: |
| \% energy from fat | 35 |
| \% energy from saturated fat | 11 |
| \% energy from non-milk extrinsic sugars | 11 |

3. Reference Nutrient Intakes (RNI's) for protein (g), sodium (mg), calcium (mg), vitamin C (mg), iron $(\mathrm{mg})$, zinc $(\mathrm{mg})$, vitamin $\mathrm{A}(\mu \mathrm{g})$, and folate $(\mu \mathrm{g})$ by age and gender. The RNI is the amount for each nutrient judged to be enough to meet the requirements of at least $97.5 \%$ of the population in each and gender group.

Table 24: Reference Nutrient Intakes for protein, sodium, calcium, vitamin C, iron, zinc, vitamin A and folate by age and gender

| Age/Gender | Protein <br> $(\mathrm{g} / \mathrm{d})$ | Sodium <br> $(\mathrm{mg} / \mathrm{d})$ | Calcium <br> $(\mathrm{mg} / \mathrm{d})$ | Vitamin C <br> $(\mathrm{mg} / \mathrm{d})$ | Iron <br> $(\mathrm{mg} / \mathrm{d})$ | Zinc <br> $(\mathrm{mg} / \mathrm{d})$ | Vitamin A <br> $(\mu \mathrm{g} / \mathrm{d})$ | Folate <br> $(\mu \mathrm{g} / \mathrm{d})$ |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Boys |  |  |  |  |  |  |  |  |
| $4-6$ yrs | 19.7 | 700 | 450 | 30 | 6.1 | 6.5 | 400 | 100 |
| $11-14$ yrs | 42.1 | 1,600 | 1,000 | 35 | 11.3 | 9.0 | 600 | 200 |
| Girls |  |  |  |  |  |  |  |  |
| $4-6$ yrs | 19.7 | 700 | 450 | 30 | 6.1 | 6.5 | 400 | 100 |
| $11-14$ yrs | 41.2 | 1,600 | 800 | 35 | 14.8 | 9.0 | 600 | 200 |

### 10.2 Food and nutrient-based standards

School Food Trust. www.schoolfoodtrust.org/school-cooks-caterers/resources/guide-to-the-nutrient-based-standards ${ }^{29}$

## Key to symbols

food or food groups that must be providedfood or food groups where the frequency or amount provided is restricted
food or food groups that are no longer allowed

## Appendix 1

## Final food-based standards

These are the final food-based standards which will also need to be met when the nutrient-based standards are adopted.

| Food/food groups | Final food-based standards for school lunches from 2008 (primary) and 2009 (secondary) | Food-based standards for school food other than lunches from 2007 |
| :---: | :---: | :---: |
| Fruit and vegetables | Not less than two portions per day per pupil must be provided; at least one should be vegetables or salad and at least one should be fruit | Fruit and/or vegetables must be available in all school food outlets |
| O. Oily fish | Oily fish such as mackerel or salmon must be provided at least once every three weeks | No standard |
| - Meat products | A meat product (manufactured or homemade) from each of the four groups below may be provided no more than once per fortnight across the school day, providing the meat product also meets the standards for minimum meat content and does not contain any prohibited offal*: <br> Group 1: Burger, hamburger, chopped meat, corned meat; <br> Group 2: Sausage, sausage meat, link, chipolata, luncheon meat; <br> Group 3: Individual meat pie, meat pudding, Melton Mowbray pie, game pie, Scottish (or Scotch) pie, pasty or pastie, bridie, sausage roll; <br> Group 4: Any other shaped or coated meat product |  |
| Starchy food cooked in fat or oil | Starchy food cooked in fat or oil should not be provided more than three times a week across the school day |  |
| Bread | Bread with no added fat or oil must be provided on a daily basis | No standard |
| Deep-fried food restricted | No more than two deep-fried food items, such as chips and battercoated products, in a single week across the school day |  |
| Salt and condiments restricted | No salt shall be available to add to food after the cooking process is complete. Salt shall not be provided at tables or service counters |  |
|  | Condiments, such as ketchup and mayonnaise, may only be available in sachets or in individual portions of not more than 10 g or 1 teaspoonful |  |

[^1]Table 25: Nutrient-based standards for primary and middle schools

| Energy or Nutrient <br> and amount of <br> measurement | Maximum or <br> minimum value | Primary Schools | Middle Schools |
| :--- | :---: | :---: | :---: |
| Energy (kj) | - | 2215 | 2549 |
| Energy (kcals) | - | 530 | 610 |
| Fat (g) | Max | 20.6 | 23.7 |
| Saturated fat (g) | Max | 6.5 | 7.5 |
| NMES (g) | Max | 15.5 | 17.9 |
| Sodium (mg) | Min | 499 | 714 |
| Carbohydrate (g) | Min | 70.6 | 81.3 |
| Fibre (g) | Min | 4.2 | 4.9 |
| Protein (g) | Min | 3.5 | 12.5 |
| Iron (mg) | Min | 2.5 | 5.2 |
| Zinc (mg) | Min | 193 | 3.2 |
| Calcium (mg) | Min | 175 | 350 |
| Vitamin A ( $\mu \mathrm{g})$ | 10.5 | 210 |  |
| Vitamin C $(\mathrm{mg})$ | 53 | 12.3 |  |
| Folate $(\mu \mathrm{g})$ | 70 |  |  |

### 10.3 Information letter for parents: Primary schools 2007-8

## Dear Parent / Guardian

## Newcastle School Food Study

Children in Key Stage 1 from your child's school took part in a study in 2002/03 with the aim of finding out about their eating habits. This study was important nationally as well as in Newcastle and was particularly helpful in health promotion in this region. We are delighted that your child's school has once again agreed to take part in this study.

I am now inviting your child to take part in the 2007/2008 study to see how diets have changed over the past few years. The study is supported by the Department of Health and has been approved by Newcastle Education Authority and by Newcastle University's Research Ethics Committee.

## What we would like you to do:

- Record everything your child eats and drinks at home for four days. Your child will be given a recording booklet which has a simple tick list for completion and we request that you complete this record during the times your child is not at school. We will employ trained observers to complete this record during the time your child is at school.


## What we would like your child to do:

- While taking part in the study, we would like your child to bring the recording booklet to school every morning and take it home in the afternoon.
- Your child will be measured for height, waist circumference, weight and body composition by the nutritionist $(x)$ working on the study. These measurements will be taken in private and all the information collected will be confidential. You will be invited to attend if you wish.


## What your child will gain:

- Previously children have enjoyed participating in this study.
- A certificate on completion of the food diary.

Your child's school will receive book tokens to the value of $£ 1$ for each child participating in the study.
This study will take minimum time and effort and should not interfere with school work. Your child is free to leave the study at any time without the need to give any reason. If you have any queries about the study, please contact me (Ashley Adamson) at the above address, or ring me on the phone number below.

Please complete and sign the consent form on the following page and return to school as soon as possible.

Yours sincerely,


### 10.4 Consent form used in primary schools and middle schools 2007-8

## CONSENT FORM

## School Food Study

ID No.

I have read the Recruitment Letter explaining how my child will be involved in the study and have had time to consider it. I understand that participation is voluntary and that my child is free to withdraw at anytime, without giving any reason.


## I agree/do not agree* to take part in the study

## Signed(child)

Name of child
Date
*please delete as appropriate

Name: Mr/Mrs/Ms $\qquad$

## Address

Post Code
Telephone no. (day)

Telephone no. (evening) $\qquad$
Mobile phone no $\qquad$

The only medical information we need to know for this study is does your child have a pacemaker? yes/no* appropriate

We need to know this because the weighing scale we will use is electrical, if your child has a pacemaker we will ensure that we use a non-electrical scale to weigh them.

### 10.5 Information letter for parents: Middle schools 2007-8

Dear Parent / Guardian

## Northumberland Schools Food Study

Since 1980 Year 7 children from your child's school have been part of the Northumberland School Food Study. Studies were conducted in 1980, 1990 and 2000 with the aim of finding out about children's eating habits and how these have changed. No other studies of children's diets and how they have changed exist. These studies were important nationally as well as in Northumberland and were particularly helpful in health promotion in this region. We are delighted that your child's school has once again agreed to take part in this study.

I am now inviting your child to take part in the year 2009 study. The study is supported by the Department of Health and has been approved by Northumberland Education Authority and by Newcastle University's Research Ethics Committee.

## What we would like your child to do:

- Write down everything they eat and drink for three days; this will be followed by a brief interview with a nutritionist. This will be carried out on two occasions, once in Autumn/Winter terms and once in Spring/Summer terms.
- Be measured for height and weight once early in 2010.
- Collect some information from you about your occupation.

The interview with the nutritionist and measurement of height and weight will be private, and all the information will be confidential.

## What your child will gain:

- Previously children have enjoyed writing down what they eat and participating in this study.
- A certificate on completion of the two 3-day food diaries.
- After the research is complete we will return to school to tell the children who took part, how their diet compared with diets of Year 7 children 10, 20, and 27 years ago.

Your child's school will receive book tokens to the value of $£ 1$ for each child participating in the study.
This study will take minimum time and effort and should not interfere with school work. Your child is free to leave the study at any time without the need to give any reason. If you have any queries about the study, please contact me (Ashley Adamson) at the above address, or ring me on the phone number below.

Please complete and sign the consent sheet on the following page and return to school as soon as possible.

Yours sincerely

Ashley Adamson (Dr)


Lead investigator
Senior Lecturer at Newcastle University
Tel: 01912225276

### 10.6 Information letter and consent form for middle schools 2009-10

Dear Parent / Guardian

## Northumberland Schools Food Study

Since 1980 Year 7 children from your child's school have been part of the Northumberland School Food Study, which looks at children's eating habits and how these have changed. No other studies of children's diets and how they have changed exist. These studies were important nationally as well as in Northumberland and helpful in health promotion in this region. We are delighted your child's school has once again agreed to be involved in this study, and would like to invite your child to take part.

## What the study involves:

- Your child writing down everything they eat and drink for three days; followed by a brief interview with the nutritionist ( $x$ ) to clarify what they have written. This will be done on two occasions, once in the Autumn/Winter term and once in the Spring/Summer term.
- One measurement of your child's height and weight in 2010.
- Collecting some information from you about your occupation.

The interview with the nutritionist (x) and measurement of height and weight will be private, and all the information will be confidential.

Previous studies like this have found it helpful to communicate with the child by text messaging. When your child is given a diary they will be asked for a mobile telephone number to send a reminder text to start their diary and attend interview.

## Why your child should take part:

- Previously children have enjoyed writing down what they eat and taking part in this study.
- On completion of two 3-day food diaries they will receive a certificate of achievement and a £10 voucher.
- They will be making a valuable contribution to their school's involvement. For each child that completes the study the school will receive book tokens to the value of $£ 1$ per child.
- After the research is complete we will return to school to tell the children who took part, how their diet compared with diets of Year 7 children over the last 30 years.

This study will not take much time or effort and should not interfere with school work. Your child is free to leave the study at any time without the need to give any reason. If you have any queries about the study, please contact me (Ashley Adamson) at the above address, or, e-mail or ring me on the phone number below.

Yours sincerely,

Dr Ashley Adamson
Lead investigator
Senior Lecturer at Newcastle University
Tel: 01912225276
E-mail: a.j.adamson@ncl.ac.uk


Name of child $\qquad$

Class
School


## What do I do now?

## 1. IF YOU ARE HAPPY FOR YOUR CHILD TO TAKE PART YOU DON'T NEED TO DO ANYTHING!

2. If you are happy for your child to take part but DO NOT want them contacted by text messaging please tick this boxand RETURN THIS PART OF THE LETTER TO SCHOOL.

Or
3. If you DO NOT wish your child to take part in any of this study please sign here
and
RETURN THIS PART OF THE LETTER TO SCHOOL.

### 10.7 FAST food groups

| FAST Food Group ID | FAST Food Group Name |
| ---: | :--- |
| 1 | White breads |
| 2 | Wholemeal breads |
| 3 | Breakfast cereal wholegrain not high sugar |
| 4 | Breakfast cereal refined low sugar |
| 5 | Breakfast cereal refined high sugar |
| 6 | Pasta \& rice dishes |
| 7 | Pasta \& rice |
| 8 | Chips, oven |
| 9 | Chips, fried |
| 10 | Potatoes not chips |
| 11 | Biscuits |
| 12 | Confectionery, cakes and sweet puddings |
| 13 | Fruit |
| 14 | Fruit Juice |
| 15 | Vegetable |
| 16 | Milk full fat as drink |
| 17 | Milk full fat |
| 18 | Milk semi-skimmed as drink |
| 19 | Milk semi-skimmed |
| 20 | Yoghurts |
| 21 | Cheese |
| 22 | Milk based pudding |
| 23 | Meat and fish non-processed |
| 24 | Meat and fish processed product |
| 25 | Beans and Pulses |
| 26 | Eggs |
| 27 | Pizza |
| 28 | Cordial or squash reduced sugar |
| 29 | Cordial or squash full sugar |
| 30 | Carbonated drink full sugar |
| 31 | Carbonated drink reduced sugar |
| 32 | Chocolate and milkshake powder |
| 33 | Water |
| 34 | Tea and Coffee |
| 35 | Crisps and savoury snacks |
| 36 | Sugar |
| 37 | Spreading fats |
| 38 | Miscellaneous |
| 39 | White bread added fibre |
| 40 | Breakfast cereal, whole grain, high sugar |
| 41 | Meat, fish, cheese and egg dish |
| 42 | Supplements |
| 43 | Nuts and Seeds |
|  |  |

### 10.8 Flowchart detailing numbers in primary school analysis



### 10.9 Food group tables for primary schools

Table 26: Average daily number of portions for school lunch (consumers only) in 4-7yr olds from 2003-4 to 2008-9

| Food groups | Mean number of portions/ day |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | mean | median | SD | \% consumers | mean | median | SD | \% consumers |
| Fried chips | 0.4 | 0.3 | 0.2 | 63 | 0.3 | 0.3 | 0.0 | 54 |
| Confectionery | 0.7 | 0.7 | 0.3 | 92 | 0.5 | 0.7 | 0.2 | 75 |
| Crisps | 0.4 | 0.3 | 0.2 | 1 | - | - | - | 0 |
| Fruit | 0.5 | 0.3 | 0.3 | 21 | 0.6 | 0.7 | 0.3 | 51 |
| Vegetables | 0.6 | 0.7 | 0.3 | 47 | 0.8 | 0.7 | 0.6 | 77 |
| Fizzy drinks | 0.3 | 0.3 | - | 1 | - | - | - | 0 |
| Cordial/ squash | 0.4 | 0.3 | 0.2 | 17 | 0.7 | 0.7 | 0.5 | 1 |

Table 27: Average daily number of portions for packed lunch (consumers only) in 4-7yr olds from 2003-4 to 2008-9

| Food groups | Mean number of portions/ day |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | mean | median | SD | \% consumers | mean | median | SD | $\%$ consumers |
| Fried chips | 0.3 | 0.3 | 0.0 | 1 | 0.7 | 0.7 | - | 0.3 |
| Confectionery | 0.6 | 0.7 | 0.4 | 68 | 0.6 | 0.7 | 0.3 | 44 |
| Crisps | 0.7 | 1.0 | 0.3 | 81 | 0.7 | 0.7 | 0.3 | 50 |
| Fruit | 0.8 | 0.7 | 0.4 | 54 | 1.0 | 1.0 | 0.6 | 77 |
| Vegetables | 0.8 | 0.7 | 0.5 | 22 | 0.8 | 0.7 | 0.6 | 47 |
| Fizzy drinks | 0.6 | 0.5 | 0.3 | 8 | 0.7 | 0.7 | 0.3 | 1 |
| Cordiall squash | 0.6 | 0.7 | 0.3 | 55 | 0.7 | 0.7 | 0.3 | 41 |

Table 28: Average daily number of portions for total diet (consumers only) in 4-7yr olds from 2003-4 to 2008-9

| Food groups | Mean number of portions/ day |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | mean | median | SD | \% consumers | mean | median | SD | \% consumers |
| Fried chips | 0.5 | 0.5 | 0.3 | 66 | 0.4 | 0.3 | 0.2 | 55 |
| Confectionery | 1.8 | 1.8 | 0.8 | 100 | 1.3 | 1.3 | 0.7 | 98 |
| Crisps | 0.8 | 0.8 | 0.4 | 86 | 0.6 | 0.5 | 0.4 | 71 |
| Fruit | 1.4 | 1.3 | 0.9 | 92 | 1.7 | 1.5 | 1.1 | 98 |
| Vegetables | 1.1 | 1.0 | 0.8 | 76 | 1.5 | 1.3 | 1.0 | 92 |
| Fizzy drinks | 0.7 | 0.5 | 0.5 | 56 | 0.5 | 0.3 | 0.4 | 30 |
| Cordial/ squash | 0.8 | 0.5 | 0.7 | 62 | 0.7 | 0.5 | 0.6 | 56 |

### 10.10 Flowchart detailing numbers in middle school analysis



[^2]
### 10.11 Food group tables for middle schools

Table 29: Average daily number of portions for school lunch (consumers only) in 11-12yr olds from 1999-00 to 2009-10

| Food groups | Weight (g) |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1999-2000 |  |  |  | 2009-2010 |  |  |  |
|  | mean | median | SD | \% consumers | mean | median | SD | \% consumers |
| Fried chips | 59 | 47 | 38 | 72 | 48 | 41 | 24 | 46 |
| Confectionery | 43 | 40 | 23 | 89 | 32 | 27 | 24 | 78 |
| Crisps | 5 | 4 | 2 | 4 | 5 | 5 | 1 | 2 |
| Fruit | 34 | 35 | 19 | 7 | 17 | 14 | 15 | 6 |
| Vegetables | 22 | 16 | 19 | 55 | 12 | 8 | 12 | 59 |
| Fizzy drinks | 119 | 83 | 92 | 26 | 175 | 165 | 112 | 17 |
| Cordial/ squash | 78 | 65 | 51 | 29 | 114 | 83 | 97 | 22 |

Table 30: Average daily number of portions for packed lunch (consumers only) in 11-12yr olds from 1999-00 to 2009-10

| Food groups | Weight (g) |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | 1999-2000 |  |  |  | 2009-2010 |  |  |  |
|  | mean | median | SD | \% consumers | mean | median | SD | \% consumers |
| Fried chips | - | - | - | 0 | - | - | - | 0 |
| Confectionery | 30 | 16 | 33 | 74 | 23 | 15 | 26 | 56 |
| Crisps | 17 | 15 | 11 | 83 | 17 | 15 | 10 | 74 |
| Fruit | 80 | 52 | 73 | 38 | 86 | 78 | 59 | 71 |
| Vegetables | 14 | 9 | 19 | 26 | 21 | 13 | 20 | 32 |
| Fizzy drinks | 147 | 83 | 110 | 23 | 106 | 83 | 40 | 6 |
| Cordial/ squash | 181 | 176 | 99 | 65 | 167 | 160 | 80 | 62 |

Table 31: Average daily number of portions for total diet (consumers only) in 11-12yr olds from 199900 to 2009-10

| Food groups | Weight (g) |  |  |  |  |  |  |  |  |
| :--- | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | mean | median | SD | \% consumers | mean | median | SD | \% consumers |  |
| Fried chips | 84 | 69 | 61 | 88 | 46 | 37 | 33 | 62 |  |
| Confectionery | 83 | 77 | 49 | 100 | 54 | 47 | 38 | 97 |  |
| Crisps | 19 | 16 | 13 | 90 | 14 | 13 | 10 | 84 |  |
| Fruit | 72 | 55 | 60 | 70 | 100 | 85 | 79 | 79 |  |
| Vegetables | 44 | 38 | 31 | 89 | 31 | 22 | 28 | 91 |  |
| Fizzy drinks | 192 | 159 | 145 | 89 | 160 | 121 | 134 | 73 |  |
| Cordial/ squash | 156 | 117 | 141 | 83 | 216 | 171 | 161 | 87 |  |


[^0]:    * Information from Newcastle City Council based on schools taking part: 2003-4 paid school meals= 192,686; free school meals=137,738; 2008-9 paid school= 161,663; free school meals=116,549

[^1]:    * Meat Products (England) Regulations 2003 www.opsi.gov.uk/si/si2003/20032075.htm

[^2]:    *In 2009/10 the recruitment method was an opt-out approach. Children were asked to return a form should they not wish to participate.
    $\dagger$ Includes children who did not opt-out but did not wish to participate.

