

# **Secondary analysis of the Survey of Sugar intake among Children in Scotland**

## **Food Standards Agency Scotland Research Project S14039**

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## GENERAL INTRODUCTION

In May – September 2006 a national survey of the diet of children aged 3-17 years was carried out across Scotland, funded by the Food Standards Agency Scotland (research project S14029). 2,498 children from 80 post-code sectors were sent an invitation to participate and 1,700 were visited at home by trained field workers for measurements of height and weight, questionnaires about physical activity and dental health and collection of a previously mailed 140-item food frequency questionnaire (FFQ). 1,512 questionnaires were returned and 1,391 were used in the analysis.

For validation for the FFQs, two sub-samples of children and their parents were asked to complete another measure of diet. 311 children were invited to complete a 4-day non-weighed diet diary and a further 429 were invited to complete a single interviewer-administered 24-hour multiple pass recall (24-hour MPR). Complete data were collected for 57% of children in the diary sub-sample and 98% of children in the 24-hour MPR sample.

This report contains secondary analysis of the data obtained from the FFQ, 4-day diet diary and 24-hour recall. The report is divided into three separate sections which present analyses carried out to utilise the strengths of the different methods. The FFQ provided data on the frequency of consumption on 140 foods and drinks in all respondents and was used to identify broader dietary patterns using data reduction techniques such as principal component analysis (PCA). The diet diaries contained information on the meal and snack pattern and the type of foods consumed at different times of day and on different types of days (e.g. weekdays and weekends or term-time vs. holidays). The 24-hour MPR interview schedule also recorded the source and location at which foods and drinks were consumed and was used to identify school meals and packed lunches.

The full report of the survey, including details of all methods used, is available at <http://www.foodstandards.gov.uk/multimedia/pdfs/sugarintakescot2008rep.pdf>

## **SUMMARY OF FINDINGS**

This analysis was designed to take advantage of the three different methods of dietary data collection used in the Survey of Sugar intake among Children in Scotland by using the most appropriate methods to address a number of additional questions:

- Do the patterns of intake of different foods allow overall dietary patterns to be identified?
- What proportion of children meet the dietary targets for sugar and fat intake?
- What is the pattern of meal and snack intake in children?
- How does the nutrient intake of children eating school lunches differ from children who have packed lunches or lunches out of school?

For the analyses of dietary patterns and the proportion of children meeting the dietary targets the FFQ was used as it provided an estimate of the habitual consumption of all foods and drinks. However, FFQs do not provide information on the time of consumption, so for the meal and snack pattern analysis the 4-day diet diaries were used. The 24-hour multiple pass recall method collects detailed information on the place of consumption and source of each meal and snack, so this was used to compare lunches prepared in school canteens with packed lunches consumed in school but brought from home.

### **DIETARY PATTERNS ANALYSIS**

The dietary patterns analysis showed that clear dietary patterns were seen in children in all age and sex groups. In most cases both 'healthy' and 'unhealthy' patterns were clearly observed, but the foods which contributed most strongly to these patterns differed between the age and sex sub-groups. The clear associations between dietary patterns and socio-economic status were consistent with patterns seen in the analysis of food groups in the main study, and demonstrate that dietary behaviour is linked to affluence. However, it was shown in the main survey that the association between intake of nutrients such as NMES, fat and saturated fatty acids and socio-economic status were much less marked. This suggests that in surveys in which dietary data collection is limited to information on the consumption of key foods, such as the Scottish Health Survey, food pattern analysis may be used to provide a summary of patterns of food choice but should not be used as a substitute for measurement of nutrient intake.

## **PROPORTION OF CHILDREN MEETING DIETARY TARGETS**

The proportion of children meeting Scottish Dietary Targets for NMEs, fat and saturated fatty acids was very low, particularly for NMEs and SFA for which only 10% of children in the survey met the targets. These targets were based on the UK Dietary Reference Values which are based on medical and nutritional evidence but were last revised in 1991, and review of some aspects is ongoing. It should also be borne in mind that the targets are for the population average not for each individual: for the population average to meet the target it is necessary for the majority of individuals, but not each one, to achieve the target<sup>2</sup>.

## **MEAL AND SNACK PATTERNS**

Analysis of daily meal patterns of the children who completed a diet diary demonstrated that a pattern of three meals and two snacks was the norm in all age and sex subgroups. This pattern may be reinforced by the structure of the school day with a break mid-morning and a gap between returning from school and an evening mealtime, though it was also seen on weekends and school holidays.

There was also clear evidence that most children ate breakfast (defined as the consumption of one or more solid food items before 9am on weekdays or 11am at weekends). Though solid foods could include sweets or crisps, the majority were consuming traditional breakfast foods such as breakfast cereals which were eaten on 61% of the days of the records. This traditional pattern was contrary to popularly held views that many children miss breakfast or only consume high fat, high sugar snack foods. It should be borne in mind that the children who completed the diaries may not have been completely representative of the whole population as the response rate for the diary completion was lower than for the other methods some bias in favour of those children with 'better' diets is possible, but it is also possible that school breakfast clubs and/or the existence of easily prepared breakfast foods have helped to ensure that the majority of children do not start the school day hungry.

## **SCHOOL LUNCH, PACKED LUNCH AND LUNCH OUT OF SCHOOL**

The analysis of the food and nutrient intake of children eating school lunches, packed lunch or lunch out of school demonstrated that the intake of foods and nutrients was more similar between the groups when viewed over the whole day than at lunchtime alone. This suggests that future research on the nutritional impact of school meals needs to take the rest of the day's food intake into account. In general, school lunches provided a better nutrient profile than packed lunches or lunches out of school, though this varied by age group and between

nutrients. For the majority of the younger children intakes were close to or exceeded the Dietary Reference Values for many nutrients but in the older children intake of many minerals and some vitamins was below recommended levels in all groups, particularly in those having lunch out of school. This is supported by the comparison of the lunchtime nutrient intake with the Scottish Nutrient Standards for school lunches which suggests that NSP, iron, vitamin A and folate were the nutrients which did not meet the standards in most children, particularly those aged 12-17years.

It is important to note that the results for the school meals reflect what was eaten rather than what was served, which is likely to have been closer to the standards. This suggests that more effort is needed to encourage children to make healthy choices when these are provided. Further monitoring the diet of children in Scotland following the implementation of the Schools (Food and Nutrition) Act will provide information on the impact of the many changes in the school food environment of children and their possible 'carry-over' effects on the diet out of school.

## **REFERENCE FOR SUMMARY**

1. The Scottish Office Department of Health. Eating for Health: a Diet Action Plan for Scotland. Edinburgh, 1996.

# **Section 1. Secondary analysis of the Food Frequency Questionnaires from the Survey of Sugar Intake among Children in Scotland**

**Leone Craig**

## **1.1 DIETARY PATTERNS OF SCHOOL-AGED CHILDREN IN SCOTLAND**

### **1.1.1 INTRODUCTION**

This section describes additional analysis carried out on the dietary data obtained from the food frequency questionnaires (FFQs) in order to investigate dietary patterns and assess their association with deprivation and with overweight and obesity.

Until recently, research on diet and health has focused on intakes of individual nutrients and sometimes individual foods or food groups. However, eating is a complex behaviour and intake of individual nutrients or foods are not independent of intakes of other nutrients or foods. Recently a number of statistical methods have been suggested to identify patterns of dietary behaviour the most popular of which is principal components analysis<sup>1</sup>. This is a data-driven method which identifies foods that are frequently eaten together within a dataset by aggregating items based on the degree to which they are correlated with one another. The goal is to identify groups of food that account for the largest amount of the overall variation in diet between individuals. Several groups of foods, or 'patterns', are usually identified. Subjects are assigned scores which describe how closely their diet conforms to each of the patterns. As the patterns are independent of each other, an individual may have a high score on more than one dietary pattern.

This method has been mainly used in studies of diet in adult populations but has been used previously to examine associations between dietary patterns and socio-demographic factors in British children aged 3, 4 and 7 years from the Avon Longitudinal Study of Parents and Children (ALSPAC)<sup>2,3</sup> and is currently being used in another FSAS funded study with data from the Scottish Health Survey and the Expenditure and Food Survey.

The overall aim of this additional analysis was to explore dietary patterns in school-age children.

The specific objectives were:

- To identify dietary patterns from the FFQs by age and sex using principal components analysis
- To investigate associations between dietary patterns and deprivation
- To investigate associations between dietary patterns and overweight and obesity

### **1.1.2 METHODS**

The FFQs used in this survey were based on the Scottish Collaborative Group FFQ (SCG FFQ), which has been widely used in epidemiological studies in Scotland<sup>4</sup>. Two new versions of the SCG FFQ were developed for this survey:

- version C2 for children aged 3-11 years which included instructions for completion by a parent or guardian with help from the child;
- version C3 for young people aged 12-17 years with instructions for completion by a young person with help from their parent or guardian.

Version C2 lists 140 foods or drinks with a measure representing a small portion for each item. Participants were asked to estimate the frequency and amount of each food or drink consumed in a typical week by selecting one of nine options, ranging from '*rarely or never*' to '*7 or more measures per day*'.

Version C3 was very similar to version C2 apart from the addition of another six items in the beverages section to include coffee and a range of alcoholic drinks. The measures of food and drink given on the FFQ were the same as those in C2 as participants were able to increase the number of measures consumed to describe larger portions. However, for a few foods for which the measure was difficult to define (e.g. one serving) the weight used in the calculation of intake was higher in version C3.

## **Data handling**

Current standard operating procedures for the SCG FFQ recommend that data is not produced for FFQs containing more than 10 missed lines. Of 1,512 respondents who returned an FFQ, 51 (3%) had missed more than 10 lines, and were therefore excluded from the dietary analysis. Of the 1461 respondents who had a complete FFQ (i.e.  $\leq 10$  missing lines), 70 (5%) with extreme total energy intakes ( $< 2.5$ th centile or  $> 97.5$ th centile for each age group (3-7, 8-11 or 12-17 years at the interview)) were further excluded from the dietary analysis. These exclusions are also in line with current standard operating procedures for the FFQ. After exclusion of outliers and incomplete questionnaires, 1,391 FFQs were available for analysis. The analysis of dietary patterns was carried out for school-age children only therefore children aged 3 and 4 years of age were excluded from this analysis. After exclusion of the 3 and 4 year old children, 1,233 FFQs were available for analysis of dietary patterns.

## **Data analysis**

Data analysis was carried out using SPSS version 15.0<sup>5</sup>. Data was weighted for selection and non-response bias according to the same methods used for the main report<sup>6</sup>.

### ***Dietary patterns analysis***

The weight consumed (in grams per day) for each item on the FFQ was calculated by multiplying the frequency of consumption by the portion weight. Missing lines were recoded as zero grams per day for children with less than or equal to 10 missing lines.

Analysis was carried out separately by age group (5-11 and 12-17 years) and sex. The decision was made to explore the dietary patterns separately by sex within each age group due to an a priori assumption that patterns may be different between the sexes particularly in the older age group and the fact that the questionnaires differed slightly between age groups. However, this prevents direct comparisons between the patterns identified in the different age and sex groups.

Food items which were consumed by less than 5% of the sample (soya milk for all respondents and some alcoholic beverages and marmite for 12-17 year olds) were excluded. Principal components analysis (PCA) was carried out using the weight in grams per day of all the remaining food items. PCA aggregates the food items according to the degree with which they are correlated with one another, identifying groups of foods (principal components) that account for the largest amount of variance within the sample. The first principal component accounts for the largest amount of variance in the sample, the second principal component

accounts for the next largest amount of variance and is uncorrelated with the first and so on. It is normal to retain only a few of the components which explain the greatest variance in the sample.

The number of components was selected primarily by examination of Scree plots<sup>7</sup>, but the interpretability of the components was also considered. The Scree plot shows the proportion of total variance explained by each component and it is conventional to choose the number of components above the point where the curve begins to level off (i.e. those explaining the greatest variance), although this is not always clear and therefore can be subjective. Where the number of components to choose was not clear from the Scree plot, the effect of removing or adding components on the content of the components and therefore ease of interpreting the components was assessed. The Scree plots for each age and sex group can be seen in Appendix 1.1.

In order to simplify the structure of the components and make them easier to interpret, rotation was carried out using Varimax orthogonal rotation, which is the most commonly used method and keeps components uncorrelated with each other<sup>8</sup>. The goal of rotation is to maximise the variance of factor loadings (correlation coefficients between each of the variables (food items) and the component) so that for each component, high loadings (correlations) will result for a few variables with the rest being near zero, thus making the components easier to interpret.

Factor loadings (correlations)  $<-0.3$  and  $>0.3$  were used to define the patterns. A positive loading indicates a positive association between the food and the dietary pattern, whereas a negative loading indicates an inverse association between the food and the dietary pattern. The larger the loading of a food item to the component, the greater the contribution of that food item to the component, food items with large factor loadings are used as the basis for naming the components.

The factor scores were saved for each component. Factor scores are the scores for each child on each component. To compute the factor score for each child for each component, the child's standardized score on each food item is multiplied by the corresponding factor loading of the food for that component and then summed. The factor scores can be used as variables in subsequent analysis. Each child is assigned a factor score for each component, the higher the factor score the more likely the child is to follow that pattern.

PCA requires a large sample size due to the fact that the analysis is based on a correlation matrix of the variables and correlations usually need a large sample size before they

stabilize. It has been suggested that a sample size of 200 is fair and 300 is good<sup>9</sup>, but it has also been suggested that the ratio of sample size to the number of variables is important with anything from 2-10 subjects per variable being recommended<sup>10</sup>. The sample sizes for the various age and sex groups ranged from 250-381 meaning they were fair to good by the first definition however, as there were approximately 140 items on the food frequency questionnaire this would need 280-1,400 subjects to fulfil the second criteria for sample size. The minimum number of 280 was achieved in the younger age groups but not quite in the older children.

### ***Scottish Index of Multiple Deprivation***

Data was analysed by quintiles (fifths of the distribution) of the Scottish Index of Multiple Deprivation<sup>11</sup> (SIMD). Those respondents in the first quintile live in one of the 20% least deprived areas in Scotland and those in the fifth quintile live in one of the 20% most deprived areas in Scotland.

### ***Classification of overweight and obese***

Body mass index (BMI) was calculated as weight (kg) divided by height (m<sup>2</sup>). BMI z-score based on the UK 1990 reference data<sup>12</sup> was determined using the lmsGrowth program version 2.09<sup>13</sup>. Respondents were classified as follows:

- neither overweight nor obese: BMI <85<sup>th</sup> centile (z-score <1.04);
- overweight but not obese: BMI ≥85<sup>th</sup> centile and <95<sup>th</sup> centile (z-score ≥1.04 and <1.64);
- obese: BMI ≥95<sup>th</sup> centile (z-score ≥1.64).

### ***Tests of association***

For the dietary patterns, tests of association were carried out using the Complex Samples option in SPSS to take account of sample design and response.

Associations between factor scores and SIMD quintile were assessed using ANOVA under the Complex Samples General Linear Model procedure.

The association between factor scores and BMI classification were assessed using ANCOVA under the Complex Samples General Linear Model procedure adjusting for decimal age at interview and SIMD.

### 1.1.3 RESULTS

This section describes the dietary patterns derived from the 1,233 children aged 5-17 years for whom a valid FFQ was obtained (see data handling section) and the association with socio-economic status and with overweight and obesity.

PCA identified 3 dietary patterns in each age and sex group. Tables 1.1-1.4 show the components for the various age and sex groups. The foods in the tables are only those with high factor loadings (<-0.3 and >0.3) and are shown in order of the strength of the factor loadings (high to low). Foods with negative factor loadings in the components are shown in italics. Full details of the factors can be found in Appendix 1.2.

The three patterns accounted for 11.6% and 13.0% of the variance respectively in boys and girls aged 5-11 years, and 14.4% and 15.1% of the variance respectively in boys and girls aged 12-17 years.

The first component accounted for 5.1-6.2% of the variance in the separate groups and for girls aged 12-17 years each of the 3 factors accounted for approximately the same amount of variance (5%), whereas in the other groups the second and third factors accounted for progressively less of the variance.

The components were subjectively assigned labels based on the foods with high loadings within that component.

For boys and girls aged 5-11 years and boys aged 12-17 years the first component was characterised by high intakes of 'healthier' foods such as fruit and vegetables, however, for girls aged 12-17 years the first component was characterised by high intakes of more 'unhealthy' foods such as puddings, although the % variance explained did not differ much from the second and third components.

For most of the groups at least one of the other 2 patterns identified was a more 'unhealthy' 'snacks' or 'puddings' pattern. For 5-11 year old boys a third 'fish & sauce' pattern was identified and for 12-17 year old boys a third pattern loading highly for 'starchy food & drinks' was identified.

In girls aged 5-11 years one 'healthy' dietary pattern ('fruit & vegetables') was identified but two more 'unhealthy' patterns were identified: a 'puddings' and a 'snacks' pattern.

For boys and girls aged 5-11 years and boys aged 12-17 years fruit and vegetables loaded highly within the same component (component 1), although for 12-17 year old boys there was a predominance of vegetables, however, for girls aged 12-17 years fruit and vegetables loaded highly in separate components (components 2 and 3 respectively).

As the decision was made to explore the dietary patterns separately by age group and sex no comparison can be made between the groups for similarly named components as the food items which make up the components differ in the separate groups.

*Tables 1.1 - 1.4*

**Table 1.1 Components for boys aged 5-11 years**

<b>Variance explained</b>	<b>Component 1 'Fruit &amp; vegetables' 5.3%</b>	<b>Component 2 'Snacks' 3.3%</b>	<b>Component 3 'Fish &amp; sauce' 3.0%</b>
	Broccoli	Regular crisps	Other sauce
	Cauliflower, swede or turnip	Boiled, chewy sweets or chocolate sweets	Grilled oily fish
	Cabbage	White bread or rolls	Tomato sauce
	Raw carrots	Sugar	Roast or fried potatoes
	Other green veg	Regular fizzy drinks	Fruit tarts, crumbles or pies
	Tomatoes	Sausages	Eggs
	Other salad veg	Iced lollies	Meat sauce
	Spinach	Meat burgers or mince	Grilled or poached white fish
	Other fruit	Jelly	Smoked oily fish
	Onions	Other savoury snacks	Quiche
	Oranges	Canned or dried soup	Pasta or couscous
	Pitta, naan, tortilla, bagel etc	Gravy	<i>Fromage frais (-)*</i>
	Kiwi	Chocolate biscuits	Potato salad
	Prawns	Chocolate bars	Gravy
	Cooked carrots	Fancy biscuits	
	Bananas		
	Apples		
	Sweetcorn		
	Peppers		
	Mixed vegetable dishes		
	Home made soup		
	Peas or green beans		
	Grapes, melon, pear		
	Boiled, mashed or baked potatoes		
	Water		
	Rice		
<i>Base (weighted)</i>	<i>351</i>	<i>351</i>	<i>351</i>
<i>Base (unweighted)</i>	<i>381</i>	<i>381</i>	<i>381</i>

\*Negative factor loading

**Table 1.2 Components for girls aged 5-11 years**

<b>Variance explained</b>	<b>Component 1 'Fruit &amp; vegetables' 5.2%</b>	<b>Component 2 'Puddings' 4.4%</b>	<b>Component 3 'Snacks' 3.4%</b>
	Other green veg	Sponge puddings	Iced lollies
	Broccoli	Cream cakes or gateaux	Cold ham or turkey
	Cooked carrots	Fruit tarts, crumbles or pies	Chocolate biscuits
	Raw carrots	Milk puddings	<i>Potato salad (-)*</i>
	Cabbage	Cakes with icing	Bottled sauces (e.g. ketchup)
	Cauliflower, swede or turnip	Cheesecake	Boiled, chewy sweets or chocolate sweets
	Onions	Plain cakes	Other savoury snacks
	Spinach	Custard	Meat burgers or mince
	Smoothies	Quiche	Wrapped ice creams
	Sweetcorn	Pizza	<i>Other green veg (-)*</i>
	Oranges	Meat or chicken pies, pasties, sausage roll	White bread or rolls
	Peppers	Home cooked chips	Other ice cream
	Rice	Noodles	<i>Bought chips (-)*</i>
	Peas or green beans	Mousse	Sausages
	Other salad veg	Baked beans	<i>Quorn, soya or tofu (-)*</i>
	Kiwi	Fish fingers	
	Grilled or poached white fish	Fish cakes or fish pie	
	Other fruit	Chicken nuggets	
	Apples	Canned or dried soup	
	Bananas	Fruit cake or malt loaf	
	Grapes, melon, pear	Meat sauce	
	Grilled oily fish	Sugar	
	Home made soup	Doughnuts or muffins	
	Prawns		
	Tomato sauce		
	Tinned salmon, sardines, mackerel, pilchards		
	Pasta or couscous		
	Pitta, naan, tortilla, bagel etc		
<i>Base (weighted)</i>	<i>315</i>	<i>315</i>	<i>315</i>
<i>Base (unweighted)</i>	<i>340</i>	<i>340</i>	<i>340</i>

\*Negative factor loading

**Table 1.3**                      **Components for boys aged 12-17 years**

<b>Variance explained</b>	<b>Component 1 'Vegetables' 6.2%</b>	<b>Component 2 'Puddings' 4.7%</b>	<b>Component 3 'Starchy food &amp; drinks' 3.5%</b>
	Raw carrots	Sponge puddings	Roast or fried potatoes
	Mixed vegetable dishes	Milk puddings	Alcopops
	Other salad veg	Wrapped ice creams	Pasta or couscous
	Sweetcorn	Iced lollies	Pitta, naan, tortilla, bagel etc
	Cooked carrots	Jelly	Boiled, mashed or baked potatoes
	Broccoli	Fruit tarts, crumbles or pies	Lager or beer
	Peppers	Custard	Orange, lemon etc diluting juice
	Peas or green beans	Other ice cream	Savoury biscuits, crackers and breadsticks
	Other green veg	Nuts	Pizza
	Onions	Nut roast, nut burgers or vegetable burgers	Sausages
	Spinach	Plain cakes	Rice
	Tomatoes	Cheesecake	No added sugar orange, lemon or other diluting juice
	Cabbage	Cream cakes or gateaux	Cold ham or turkey
	Coleslaw	Boiled, chewy sweets or chocolate sweets	Meat or chicken pies, pasties, sausage roll
	Cauliflower, swede or turnip	Other fruit flavoured drinks including flavoured water	Smoked oily fish
	Potato salad	Chicken nuggets	Other sauce
	Other beans or lentils	Fish cakes or fish pie	Cereal bars or flapjacks
	Bananas	Doughnuts or muffins	Blackcurrant diluting juice
	Grilled or poached white fish	Smoothies	Mayonnaise or salad cream
	Pure apple juice	Other savoury snacks	
	Other fruit	Fish fingers	
	Smoked oily fish		
	Dried fruit		
	Fruit tarts, crumbles or pies		
	Tinned salmon, sardines, mackerel, pilchards		
	Grilled oily fish		
	Rice		
	Nut roast, nut burgers or vegetable burgers		
	Fried oily fish		
	<i>Regular crisps (-)*</i>		
	Kiwi		
<i>Base (weighted)</i>	<i>281</i>	<i>281</i>	<i>281</i>
<i>Base (unweighted)</i>	<i>250</i>	<i>250</i>	<i>250</i>

\*Negative factor loading

**Table 1.4**            **Components for girls aged 12-17 years**

	<b>Component 1</b>	<b>Component 2</b>	<b>Component 3</b>
<b>Variance explained</b>	<b>'Puddings'</b>	<b>'Fruit'</b>	<b>'Vegetables'</b>
	<b>5.1%</b>	<b>5.0%</b>	<b>5.0%</b>
	Bacon or gammon	Bananas	Broccoli
	Cheesecake	Oranges	Cauliflower, swede or turnip
	Cream cakes or gateaux	Kiwi	Cabbage
	Custard	Apples	Cooked carrots
	Milk puddings	Tinned fruit	Mixed vegetable dishes
	Alcopops	Dried fruit	Peppers
	Regular fizzy drinks	Grapes, melon, pear	Sweetcorn
	Doughnuts or muffins	Other fruit	Onions
	Sugar	Fresh fruit salad	Fish fingers
	Baked beans	Nuts	Tomatoes
	Other savoury snacks	Other salad veg	Peas or green beans
	Bought chips	Home made soup	Other salad veg
	Pizza	Other green veg	Brown or granary bread or rolls
	Wrapped ice creams	Tuna	Other green veg
	Regular crisps	Peanut butter	Pasta or couscous
	Sausages		Spinach
	Iced lollies		Quiche
	Coleslaw		
	Canned or dried soup		
	Meat or chicken pies, pasties, sausage roll		
	Boiled, chewy sweets or chocolate sweets		
	Gravy		
	Scones or pancakes		
	Chocolate bars		
<i>Base (weighted)</i>	273	273	273
<i>Base (unweighted)</i>	262	262	262

### ***Association between dietary patterns and Scottish Index of Multiple Deprivation***

Figures 1.1-1.12 show the relationship between the dietary components and SIMD for the various age and sex groups. Further details can be found in Appendix 1.3. Overall the results indicate that children living in the most deprived areas had a lower consumption of 'healthier' foods (fruit and vegetables) and a higher consumption of more 'unhealthy' foods (snacks and puddings).

In boys aged 5-11 years component 1 'fruit & vegetables' was associated with lower levels of deprivation (Figure 1.1) and component 2 'snacks' was associated with higher levels of deprivation (Figure 1.2).

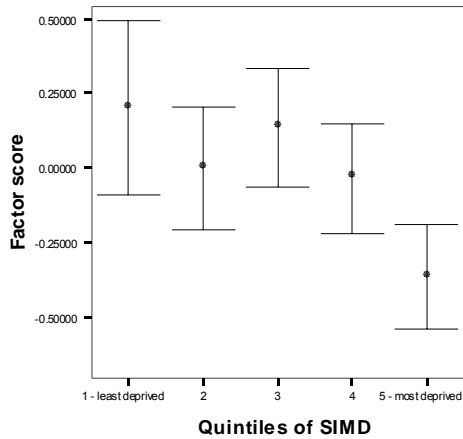
In girls aged 5-11 years component 1 'fruit & vegetables' was associated with lower levels of deprivation (Figure 1.4) and components 2 'puddings' (Figure 1.5) and 3 'snacks' (Figure 1.6) were associated with higher levels of deprivation.

In boys aged 12-17 years component 1 'vegetables' was associated with lower levels of deprivation (Figure 1.7) and component 2 'puddings' was associated with higher levels of deprivation (Figure 1.8).

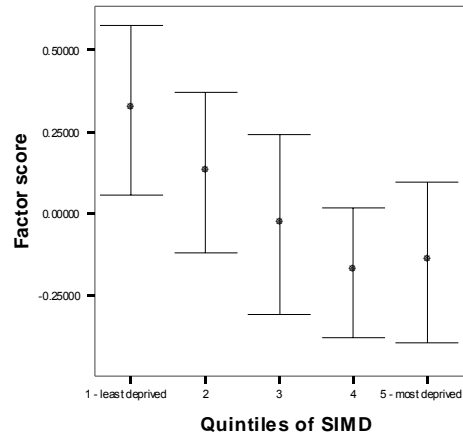
In girls aged 12-17 years component 1 'puddings' was associated with higher levels of deprivation (Figure 1.10) and component 3 'vegetables' was associated with lower levels of deprivation (Figure 1.12). Component 2 'fruit' showed overall a significant association with SIMD but not a significant linear association (Figure 1.11).

*Figures 1.1 - 1.12*

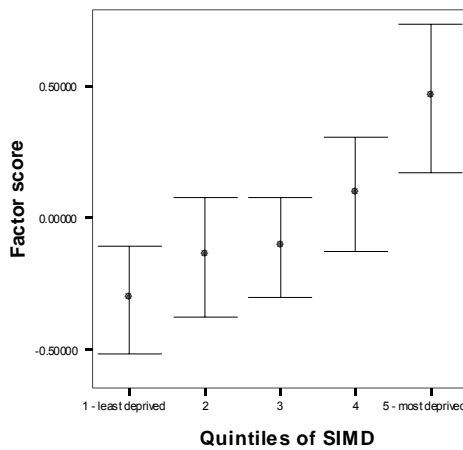
**Figure 1.1:** Mean (95% CI) of factor scores for component 1 'fruit & vegetables' in boys aged 5-11 years by quintile of SIMD.  
*p* for trend = 0.003



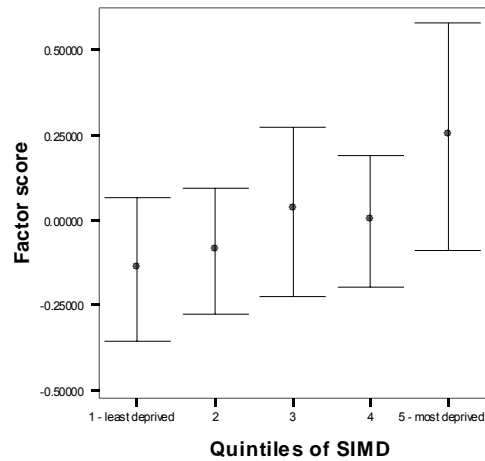
**Figure 1.4:** Mean (95% CI) of factor scores for component 1 'fruit & vegetables' in girls aged 5-11 years by quintile of SIMD.  
*p* for trend = 0.003



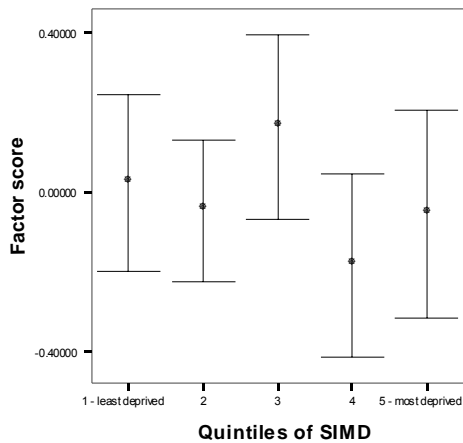
**Figure 1.2:** Mean (95% CI) of factor scores for component 2 'snacks' in boys aged 5-11 years by quintile of SIMD.  
*p* for trend < 0.001



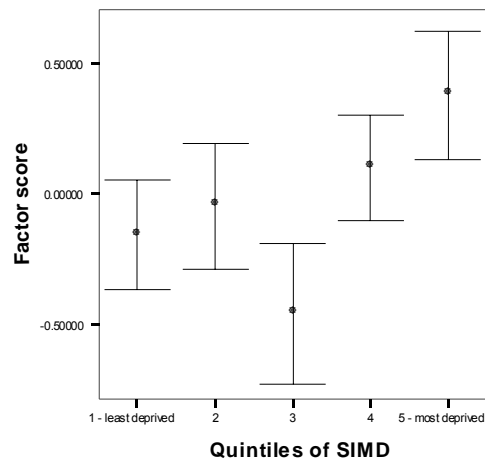
**Figure 1.5:** Mean (95% CI) of factor scores for component 2 'puddings' in girls aged 5-11 years by quintile of SIMD.  
*p* for trend = 0.011



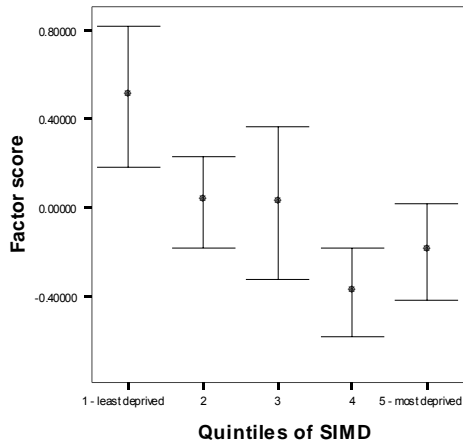
**Figure 1.3:** Mean (95% CI) of factor scores for component 3 'fish & sauce' in boys aged 5-11 years by quintile of SIMD.  
*p* for trend = 0.726



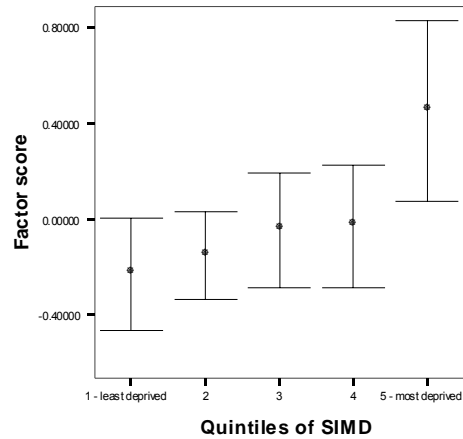
**Figure 1.6:** Mean (95% CI) of factor scores for component 3 'snacks' in girls aged 5-11 years by quintile of SIMD.  
*p* for trend = 0.003



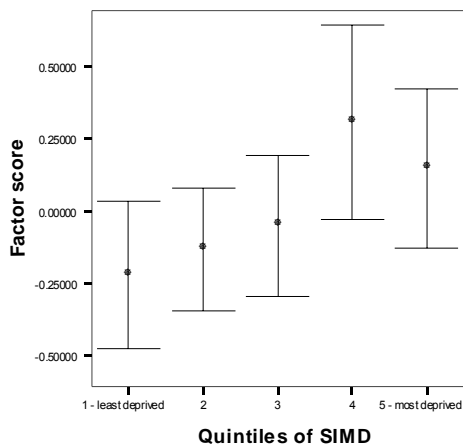
**Figure 1.7: Mean (95% CI) of factor scores for component 1 'vegetables' in boys aged 12-17 years by quintile of SIMD.**  
*p for trend = 0.002*



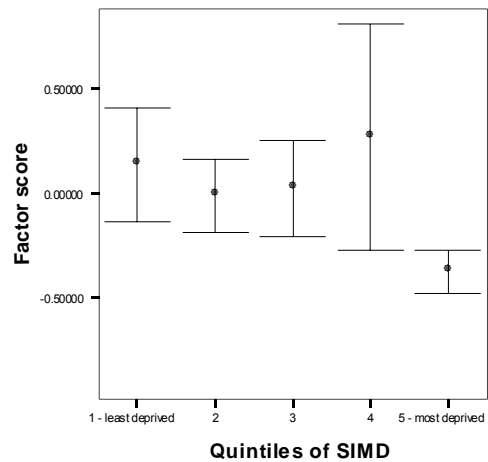
**Figure 1.10: Mean (95% CI) of factor scores for component 1 'puddings' in girls aged 12-17 years by quintile of SIMD.**  
*p for trend = 0.007*



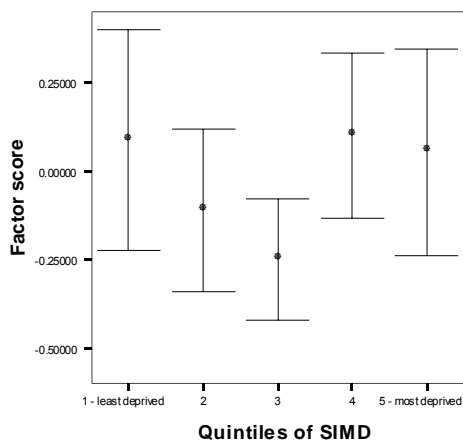
**Figure 1.8: Mean (95% CI) of factor scores for component 2 'puddings' in boys aged 12-17 years by quintile of SIMD.**  
*p for trend = 0.017*



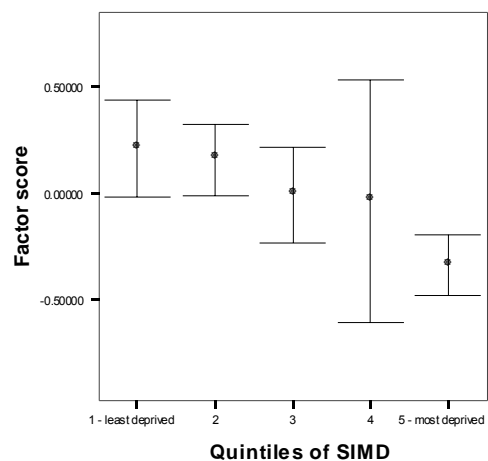
**Figure 1.11: Mean (95% CI) of factor scores for component 2 'fruit' in girls aged 12-17 years by quintile of SIMD.**  
*p for trend = 0.062*



**Figure 1.9: Mean (95% CI) of factor scores for component 3 'starchy food & drinks' in boys aged 12-17 years by quintile of SIMD.**  
*p for trend = 0.813*



**Figure 1.12: Mean (95% CI) of factor scores for component 3 'vegetables' in girls aged 12-17 years by quintile of SIMD.**  
*p for trend = 0.004*



## Association between dietary patterns and overweight and obesity

The only significant associations between BMI group and dietary patterns were found in boys aged 5-11 years. There was a significant linear association between component 2 'snacks' and BMI group with the lowest factor score in obese children i.e. obese children ate less of the snack foods associated with this component. There was also a significant linear association between component 3 'fish & sauce' and BMI group with the highest factor score in obese children i.e. these foods were eaten more by obese children.

Tables 1.5 and 1.6

Table 1.5 Factor scores for components by BMI classification in 5-11 year olds

	BMI Classification			P-value*	P-value†
	Neither overweight nor obese	Overweight	Obese		
<b>Boys</b>					
Component 1 'Fruit & vegetables'					
Mean	0.022	-0.078	-0.057	0.668	0.571
Lower 95% confidence limit	-0.110	-0.289	-0.331		
Upper 95% confidence limit	0.155	0.134	0.217		
Component 2 'Snacks'					
Mean	0.011	0.229	-0.237	<b>0.009</b>	<b>0.047</b>
Lower 95% confidence limit	-0.112	-0.064	-0.449		
Upper 95% confidence limit	0.135	0.522	-0.025		
Component 3 'Fish & sauce'					
Mean	-0.042	-0.150	0.320	<b>0.047</b>	<b>0.023</b>
Lower 95% confidence limit	-0.152	-0.386	0.054		
Upper 95% confidence limit	0.069	0.086	0.587		
<b>Girls</b>					
Component 1 'Fruit & vegetables'					
Mean	0.007	-0.069	0.114	0.653	0.461
Lower 95% confidence limit	-0.115	-0.372	-0.175		
Upper 95% confidence limit	0.129	0.233	0.403		
Component 2 'Puddings'					
Mean	0.010	0.021	-0.122	0.509	0.288
Lower 95% confidence limit	-0.137	-0.276	-0.326		
Upper 95% confidence limit	0.157	0.319	0.082		
Component 3 'Snacks'					
Mean	-0.047	-0.067	0.220	0.201	0.073
Lower 95% confidence limit	-0.170	-0.397	-0.046		
Upper 95% confidence limit	0.076	0.262	0.486		
<i>Base (weighted)</i>					
Boys	245	45	46		
Girls	216	45	46		
<i>Base (unweighted)</i>					
Boys	264	50	52		
Girls	234	49	48		

\*P-value for overall association between BMI classification and factor score adjusted for age and SIMD

†P-value for linear association between BMI classification and factor score adjusted for age and SIMD

**Table 1.6** Factor scores for components by BMI classification in 12-17 year olds

	BMI Classification			<i>P-value*</i>	<i>P-value†</i>
	Neither overweight nor obese	Overweight	Obese		
<b>Boys</b>					
Component 1 'Vegetables'					
Mean	-0.013	0.026	0.059	<i>0.903</i>	<i>0.674</i>
Lower 95% confidence limit	-0.202	-0.292	-0.233		
Upper 95% confidence limit	0.175	0.343	0.350		
Component 2 'Puddings'					
Mean	0.034	-0.245	0.082	<i>0.279</i>	<i>0.791</i>
Lower 95% confidence limit	-0.129	-0.580	-0.216		
Upper 95% confidence limit	0.197	0.089	0.380		
Component 3 'Starchy food & drinks'					
Mean	-0.044	0.013	0.044	<i>0.844</i>	<i>0.559</i>
Lower 95% confidence limit	-0.232	-0.550	-0.207		
Upper 95% confidence limit	0.144	0.576	0.294		
<b>Girls</b>					
Component 1 'Puddings'					
Mean	-0.059	0.252	-0.067	<i>0.463</i>	<i>0.958</i>
Lower 95% confidence limit	-0.225	-0.263	-0.287		
Upper 95% confidence limit	0.106	0.766	0.154		
Component 2 'Fruit'					
Mean	-0.028	0.037	-0.036	<i>0.849</i>	<i>0.947</i>
Lower 95% confidence limit	-0.188	-0.187	-0.246		
Upper 95% confidence limit	0.132	0.261	0.173		
Component 3 'Vegetables'					
Mean	-0.079	0.124	0.171	<i>0.192</i>	<i>0.113</i>
Lower 95% confidence limit	-0.209	-0.283	-0.109		
Upper 95% confidence limit	0.051	0.530	0.450		
<i>Base (weighted)</i>					
<i>Boys</i>	<i>177</i>	<i>37</i>	<i>56</i>		
<i>Girls</i>	<i>154</i>	<i>44</i>	<i>54</i>		
<i>Base (unweighted)</i>					
<i>Boys</i>	<i>153</i>	<i>34</i>	<i>52</i>		
<i>Girls</i>	<i>149</i>	<i>43</i>	<i>49</i>		

\*P-value for overall association between BMI classification and factor score adjusted for age and SIMD

†P-value for linear association between BMI classification and factor score adjusted for age and SIMD

## 1.1.4 DISCUSSION

For most of the age and sex groups, one 'healthy' dietary pattern characterised by high intakes of 'healthier' foods such as fruit and vegetables was identified and this was usually the first pattern which explained the greatest variance.

For most of the groups at least one of the other 2 patterns identified was a more 'unhealthy' 'snacks' or 'puddings' based pattern. For younger boys a third 'fish & sauce' based pattern was identified and for older boys a third 'starchy food & drinks' based pattern was identified.

Older girls (12-17 years) seemed to differ from the other age and sex groups with respect to the dietary patterns identified. The first component for older girls was a more 'unhealthy' pattern loading highly for puddings, although the % of variance explained did not differ much from the second and third components, whereas for girls aged 5-11 years and boys of both ages the first component was a 'healthy' pattern. Also for older girls fruit and vegetables loaded highly in separate components (components 2 and 3 respectively) whereas for the other age and sex groups, fruit and vegetables loaded highly within the same component (component 1), although for 12-17 year old boys there was a predominance of vegetables. Also for girls aged 12-17 years each of the 3 factors accounted for approximately the same amount of variance (5%) whereas for the other sex and age groups the first component accounted for 5.2-6.2% of the variance with the other components accounting for less.

The three dietary patterns identified for each age and sex group only accounted for 12-15% of the variance. This is very slightly lower than the variance explained by 3 factors identified at 4, 7 and 9 years of age in the ALSPAC Study (17.7% at age 4 years, 18.1% at age 7 years and 19.2% at age 9 years)<sup>14</sup> and 3 factors identified in an Australian study of 12-18 year olds which accounted for 21.7% of variance<sup>15</sup>. The lower variance explained in the current study is most likely due to the fact that the decision was made not to group the foods prior to running the analysis. It has been shown that reducing the number of input variables by prior grouping of foods derives patterns which explain a greater percentage of variance in intake but may attenuate relationships between the derived patterns and outcome variables<sup>16</sup>. In the current study there were approximately 140 input variables, whereas the Australian study had 86 items<sup>15</sup> and the ALSPAC Study approximately 40<sup>14</sup>. In general, dietary patterns derived using PCA tend to account for only a small amount of the total variance of the diet in a dataset, therefore results should be interpreted with caution as other patterns exist within

the data which individually explain less of the variance but jointly account for a considerable proportion of the variation between individuals<sup>1</sup>.

The three distinct dietary patterns found by the ALSPAC Study at age 4, 7 and 9 years of age were 'processed' (originally named 'junk'), 'health conscious' and 'traditional'<sup>14</sup>; at age 3 years a fourth 'snacks' patterns was found<sup>2</sup>. The foods that made up the 'processed' pattern are similar to those in the 'snacks' and 'puddings' patterns in the present study. The 'traditional' pattern contained meat, poultry, potatoes and vegetables whilst the 'health conscious' pattern loaded highly for fruit, vegetables, fish, pasta and rice at ages 3, 4 and 7 and inversely with meats at 9 years.

The Australian study of 12-18 year olds also identified 3 dietary patterns in their sample: a fruit, salad, cereals and fish pattern, a high fat and sugar pattern and a vegetables pattern<sup>15</sup>.

### ***Association with socio-economic deprivation***

The present study found significant linear relationships between dietary patterns and SIMD. 'Healthier' dietary patterns loading highly for fruit and vegetables were associated with lower levels of deprivation whereas more 'unhealthy' dietary patterns loading highly for snacks and puddings were associated with higher levels of deprivation.

Similar relationships with SIMD were found with food groups in the main report<sup>6</sup>. The main report highlighted that in general 'healthier' food groups (starchy carbohydrates, vegetables, fruit and fruit juice) were consumed in lower amounts by those living in more deprived areas and more 'unhealthy' food groups (ice-cream, processed meat, chips, crisps, confectionery, soft drinks and alcohol) were consumed in higher amounts by those living in more deprived areas.

Other studies have found similar associations between dietary patterns in children and socio-demographic factors.

The ALSPAC Study<sup>2,3</sup> found that 'junk' (renamed 'processed') food patterns were related to socially disadvantaged households (council housing, financial difficulties, lower levels of maternal education), whereas a 'healthy' component was associated with higher maternal education levels.

A Spanish study of 2-24 year olds again found similar associations with socio-demographic characteristics<sup>17</sup>. A 'snacky' pattern was associated with children from a lower socio-economic background and lower maternal education levels, and socially disadvantaged children were less likely to have the 'healthy' dietary pattern.

However, the Australian study of 12-18 year olds failed to find an association between the 3 dietary patterns identified in their sample and socio-economic indicators<sup>15</sup>.

### ***Association with overweight and obesity***

There was little association found between dietary patterns and overweight and obesity. The only significant relationships were in boys aged 5-11 years with the lowest intake of snack foods and the highest intake of fish & sauce in obese children. The few other studies that have looked at dietary patterns identified by PCA in relation to obesity in children have failed to find significant associations<sup>15,17,18</sup>.

In the main report there was also little evidence for associations between the intake of foods high in fat or sugar and overweight and obesity. The lack of an association between diet and overweight and obesity could be due to the fact that the data is cross-sectional. As was concluded in the main report the results of these analyses could be influenced by dieting and/or under-reporting in the overweight and obese but as no information was collected on dieting behaviour and no adjustment of the data has been made for possible under-reporting the results should be interpreted with caution.

## 1.2 PROPORTION OF CHILDREN MEETING POPULATION TARGETS

### 1.2.1 INTRODUCTION

This section describes additional analysis carried out on the dietary data obtained from the FFQs in order to explore the demographics of children who meet population targets.

In 1996 a set of food and nutrient based dietary targets for the Scottish population were published as part of the Scottish Diet Action Plan<sup>19</sup>.

The Scottish Dietary Target for NMES for children is  $\leq 10\%$  of total energy and for total fat and saturated fatty acids  $\leq 35\%$  and  $\leq 11\%$  food energy respectively.

In 2003, the Scottish Executive set physical activity targets which were outlined in the Physical Activity Task Force publication *Let's make Scotland more active: A strategy for physical activity*<sup>20</sup>. Its primary recommendation is that all children and young people should participate in at least one hour per day of physical activity of at least moderate intensity.

The aim of this additional analysis was to explore the proportion of children meeting the population targets for NMES, total fat and saturated fatty acids.

The specific objectives were:

- To assess the proportion of children meeting population targets for NMES, total fat and saturated fatty acids by age and sex
- To assess associations between meeting dietary targets and physical activity levels in order to examine whether 'healthy' lifestyle factors cluster in the same children
- To explore associations between the educational level of the main food provider and intake of total fat, saturated fatty acids and NMES in order to assess whether more highly educated mothers feed their children 'healthier' diets

### 1.2.2 METHODS

Details of the FFQ used in this survey and data handling methods can be found in the methods section on the dietary patterns analysis above and in the main survey report<sup>6</sup>.

Nutrient intakes were calculated from the FFQs using an in-house programme developed by the University of Aberdeen. This incorporates information on the weight of each food measure, the frequency of consumption of each food and the nutrient composition of each food. For this survey nutrient composition was derived from the National Diet and Nutrition Survey<sup>21</sup> (NDNS) nutrient databank.

After exclusion of outliers and incomplete questionnaires (see details in dietary patterns analysis above), 1,391 FFQs were available for analysis.

## **Data analysis**

Data analysis was carried out using SPSS version 15.0<sup>5</sup>. Data was weighted according to the same methods used for the main report<sup>6</sup>.

### ***Population targets***

The proportion of children meeting the Scottish dietary targets for NMES ( $\leq 10\%$  of total energy which is the equivalent of  $\leq 11\%$  food energy), total fat ( $\leq 35\%$  food energy) and saturated fatty acids ( $\leq 11\%$  food energy) was assessed in all children and by age (3-11 and 12-17 years) and sex group. The analysis was limited to those targets for which the FFQ could reliably assess intake.

The proportion meeting one, two or all three targets was assessed according to whether children also met targets for physical activity (at least one hour per day of moderate or vigorous activity).

### ***Education level of the main food provider***

In order to assess the association with nutrient intakes, the education level of the main food provider was grouped as follows:

- Degree or equivalent: First degree/ Higher degree  
Professional qualifications
- Vocational qualification: GSVQ foundation/ SVQ level 1 or 2/ SCOTVEC module  
GSVQ advanced/ SVQ level 3/ ONC/ OND  
City and Guilds  
HNC/ HND/ SVQ level 4 or 5
- Higher Grade or equivalent: Higher Grade/ A level/ CSYS
- Standard Grade or equivalent: O Grade/ Standard Grade/ GCSE/ CSE
- Other: School Leaving Certificate

- No qualification

### ***Tests of association***

Associations between the percentage of children meeting physical activity targets by number of dietary targets met was assessed using the Pearson chi-squared statistic under the Complex Samples Crosstabs procedure.

Associations between nutrient intakes and education level were assessed using ANCOVA under the Complex Samples General Linear Model procedure with adjustment for total household income.

## **1.2.3 RESULTS**

This section describes the proportion of children meeting population targets for NMES, total fat and saturated fatty acids and the associations between meeting these dietary targets and physical activity levels. This section also explores the associations between the educational level of the main food provider and intake of NMES, total fat and saturated fatty acids.

### ***Proportion of children meeting population dietary targets***

Overall almost 70% of children had intakes of total fat  $\leq 35\%$  food energy (the population target) but only 10% of children had intakes of NMES  $\leq 11\%$  food energy and 10% had intakes of saturated fatty acids of  $\leq 11\%$  food energy.

Overall, 59% of children ate a diet which met only one of the dietary targets and 13% ate a diet which met any 2 targets, however, only 2% of children ate a diet which met all 3 targets.

A greater percentage of children met the 2 fat targets combined (10%) than met the NMES target combined with the total fat target (6%) or the NMES target combined with the saturated fatty acids target (2%).

The children who met the target for saturated fatty acids also met the target for total fat and those who met the target for both saturated fatty acids and NMES met all three targets.

There was no significant difference between the sexes in the proportion of children meeting any of the dietary targets however there was a significant difference between age groups in the proportion of children meeting the dietary targets. Younger children were significantly more likely to meet the dietary target for NMES but less likely to meet the dietary target for saturated fatty acids than older children.

*Table 1.7*

***Proportion of children meeting physical activity targets***

Overall 86% of children met the physical activity target of at least 1 hour of moderate or vigorous activity per day. Boys were significantly more likely to meet the physical activity target than girls and younger children were significantly more likely to meet the physical activity target than older children.

There was no significant association between the percentages of children meeting the physical activity targets by the number of dietary targets met, although overall children who met all 3 dietary targets were less likely to meet the physical activity target.

*Tables 1.7 and 1.8*

**Table 1.7 Percentage of children meeting dietary and physical activity targets**

Population target	Sex			Age			All %
	Boys %	Girls %	<i>P-value*</i>	3-11 yrs %	12-17 yrs %	<i>P-value*</i>	
NMES ≤11% food energy	10.9	9.6	0.480	12.3	7.2	<b>0.019</b>	10.3
Total fat ≤35% food energy	70.3	67.1	0.261	71.1	65.3	0.053	68.8
Saturated fatty acids ≤11% food energy	8.9	11.7	0.133	7.5	14.3	<b>&lt;0.001</b>	10.2
Meeting only one target	61.2	56.6	0.122	62.9	53.2	<b>0.001</b>	59.0
Meeting total fat & NMES target	6.3	5.1	0.414	7.1	3.7	<b>0.018</b>	5.7
Meeting total fat & saturated fatty acids target	8.9	11.7	0.133	7.5	14.3	<b>&lt;0.001</b>	10.2
Meeting NMES & saturated fatty acids target	1.5	1.8	0.592	1.2	2.2	0.188	1.6
Meeting any two targets	12.3	13.2	0.651	12.2	13.5	0.424	12.7
Meeting all three targets	1.5	1.8	0.592	1.2	2.2	0.188	1.6
Physical activity target†	89.5	82.1	<b>0.001</b>	91.4	77.7	<b>&lt;0.001</b>	85.9
<i>Base (weighted)</i>							
<i>Dietary targets</i>	719	660		824	554		1379
<i>Physical activity target</i>	699	649		809	539		1348
<i>Base (unweighted)</i>							
<i>Dietary targets</i>	719	672		876	515		1391
<i>Physical activity target</i>	700	661		860	501		1361

\*P-value for chi-square test

†Only includes those who also have dietary data

**Table 1.8 Percentage of children meeting physical activity targets by number of dietary targets met**

Number of dietary targets met	Sex		Age		All %
	Boys %	Girls %	3-11 yrs %	12-17 yrs %	
0	92.8	79.5	91.8	79.1	86.0
1	88.2	82.7	91.3	75.7	85.6
2	90.9	85.0	91.3	83.5	88.0
3	75.1	83.3	90.9	69.8	79.5
<i>P-value*</i>	-†	-†	-†	-†	0.720
<i>Base (weighted)</i>					
0 targets met	175	183	193	165	358
1 target met	425	367	505	287	792
2 targets met	88	87	100	75	175
3 targets met	11	12	10	12	22
<i>Base (unweighted)</i>					
0 targets met	171	186	206	151	357
1 target met	429	376	537	268	805
2 targets met	89	87	106	70	176
3 targets met	11	12	11	12	23

\*P-value for chi-square test

†P-value not computed as count <5 for some cells

### **Association between education level of the main food provider and nutrient intakes**

There was a significant linear association found between education level of the main food provider and children's intakes of NMES (% food energy). Children in households in which the main food provider was educated to degree level had the lowest intakes of NMES (% food energy) and children in households where the main food provider had no formal qualification had the highest intakes of NMES (% food energy). There was no significant association found between education level of the main food provider and children's intakes of either total fat or saturated fatty acids.

*Table 1.9*

**Table 1.9 Average nutrient intake by educational level of main food provider adjusted for income**

	Education level of main food provider						<i>P-value*</i>	<i>P-value†</i>
	Degree	Vocational Qualification	Higher Grade	Standard Grade	Other	No qualification		
NMES (% food energy)								
Mean	17.1	18.4	18.7	18.9	19.4	19.4	<b>0.007</b>	<b>0.011</b>
Lower 95% confidence limit	16.3	17.6	17.1	18.0	16.3	18.2		
Upper 95% confidence limit	17.8	19.2	20.2	19.9	22.5	20.5		
Total fat (% food energy)								
Mean	32.7	33.0	32.8	33.1	32.4	32.8	<i>0.956</i>	<i>0.838</i>
Lower 95% confidence limit	32.2	32.5	31.9	32.5	29.8	32.1		
Upper 95% confidence limit	33.3	33.4	33.7	33.7	35.0	33.6		
Saturated fatty acids (% food energy)								
Mean	13.8	14.0	14.0	14.0	13.4	13.6	<i>0.662</i>	<i>0.255</i>
Lower 95% confidence limit	13.5	13.8	13.5	13.6	12.1	13.2		
Upper 95% confidence limit	14.1	14.2	14.5	14.3	14.6	14.1		
<i>Base (weighted)</i>	<i>360</i>	<i>447</i>	<i>91</i>	<i>251</i>	<i>27</i>	<i>175</i>		
<i>Base (unweighted)</i>	<i>383</i>	<i>476</i>	<i>95</i>	<i>265</i>	<i>30</i>	<i>182</i>		

\*P-value for overall association

†P-value for linear association

## 1.2.4 DISCUSSION

### ***Dietary targets***

Overall only 2% of children ate a diet which met all 3 dietary targets for NMES, total fat and saturated fatty acids. Children were most likely to meet the population target for total fat intake. This is consistent with the fact that in the main report the average intake of total fat was below the Scottish Dietary Target and the average intakes of NMES and saturated fatty acids were above the Scottish Dietary Targets.

Younger children were more likely to meet the dietary target for NMES but less likely to meet the dietary target for saturated fatty acids than older children. Again, this is consistent with the results from the main report which found no significant difference between the sexes for average intakes of NMES, total fat and saturated fatty acids as % of food energy but younger children had significantly lower intakes of NMES (% food energy) but significantly higher intakes of saturated fatty acids (% of food energy).

Children who met the target for saturated fatty acids also met the target for total fat. Only 2% of children managed to meet both the saturated fatty acids target and the NMES target and those meeting the target for saturated fatty acids and NMES also met the target for total fat. These results suggest that advice to eat a 'healthier' diet should concentrate on saturated fat intake and not total fat, but ensure that a lower fat intake is also combined with a low NMES intake.

### ***Physical activity targets***

Overall, a high percentage of children (86%) met the physical activity target of at least 1 hour of moderate or vigorous activity per day. As discussed in the main report it is likely that this high proportion is due in part to the timing of the fieldwork over the summer period (May to September).

There was no significant association between the percentages of children meeting the physical activity targets by the number of dietary targets met, although overall children who met all 3 dietary targets were less likely to meet the physical activity target. This suggests that those who are more physically active do not necessarily have 'healthier' diets than those who are less physically active.

In general other studies have found stronger relationships between physical inactivity (television viewing) and diet, with more 'unhealthy' diets being associated with greater time spent watching television. The National Diet and Nutrition Survey: young people aged 4 to 18 years<sup>22</sup> found overall in 7 to 18 year olds that total fat as percentage of energy was positively correlated with time spent in sedentary activity and inversely correlated with calculated activity score but not time spent in physical activity. Percentage energy from total sugars was positively correlated with total number of activities of at least moderate intensity in 7-10 year old boys but there was no significant relationship with physical activity in girls.

### ***Association between education level of the main food provider and nutrient intakes***

There was a significant association between education level of the main food provider and children's intakes of NMES. Children in households where the main food provider was educated to degree level had the lowest intakes of NMES and children in households where the main food provider had no formal qualification had the highest intakes of NMES. The magnitude and strength of the association with education level is similar to the association with SIMD in the main report. In the main report there was a significant association between SIMD and intake of NMES (% food energy) with higher intakes in the more deprived quintiles but no significant association between SIMD and intake of total fat (% food energy) or saturated fatty acids (% food energy). The similar association between nutrient intakes and education level of the main food provider and SIMD are due to the fact that there is a highly significant association between education level and SIMD with the highest proportion of those with degrees and the lowest proportion of those with no formal qualification in less deprived quintiles.

The ALSPAC Study found a similar association between NMES intake and maternal education level in 18 month old children<sup>23</sup>. Children of mothers with low education level had significantly higher intakes of NMES compared to mothers with high education level after adjustment for maternal smoking and maternal age. Unlike the present study, they found a significant association between maternal education level and intake of total fat with higher intakes in children of mothers with low education level, but this data was collected in 1993-1994, at least 12 years before the present study.

## **1.3 ASSOCIATION BETWEEN DIETARY PATTERNS AND POPULATION TARGETS**

### **1.3.1 INTRODUCTION**

The aim of this section was to explore associations between dietary patterns and meeting dietary targets for NMES, total fat and saturated fatty acids, in order to assess the types of diets which are associated with meeting the targets and assess which food groups to focus on in aiming to meet the targets.

### **1.3.2 METHODS**

Details of the methodology for defining the dietary patterns and cut-offs for population targets can be found in the 2 methods sections above. Further details of the FFQ used in this survey and data handling methods can be found in the main survey report<sup>6</sup>.

#### ***Tests of association***

Differences in mean factor scores between those meeting and those not meeting the targets were assessed using t-test under the Complex Samples General Linear Model procedure.

### **1.3.3 RESULTS**

Boys aged 5-11 years who met the Scottish Dietary Target for NMES intake had a significantly higher factor score on component 1 'fruit & vegetables' and girls aged 5-11 years who met the NMES target had a significantly lower factor score on component 3 'snacks'.

Boys aged 5-11 years who met the Scottish Dietary Target for total fat intake had a significantly lower factor score on component 2 'snacks' and component 3 'fish & sauce' and girls aged 5-11 years who met the total fat target had a significantly higher factor score on component 1 'fruit & vegetables' and a significantly lower factor score on component 2 'puddings'.

Girls aged 5-11 years who met the Scottish Dietary Target for intake of saturated fatty acids had a significantly higher factor score on component 1 'fruit & vegetables' and a significantly

lower factor score on component 3 'snacks'. There was no significant relationship between meeting the saturated fatty acids target and factor score on any of the components in boys aged 5-11 years.

Boys aged 12-17 years who met Scottish Dietary Target for NMES intake had a significantly lower factor score on component 2 'puddings' and component 3 'starchy food & drinks' and girls aged 12-17 years who met the NMES target had a significantly lower factor score on component 1 'puddings'.

Boys aged 12-17 years who met Scottish Dietary Targets for intake of total fat and saturated fatty acids had a significantly higher factor score on component 1 'vegetables' and a significantly lower factor score on component 2 'puddings' and girls aged 12-17 years who met the total fat and saturated fatty acids targets had a significantly lower factor score on component 1 'puddings' and a significantly higher factor score on component 2 'fruit'.

*Tables 1.10 and 1.11*

**Table 1.10** Factor scores for components by meeting the various targets in 5-11 year olds

	Population target met								
	NMES			Total Fat			Saturated fatty acids		
	Not met	Met	<i>P-value</i>	Not met	Met	<i>P-value</i>	Not met	Met	<i>P-value</i>
<b>Boys</b>									
Component 1 'Fruit & vegetables'									
Mean	-0.070	0.562	<b>0.036</b>	-0.168	0.056	<i>0.066</i>	-0.046	0.565	<i>0.165</i>
Lower 95% confidence limit	-0.187	-0.021		-0.360	-0.097		-0.148	-0.316	
Upper 95% confidence limit	0.047	1.145		0.025	0.209		0.055	1.446	
Component 2 'Snacks'									
Mean	0.027	-0.215	<i>0.318</i>	0.331	-0.110	<b>0.005</b>	0.022	-0.272	<i>0.154</i>
Lower 95% confidence limit	-0.078	-0.713		0.053	-0.237		-0.108	-0.641	
Upper 95% confidence limit	0.132	0.283		0.608	0.017		0.152	0.097	
Component 3 'Fish & sauce'									
Mean	-0.030	0.241	<i>0.270</i>	0.166	-0.055	<b>0.032</b>	0.032	-0.394	<i>0.055</i>
Lower 95% confidence limit	-0.122	-0.223		-0.008	-0.158		-0.061	-0.812	
Upper 95% confidence limit	0.062	0.706		0.339	0.047		0.126	0.024	
<b>Girls</b>									
Component 1 'Fruit & vegetables'									
Mean	-0.025	0.204	<i>0.289</i>	-0.159	0.073	<b>0.032</b>	-0.061	0.577	<b>0.006</b>
Lower 95% confidence limit	-0.134	-0.222		-0.339	-0.057		-0.165	0.128	
Upper 95% confidence limit	0.084	0.631		0.021	0.203		0.043	1.027	
Component 2 'Puddings'									
Mean	0.030	-0.248	<i>0.077</i>	0.278	-0.128	<b>0.006</b>	0.026	-0.243	<i>0.058</i>
Lower 95% confidence limit	-0.094	-0.536		0.015	-0.240		-0.091	-0.533	
Upper 95% confidence limit	0.154	0.041		0.541	-0.015		0.142	0.047	
Component 3 'Snacks'									
Mean	0.084	-0.687	<b>0.001</b>	-0.026	0.012	<i>0.756</i>	0.049	-0.464	<b>0.005</b>
Lower 95% confidence limit	-0.040	-1.129		-0.224	-0.145		-0.090	-0.794	
Upper 95% confidence limit	0.208	-0.245		0.173	0.168		0.188	-0.135	
<i>Base (weighted)</i>									
Boys	312	39		88	263		325	27	
Girls	280	34		99	216		285	30	
<i>Base (unweighted)</i>									
Boys	339	42		95	286		353	28	
Girls	303	37		106	234		307	33	

**Table 1.11** Factor scores for components by meeting the various targets in 12-17 year olds

	Population target met								
	NMES			Total Fat			Saturated fatty acids		
	Not met	Met	<i>P-value</i>	Not met	Met	<i>P-value</i>	Not met	Met	<i>P-value</i>
<b>Boys</b>									
Component 1 'Fruit & vegetables'									
Mean	-0.008	0.091	<i>0.539</i>	-0.204	0.113	<b><i>0.019</i></b>	-0.093	0.634	<b><i>0.003</i></b>
Lower 95% confidence limit	-0.178	-0.251		-0.436	-0.084		-0.244	0.146	
Upper 95% confidence limit	0.162	0.434		0.028	0.310		0.059	1.122	
Component 2 'Puddings'									
Mean	0.037	-0.427	<b><i>0.019</i></b>	0.271	-0.150	<b><i>0.001</i></b>	0.056	-0.382	<b><i>&lt;0.001</i></b>
Lower 95% confidence limit	-0.108	-0.783		0.033	-0.283		-0.092	-0.560	
Upper 95% confidence limit	0.181	-0.071		0.508	-0.017		0.204	-0.203	
Component 3 'Starchy food & drinks'									
Mean	0.042	-0.485	<b><i>0.003</i></b>	-0.012	0.007	<i>0.898</i>	0.014	0.097	<i>0.504</i>
Lower 95% confidence limit	-0.123	-0.772		-0.234	-0.200		-0.160	-0.388	
Upper 95% confidence limit	0.206	-0.198		0.209	0.214		0.189	0.194	
<b>Girls</b>									
Component 1 'Puddings'									
Mean	0.036	-0.509	<b><i>&lt;0.001</i></b>	0.283	-0.143	<b><i>0.012</i></b>	0.078	-0.416	<b><i>0.002</i></b>
Lower 95% confidence limit	-0.115	-0.736		-0.028	-0.272		-0.078	-0.676	
Upper 95% confidence limit	0.187	-0.281		0.593	-0.015		0.235	-0.155	
Component 2 'Fruit'									
Mean	-0.017	0.241	<i>0.353</i>	-0.276	0.140	<b><i>0.001</i></b>	-0.146	0.777	<b><i>0.003</i></b>
Lower 95% confidence limit	-0.138	-0.305		-0.404	-0.032		-0.224	0.182	
Upper 95% confidence limit	0.104	0.788		-0.148	0.312		-0.068	1.371	
Component 3 'Vegetables'									
Mean	0.013	-0.191	<i>0.132</i>	-0.134	0.068	<i>0.119</i>	-0.009	0.049	<i>0.771</i>
Lower 95% confidence limit	-0.117	-0.428		-0.298	-0.108		-0.134	-0.333	
Upper 95% confidence limit	0.144	0.047		0.030	0.244		0.116	0.431	
<i>Base (weighted)</i>									
Boys	259	22		100	181		245	36	
Girls	255	18		92	181		230	43	
<i>Base (unweighted)</i>									
Boys	228	22		87	163		217	33	
Girls	246	16		87	175		222	40	

### **1.3.4 DISCUSSION**

As may be expected, in general children meeting the Scottish Dietary Target for NMES intake had significantly lower factor scores on dietary patterns characterised by high intakes of sweet foods and drinks such as puddings and tended to have higher scores on dietary patterns associated with high intakes of fruit and vegetables although this was only significant in boys aged 5-11 years.

Children who met the dietary target for total fat and saturated fatty acids again tended to have significantly higher factor scores on 'healthier' dietary patterns loading highly for fruit and vegetables and lower scores on 'unhealthier' components characterised by high intakes of snacks and puddings.

In older children the same dietary patterns were significantly associated with meeting the target for total fat and saturated fatty acids within each sex, but this was not the case in younger children.

### **1.4 CONCLUSION**

PCA identified 3 dietary patterns in each age (5-11 years and 12-17 years) and sex group. Clear associations between dietary patterns and socio-economic deprivation were found. 'Healthier' patterns loading highly for fruit and vegetables were associated with less deprivation whereas more 'unhealthy' patterns ('snacks' and 'puddings') were associated with greater socio-economic deprivation.

There were no consistent associations between dietary patterns and overweight or obesity, however, the lack of an association should be interpreted with caution as the data is cross-sectional and no adjustment has been made for possible dieting and/or under-reporting.

Children were most likely to meet the population dietary target for total fat intake (69%), but only 10% met the targets for NMES or saturated fatty acids and only 2% of children ate a diet which met all three targets. There was no significant association between the percentages of children meeting the physical activity targets by the number of dietary targets met, suggesting that 'healthy' lifestyle factors don't necessarily cluster in the same children.

The higher the educational level of the main food provider the lower children's intakes of NMES, but no significant association was found between education level of the main food provider and children's intakes of either total fat or saturated fatty acids, suggesting that the diets of children with more highly educated mothers may contain less NMES but are no healthier in terms of intakes of fat.

In general, meeting the dietary targets for NMES, total fat and saturated fatty acids was positively associated with 'healthier' dietary patterns and inversely associated with more 'unhealthy' dietary patterns. This supports the suggestion in the main survey report<sup>6</sup> that in order to meet the dietary targets a high intake of 'healthier' foods should be combined with a low intake of 'unhealthy' foods, therefore the focus for health promotion should be one of a healthy balanced diet with no single food group targeted.

## 1.5 REFERENCES FOR SECTION 1

1. Michels KB & Schulze MB. Can dietary patterns help us detect diet-disease associations? *Nutrition Research Reviews* 2005; 18:241-8.
2. North K, Emmett P and the ALSPAC Study Team. Multivariate analysis of diet among three-year-old children and associations with socio-demographic characteristics. *Eur J Clin Nutr* 2000; 54:73-80.
3. Northstone K, Emmett P and the ALSPAC Study Team. Multivariate analysis of diet at four and seven years of age and associations with socio-demographic characteristics. *Eur J Clin Nutr* 2005; 59:751-760.
4. <http://www.foodfrequency.org.uk>
5. SPSS Inc. SPSS for Windows: Release 15.0, Chicago, Illinois: SPSS Inc. 2006.
6. Sheehy C, McNeill G, Masson L, Craig L, Macdiarmid J, Holmes B & Nelson M. Survey of sugar intake among children in Scotland. Food Standards Agency Scotland (FSAS), 2008. <http://www.food.gov.uk/multimedia/pdfs/sugarintakescot2008rep.pdf>
7. Cattell RB. The scree test for the number of factors. *Multivariate Behavioral Research* 1966; 1:245-276.
8. Kline P. An Easy Guide to Factor Analysis. London: Routledge, 1994.
9. Comrey AL & Lee HB. A first course in factor analysis. Hillsdale, New Jersey: Lawrence Erlbaum, 1992.
10. Costello AB & Osborne JW. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation* 2005; 10 (7). <http://pareonline.net/pdf/v10n7.pdf>
11. <http://www.scotland.gov.uk/Publications/2006/10/13142739/0>
12. Cole TJ, Freeman JV & Preece MA. Body Mass Index reference curves for the UK, 1990. *Arch Dis Child* 1995; 73:25-9.
13. Pan H & Cole T. User's guide to ImsGrowth. Institute of Child Health, UK, 2005.
14. Northstone K & Emmett P. Are dietary patterns stable throughout early and mid-childhood? A birth cohort study. *Br J Nutr* 2008; 100:1069-1076.
15. McNaughton SA, Ball K, Mishra GD & Crawford DA. Dietary patterns of adolescents and risk of obesity and hypertension. *J Nutr* 2008; 138:364-70.
16. Newby PK & Tucker KL. Empirically derived eating patterns using factor or cluster analysis: a review. *Nutr Rev* 2004; 62:177-203.
17. Aranceta J, Perez-Rodrigo C, Ribas L & Serra-Majem LI. Sociodemographic and lifestyle determinants of food patterns in Spanish children and adolescents: the enKid study. *Eur J Clin Nutr* 2003; 57 (suppl 1):S40-S44.

18. Reilly JJ, Armstrong J, Dorosty AR, Emmett PM, Ness A, Rogers I, Steer C & Sherriff A. Early life risk factors for obesity in childhood: cohort study. *BMJ* 2005; 330:1357.
19. The Scottish Office Department of Health. Eating for Health: a Diet Action Plan for Scotland. Edinburgh, 1996.
20. National Physical Activity Task Force. Let's make Scotland more active: A Strategy for Physical Activity. Edinburgh, Scottish Executive. 2003. <http://www.scotland.gov.uk/Publications/2003/02/16324/17895>
21. National Diet and Nutrition Survey: adults aged 19 to 64 years: Technical Report: Appendix H. London: The Stationery Office, 2004.
22. Gregory J, Lowe S, Bates CJ, Prentice A, Jackson LV, Smithers G, Wenlock R & Farron M. National Diet and Nutrition Survey: young people aged 4 to 18 years. London: The Stationery Office, 2000.
23. Rogers I, Emmett P and the ALSPAC Study Team. The effect of maternal smoking status, educational level and age on food and nutrient intakes in preschool children: results from the Avon Longitudinal Study of Parents and Children. *Eur J Clin Nutr* 2003; 57:854-864.

## 1.6 APPENDICES FOR SECTION 1

### APPENDIX 1.1: Scree plots for principal components analysis showing the percentage of variance explained by each component.

The decision was made to retain the first 3 components explaining the greatest amount of variance for each age and sex group based primarily on the point at which each curve levelled off.

Figure A1.1a Scree plot for boys aged 5-11 years showing the percentage of variance explained by each component

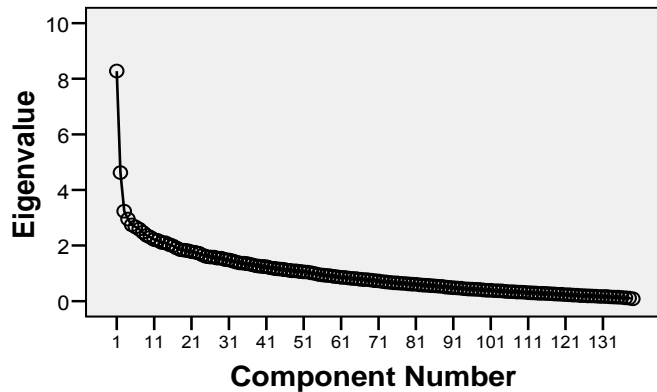


Figure A1.1b Scree plot for girls aged 5-11 years showing the percentage of variance explained by each component

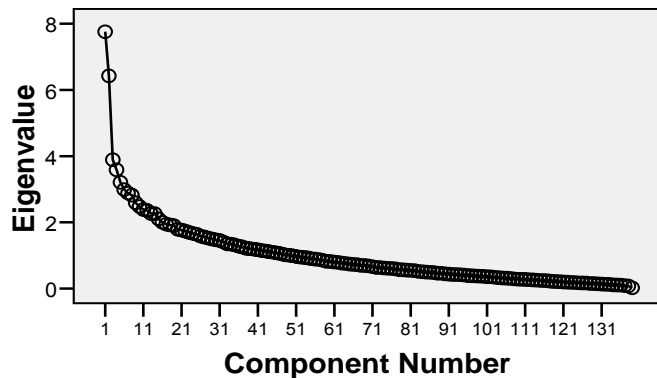


Figure A1.1c Scree plot for boys aged 12-17 years showing the percentage of variance explained by each component

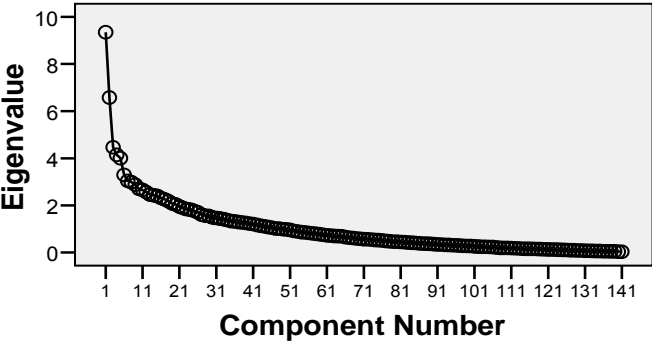
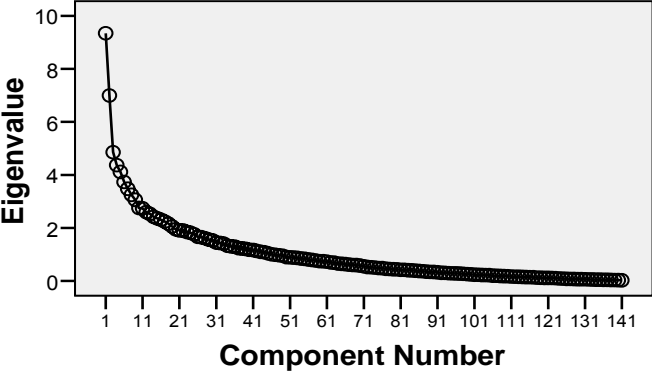


Figure A1.1d Scree plot for girls aged 12-17 years showing the percentage of variance explained by each component



## Appendix 1.2 Factor loadings for Principal Components Analysis

Table A1.2a Components for 5-11 year olds

Component % Variance	Boys			Girls		
	1 5.3	2 3.3	3 3.0	1 5.2	2 4.4	3 3.4
<b>Food Item</b>						
Unsweetened cereals	0.036	0.021	-0.041	0.237	0.056	-0.081
Sweetened cereals	-0.049	0.172	-0.161	-0.119	0.142	0.196
Ready Brek or porridge	0.294	-0.002	-0.026	0.258	0.007	-0.131
Muesli	0.062	-0.083	0.083	0.171	-0.056	-0.132
White bread or rolls	-0.124	<b>0.402</b>	-0.092	-0.137	0.067	<b>0.343</b>
Brown or granary bread or rolls	0.102	-0.253	0.099	0.147	-0.013	-0.093
Wholemeal bread or rolls	0.269	-0.217	-0.056	0.090	-0.077	-0.146
Croissants, garlic bread or Aberdeen Rolls	-0.041	0.109	0.185	-0.005	0.051	0.059
Pitta, naan, tortilla, bagel etc	<b>0.462</b>	0.047	-0.042	<b>0.310</b>	0.039	-0.121
Full fat cow's milk	0.127	0.101	0.135	-0.024	0.161	-0.116
Semi-skimmed cow's milk	0.124	-0.065	-0.037	0.157	-0.094	0.101
Skimmed cow's milk	-0.036	-0.113	0.016	0.015	-0.019	-0.039
Flavoured milk	-0.075	0.089	0.057	0.064	0.214	0.193
Drinking yogurts	-0.062	-0.114	0.039	0.117	0.130	-0.065
Flavoured yogurts	0.041	-0.029	0.160	0.119	0.006	0.233
Fromage frais	0.137	0.011	<b>-0.308</b>	-0.022	-0.053	0.106
Natural, low fat or low calorie yogurt	0.197	-0.142	-0.050	0.126	0.093	-0.141
Cream	0.129	-0.048	0.167	0.247	0.143	-0.100
Full fat cream cheese	0.152	-0.004	0.119	0.099	0.090	0.006
Cheddar cheese	0.157	0.033	0.084	0.116	-0.090	0.180
Edam, cheese spreads	0.013	0.026	-0.057	0.065	0.161	0.241
Low fat cheese	0.085	0.081	0.213	0.151	0.169	0.021
Eggs	0.108	0.236	<b>0.350</b>	0.188	0.137	0.197
Meat burgers or mince	-0.017	<b>0.347</b>	0.163	0.002	0.249	<b>0.364</b>
Meat sauce	-0.068	0.267	<b>0.339</b>	0.293	<b>0.309</b>	0.242
Frankfurters	-0.059	0.224	0.040	-0.017	0.250	0.158
Sausages	-0.158	<b>0.365</b>	0.109	-0.097	0.201	<b>0.314</b>
Bacon or gammon	-0.021	0.299	0.170	0.162	0.283	0.233
Cold ham or turkey	0.005	0.274	0.019	0.037	-0.065	<b>0.412</b>
Salami etc	0.014	-0.009	0.008	0.157	0.018	-0.004
Stewed, fried or grilled meat	0.177	0.267	0.295	0.257	0.177	0.203
Chicken nuggets	-0.114	0.182	-0.194	-0.226	<b>0.332</b>	0.154
Other chicken or turkey	0.131	0.174	0.223	0.197	0.037	0.164
Meat or chicken pies, pasties, sausage roll	-0.174	0.246	0.098	-0.154	<b>0.369</b>	0.270
Fish fingers	-0.020	-0.038	-0.028	-0.098	<b>0.341</b>	-0.054
Fish cakes or fish pie	0.100	0.017	0.243	0.132	<b>0.341</b>	-0.009
Grilled or poached white fish	0.162	0.015	<b>0.320</b>	<b>0.397</b>	0.105	-0.047
Fried or battered white fish or scampi	-0.003	0.033	0.165	0.112	0.269	-0.068
Grilled oily fish	0.178	-0.043	<b>0.412</b>	<b>0.346</b>	0.161	-0.102
Fried oily fish	0.069	-0.002	0.289	0.055	0.248	-0.092
Smoked oily fish	0.089	-0.182	<b>0.318</b>	0.089	0.076	-0.117
Tuna	0.260	0.043	0.280	0.237	0.041	0.110
Tinned salmon, sardines, mackerel, pilchards	0.174	-0.044	0.171	<b>0.321</b>	0.128	-0.005
Prawns	<b>0.425</b>	-0.015	0.075	<b>0.337</b>	0.243	-0.062
Boiled, mashed or baked potatoes	<b>0.320</b>	0.212	0.037	0.101	0.078	0.241
Potato croquettes or waffles	-0.093	0.205	-0.130	-0.114	0.215	0.221
Roast or fried potatoes	-0.110	0.135	<b>0.355</b>	0.130	0.176	0.266
Oven chips	-0.233	0.259	0.120	-0.052	0.155	0.256
Home cooked chips	-0.014	0.150	-0.023	-0.136	<b>0.368</b>	0.045
Bought chips	-0.199	0.286	-0.096	-0.221	0.231	<b>-0.319</b>
Pasta or couscous	0.165	-0.159	<b>0.312</b>	<b>0.317</b>	-0.030	0.085
Rice	<b>0.302</b>	-0.022	0.156	<b>0.425</b>	-0.001	-0.031
Noodles	0.028	0.231	0.131	-0.130	<b>0.367</b>	-0.186
Pizza	-0.177	0.204	0.010	-0.116	<b>0.390</b>	-0.030
Quiche	0.123	0.008	<b>0.312</b>	0.085	<b>0.434</b>	-0.025
Quorn, soya or tofu	0.166	-0.266	0.126	0.068	0.006	<b>-0.305</b>
Nut roast, nut burgers or vegetable burgers	0.083	-0.255	0.169	0.006	0.138	-0.150
Baked beans	0.040	0.144	0.003	-0.034	<b>0.343</b>	0.108
Other beans or lentils	0.213	-0.096	0.140	0.224	0.217	-0.148
Canned or dried soup	0.025	<b>0.334</b>	0.149	-0.070	<b>0.320</b>	0.143
Home made soup	<b>0.353</b>	0.065	0.098	<b>0.338</b>	0.083	-0.164
Bottled sauces (e.g. ketchup)	-0.097	0.231	-0.058	-0.016	0.128	<b>0.381</b>
Tomato sauce	0.004	0.112	<b>0.356</b>	<b>0.334</b>	0.212	0.191
Other sauce	0.085	0.053	<b>0.476</b>	0.159	0.105	0.062
Gravy	-0.052	<b>0.332</b>	<b>0.301</b>	0.171	0.152	0.246
Mayonnaise or salad cream	0.013	-0.020	0.143	0.253	0.126	0.061
Mixed vegetable dishes	<b>0.385</b>	-0.016	0.277	0.244	0.157	-0.120

Peas or green beans	<b>0.348</b>	-0.077	0.249	<b>0.412</b>	0.122	0.129
Sweetcorn	<b>0.409</b>	0.050	0.158	<b>0.457</b>	0.099	0.031
Broccoli	<b>0.742</b>	-0.086	0.037	<b>0.559</b>	-0.038	0.006
Cabbage	<b>0.637</b>	0.091	0.037	<b>0.508</b>	0.190	-0.051
Spinach	<b>0.529</b>	-0.058	0.045	<b>0.468</b>	0.063	-0.280
Other green veg	<b>0.566</b>	-0.086	0.194	<b>0.565</b>	0.093	<b>-0.349</b>
Cauliflower, swede or turnip	<b>0.663</b>	0.044	0.008	<b>0.504</b>	0.086	-0.009
Raw carrots	<b>0.580</b>	0.049	-0.084	<b>0.514</b>	-0.030	-0.104
Cooked carrots	<b>0.413</b>	-0.013	0.241	<b>0.540</b>	0.158	0.009
Onions	<b>0.487</b>	-0.074	0.211	<b>0.503</b>	0.015	-0.135
Tomatoes	<b>0.555</b>	-0.014	-0.053	0.277	-0.091	-0.114
Peppers	<b>0.408</b>	-0.064	0.058	<b>0.437</b>	-0.048	-0.159
Other salad veg	<b>0.551</b>	-0.055	0.016	<b>0.407</b>	-0.063	-0.142
Coleslaw	0.051	0.184	0.209	0.190	0.241	-0.152
Potato salad	-0.047	0.057	<b>0.307</b>	-0.110	0.241	<b>-0.399</b>
Fresh fruit salad	0.194	-0.031	0.086	0.276	-0.100	0.080
Tinned fruit	0.220	0.156	0.219	0.171	0.077	0.262
Apples	<b>0.411</b>	-0.066	-0.019	<b>0.387</b>	-0.183	0.037
Oranges	<b>0.480</b>	0.091	-0.006	<b>0.439</b>	-0.117	0.111
Bananas	<b>0.411</b>	-0.040	0.041	<b>0.378</b>	-0.127	-0.009
Grapes, melon, pear	<b>0.324</b>	-0.064	0.146	<b>0.368</b>	-0.187	0.222
Kiwi	<b>0.435</b>	0.045	0.078	<b>0.401</b>	-0.076	0.030
Other fruit	<b>0.502</b>	0.004	0.010	<b>0.389</b>	-0.149	0.142
Dried fruit	0.192	-0.222	0.101	0.258	-0.053	-0.118
Pure apple juice	0.191	-0.098	0.059	0.059	-0.015	-0.090
Other pure fruit juice	0.205	-0.015	0.146	0.197	-0.015	-0.121
High juice fruit drinks	0.029	0.088	0.058	-0.068	0.140	0.196
Regular fruit juice drinks	-0.040	0.154	-0.169	-0.128	0.029	0.249
Other fruit flavoured drinks including flavoured water	0.004	0.203	-0.035	-0.036	-0.022	0.246
Blackcurrant diluting juice	0.010	0.049	-0.207	0.091	0.098	0.113
No added sugar blackcurrant diluting juice	-0.040	0.219	-0.240	0.028	-0.024	0.277
Orange, lemon etc diluting juice	0.064	0.199	0.025	0.049	0.126	0.036
No added sugar orange, lemon or other diluting juice	0.012	0.242	-0.046	-0.002	-0.124	0.272
Regular fizzy drinks	-0.060	<b>0.374</b>	-0.152	-0.160	0.089	0.224
Low calorie fizzy drinks	-0.059	0.281	-0.049	-0.043	-0.064	0.259
Water	<b>0.318</b>	-0.133	0.143	0.262	-0.127	-0.028
Smoothies	0.045	-0.025	0.067	<b>0.459</b>	0.100	-0.222
Drinking chocolate	0.050	0.136	0.081	0.039	-0.006	0.011
Tea	-0.012	0.225	0.073	0.136	0.088	0.076
Sugar	-0.027	<b>0.390</b>	-0.025	-0.011	<b>0.308</b>	0.188
Jam etc	0.287	0.109	-0.136	0.172	0.194	0.168
Peanut butter	0.012	-0.167	0.245	0.032	0.076	-0.102
Chocolate spread	-0.021	0.008	-0.200	0.002	0.153	0.140
Marmite	0.224	-0.083	0.023	0.091	-0.060	0.032
Butter or margarine	0.207	0.219	-0.070	-0.015	-0.050	0.256
Regular crisps	-0.054	<b>0.460</b>	-0.281	-0.154	-0.109	0.275
Reduced fat crisps	0.031	-0.070	0.141	0.032	-0.036	-0.028
Other savoury snacks	-0.017	<b>0.335</b>	-0.051	-0.044	0.079	<b>0.373</b>
Nuts	0.054	-0.036	0.143	0.185	0.136	-0.077
Savoury biscuits, crackers and breadsticks	0.194	0.025	0.023	0.097	0.083	0.061
Plain biscuits	0.034	0.276	-0.003	0.029	0.106	0.100
Fancy biscuits	-0.067	<b>0.306</b>	-0.115	-0.088	0.249	0.224
Chocolate biscuits	-0.139	<b>0.326</b>	-0.253	-0.015	0.146	<b>0.404</b>
Cereal bars or flapjacks	0.030	0.079	0.087	0.184	0.040	0.008
Scones or pancakes	-0.010	0.123	0.075	0.022	0.219	0.175
Doughnuts or muffins	-0.056	0.130	0.136	0.019	<b>0.304</b>	0.198
Fruit cake or malt loaf	0.051	-0.095	0.229	0.165	<b>0.316</b>	-0.086
Plain cakes	0.069	0.101	0.197	0.050	<b>0.480</b>	0.036
Cakes with icing	0.019	0.146	0.160	-0.043	<b>0.525</b>	0.092
Cream cakes or gateaux	-0.047	0.205	0.178	0.085	<b>0.598</b>	0.055
Mousse	-0.041	0.103	0.269	-0.033	<b>0.346</b>	0.121
Jelly	0.093	<b>0.338</b>	0.059	-0.001	0.182	0.062
Milk puddings	0.042	0.159	0.123	0.162	<b>0.563</b>	0.060
Sponge puddings	0.093	0.237	0.223	0.113	<b>0.601</b>	0.032
Fruit tarts, crumbles or pies	0.211	0.166	<b>0.353</b>	0.145	<b>0.597</b>	-0.011
Custard	0.013	0.261	0.126	-0.024	<b>0.478</b>	-0.003
Cheesecake	0.030	0.191	0.042	0.146	<b>0.482</b>	0.001
Boiled, chewy sweets or chocolate sweets	-0.092	<b>0.409</b>	-0.098	-0.077	0.051	<b>0.375</b>
Chocolate bars	-0.061	<b>0.324</b>	-0.238	-0.111	-0.017	0.293
Wrapped ice creams	-0.026	0.101	0.076	0.127	0.123	<b>0.361</b>
Other ice cream	-0.005	0.259	0.093	-0.053	0.128	<b>0.325</b>
Iced lollies	-0.019	<b>0.351</b>	-0.085	0.030	0.061	<b>0.428</b>

Factor loadings <-0.3 and >0.3 are highlighted

**Table A1.2b Components for 12-17 year olds**

Component % Variance	Boys			Girls		
	1 6.2	2 4.7	3 3.5	1 5.1	2 5.0	3 5.0
<b>Food Item</b>						
Unsweetened cereals	-0.007	0.053	-0.034	-0.047	0.047	0.102
Sweetened cereals	-0.061	0.037	0.172	0.049	-0.030	0.069
Ready Brek or porridge	0.127	0.047	-0.086	-0.053	0.242	0.113
Muesli	0.217	-0.030	-0.020	-0.043	0.031	0.209
White bread or rolls	-0.193	-0.004	0.182	0.053	-0.173	-0.017
Brown or granary bread or rolls	0.167	0.006	-0.051	-0.099	0.064	<b>0.456</b>
Wholemeal bread or rolls	0.264	0.064	-0.204	-0.139	0.040	0.177
Croissants, garlic bread or Aberdeen Rolls	0.032	0.176	0.043	0.143	0.120	0.033
Pitta, naan, tortilla, bagel etc	0.268	-0.141	<b>0.446</b>	0.061	0.080	0.104
Full fat cow's milk	-0.084	0.287	-0.091	0.116	-0.117	-0.007
Semi-skimmed cow's milk	0.039	-0.128	0.121	-0.074	0.039	0.231
Skimmed cow's milk	0.191	0.075	0.016	0.036	0.136	0.084
Flavoured milk	-0.012	0.278	-0.051	0.232	-0.013	-0.067
Drinking yogurts	0.086	0.025	-0.053	0.035	0.088	0.038
Flavoured yogurts	0.089	0.133	-0.205	0.150	0.154	0.118
Fromage frais	-0.030	0.190	0.085	0.130	0.014	0.024
Natural, low fat or low calorie yogurt	0.172	0.017	0.168	-0.082	0.214	0.134
Cream	0.228	0.147	0.080	0.116	0.003	0.021
Full fat cream cheese	0.116	0.151	0.038	0.232	0.059	0.077
Cheddar cheese	-0.059	0.104	-0.045	0.034	0.062	0.054
Edam, cheese spreads	0.054	0.132	-0.130	0.097	-0.031	0.017
Low fat cheese	0.074	0.223	0.057	0.040	0.035	0.156
Eggs	0.056	0.262	0.083	0.212	0.143	0.088
Meat burgers or mince	-0.050	0.106	0.263	0.276	0.078	0.198
Meat sauce	0.145	0.075	0.258	0.202	0.068	0.251
Frankfurters	-0.033	0.112	0.100	0.121	-0.087	0.026
Sausages	-0.209	0.255	<b>0.365</b>	<b>0.351</b>	-0.029	-0.059
Bacon or gammon	-0.107	0.152	0.211	<b>0.636</b>	-0.021	-0.047
Cold ham or turkey	-0.098	-0.060	<b>0.340</b>	0.061	-0.047	0.257
Salami etc	0.028	0.061	0.101	-0.079	0.005	0.050
Stewed, fried or grilled meat	0.200	0.024	0.230	0.169	0.075	0.170
Chicken nuggets	-0.199	<b>0.325</b>	0.202	0.258	-0.012	-0.100
Other chicken or turkey	0.113	-0.119	0.291	0.256	0.055	0.234
Meat or chicken pies, pasties, sausage roll	-0.069	0.181	<b>0.339</b>	<b>0.325</b>	-0.023	0.158
Fish fingers	-0.026	<b>0.301</b>	0.093	0.166	-0.042	<b>0.513</b>
Fish cakes or fish pie	0.207	<b>0.320</b>	0.229	0.150	-0.065	0.018
Grilled or poached white fish	<b>0.366</b>	0.116	0.094	-0.041	0.201	0.242
Fried or battered white fish or scampi	0.261	0.258	0.098	0.047	0.118	0.225
Grilled oily fish	<b>0.321</b>	0.190	0.060	0.276	0.270	0.130
Fried oily fish	<b>0.306</b>	0.282	0.057	0.224	0.259	0.152
Smoked oily fish	<b>0.330</b>	-0.037	<b>0.318</b>	-0.055	0.076	0.185
Tuna	0.127	-0.013	0.190	0.120	<b>0.375</b>	0.102
Tinned salmon, sardines, mackerel, pilchards	<b>0.323</b>	0.128	0.104	0.148	0.058	0.195
Prawns	0.093	0.035	0.266	-0.105	0.213	0.159
Boiled, mashed or baked potatoes	0.049	-0.048	<b>0.442</b>	-0.024	0.031	0.257
Potato croquettes or waffles	0.049	0.297	0.224	0.131	0.057	-0.095
Roast or fried potatoes	0.230	-0.025	<b>0.508</b>	0.295	0.127	0.049
Oven chips	-0.213	0.235	0.270	0.189	-0.110	-0.019
Home cooked chips	-0.012	0.206	-0.088	0.245	-0.186	-0.131
Bought chips	-0.208	0.271	0.072	<b>0.431</b>	-0.125	-0.106
Pasta or couscous	0.230	-0.143	<b>0.456</b>	-0.019	0.052	<b>0.393</b>
Rice	<b>0.315</b>	-0.139	<b>0.361</b>	0.090	0.236	0.225
Noodles	-0.111	0.014	0.004	0.262	-0.013	0.002
Pizza	-0.187	0.273	<b>0.375</b>	<b>0.426</b>	-0.040	0.069
Quiche	0.248	0.133	-0.065	0.053	0.048	<b>0.311</b>
Quorn, soya or tofu	0.048	0.104	-0.132	-0.134	-0.003	0.164
Nut roast, nut burgers or vegetable burgers	<b>0.310</b>	<b>0.417</b>	-0.089	-0.129	0.102	0.105
Baked beans	-0.006	0.069	0.209	<b>0.470</b>	0.123	0.016
Other beans or lentils	<b>0.412</b>	0.298	-0.005	-0.079	0.179	0.229
Canned or dried soup	-0.023	0.270	-0.015	<b>0.327</b>	0.106	0.060
Home made soup	0.225	0.182	0.001	0.168	<b>0.419</b>	0.118
Bottled sauces (e.g. ketchup)	-0.068	0.172	0.068	0.096	-0.071	0.082
Tomato sauce	0.184	0.036	0.230	0.038	0.274	0.261
Other sauce	0.203	0.202	<b>0.317</b>	0.086	0.044	0.249
Gravy	0.094	0.006	0.224	<b>0.314</b>	-0.131	0.240
Mayonnaise or salad cream	0.108	-0.096	<b>0.310</b>	-0.001	0.071	0.190
Mixed vegetable dishes	<b>0.621</b>	0.111	0.131	0.060	0.210	<b>0.586</b>
Peas or green beans	<b>0.558</b>	-0.113	0.148	-0.040	0.076	<b>0.479</b>
Sweetcorn	<b>0.617</b>	0.016	0.174	0.108	0.053	<b>0.561</b>
Broccoli	<b>0.588</b>	-0.116	0.054	-0.032	0.132	<b>0.687</b>

Cabbage	<b>0.495</b>	0.142	-0.117	0.073	0.063	<b>0.660</b>
Spinach	<b>0.516</b>	0.143	-0.142	0.021	0.198	<b>0.359</b>
Other green veg	<b>0.547</b>	-0.053	-0.065	-0.116	<b>0.388</b>	<b>0.444</b>
Cauliflower, swede or turnip	<b>0.447</b>	0.022	-0.045	0.098	0.077	<b>0.666</b>
Raw carrots	<b>0.630</b>	-0.099	0.223	-0.046	0.256	0.132
Cooked carrots	<b>0.614</b>	-0.124	0.189	0.062	0.109	<b>0.621</b>
Onions	<b>0.535</b>	-0.075	0.097	-0.141	0.201	<b>0.528</b>
Tomatoes	<b>0.501</b>	-0.054	0.103	-0.051	0.098	<b>0.500</b>
Peppers	<b>0.562</b>	-0.059	0.130	-0.049	0.136	<b>0.562</b>
Other salad veg	<b>0.619</b>	-0.096	0.159	-0.136	<b>0.425</b>	<b>0.471</b>
Coleslaw	<b>0.463</b>	0.246	0.105	<b>0.336</b>	0.271	0.145
Potato salad	<b>0.433</b>	0.258	-0.021	0.163	0.261	0.192
Fresh fruit salad	0.138	0.094	0.027	0.170	<b>0.453</b>	-0.008
Tinned fruit	0.123	0.193	-0.029	0.163	<b>0.674</b>	-0.165
Apples	0.200	0.001	-0.046	-0.023	<b>0.725</b>	-0.021
Oranges	0.295	0.116	-0.003	0.003	<b>0.770</b>	-0.107
Bananas	<b>0.385</b>	0.052	0.010	-0.058	<b>0.806</b>	-0.053
Grapes, melon, pear	0.206	0.035	0.049	-0.018	<b>0.668</b>	0.057
Kiwi	<b>0.302</b>	0.201	-0.018	0.030	<b>0.757</b>	-0.063
Other fruit	<b>0.339</b>	0.058	-0.064	-0.093	<b>0.657</b>	0.045
Dried fruit	<b>0.327</b>	-0.017	-0.108	-0.160	<b>0.672</b>	0.046
Pure apple juice	<b>0.340</b>	0.061	0.096	-0.157	0.151	0.032
Other pure fruit juice	0.201	0.018	0.143	-0.143	0.235	0.166
High juice fruit drinks	0.118	0.257	0.131	0.104	0.034	-0.026
Regular fruit juice drinks	-0.022	0.260	0.040	0.080	0.032	-0.018
Other fruit flavoured drinks including flavoured water	0.081	<b>0.328</b>	0.052	0.063	0.128	0.140
Blackcurrant diluting juice	-0.004	0.211	<b>0.310</b>	0.196	0.067	0.116
No added sugar blackcurrant diluting juice	-0.180	0.068	0.257	0.052	0.116	0.196
Orange, lemon etc diluting juice	-0.117	0.238	<b>0.412</b>	0.195	0.119	0.120
No added sugar orange, lemon or other diluting juice	-0.190	0.199	<b>0.356</b>	0.019	0.021	0.255
Regular fizzy drinks	-0.251	0.126	0.102	<b>0.512</b>	-0.162	-0.208
Low calorie fizzy drinks	0.044	0.132	0.014	0.165	-0.086	0.028
Water	0.282	-0.097	0.170	-0.015	0.179	0.096
Smoothies	0.181	<b>0.312</b>	0.085	0.012	0.209	0.098
Drinking chocolate	0.106	0.295	-0.098	0.261	0.128	0.099
Tea	-0.024	-0.037	0.056	-0.033	-0.042	0.066
Coffee	0.088	-0.056	-0.035	0.118	0.033	0.169
Alcopops	0.057	-0.043	<b>0.490</b>	<b>0.548</b>	-0.005	-0.133
Lager or beer*	0.024	-0.017	<b>0.415</b>	-	-	-
Cider†	-	-	-	0.027	-0.016	-0.059
Sugar	-0.233	0.076	0.128	<b>0.472</b>	-0.063	0.020
Jam etc	0.052	0.109	0.003	0.031	0.155	0.066
Peanut butter	0.125	-0.015	-0.052	0.078	<b>0.326</b>	0.045
Chocolate spread	0.117	0.272	-0.034	0.219	0.039	-0.010
Butter or margarine	-0.165	0.035	0.232	0.114	-0.138	0.179
Regular crisps	<b>-0.306</b>	0.182	0.250	<b>0.357</b>	-0.182	-0.242
Reduced fat crisps	-0.032	0.210	0.139	0.123	-0.014	0.153
Other savoury snacks	-0.176	<b>0.306</b>	0.227	<b>0.434</b>	0.001	-0.032
Nuts	0.240	<b>0.426</b>	-0.125	-0.006	<b>0.432</b>	0.150
Savoury biscuits, crackers and breadsticks	0.028	0.210	<b>0.402</b>	0.101	0.160	0.104
Plain biscuits	-0.077	0.080	0.250	0.112	0.023	0.028
Fancy biscuits	0.015	0.213	0.115	0.222	0.006	0.029
Chocolate biscuits	-0.118	0.116	0.190	0.274	-0.071	-0.026
Cereal bars or flapjacks	0.156	0.079	<b>0.315</b>	0.193	0.138	0.046
Scones or pancakes	0.049	0.223	-0.079	<b>0.312</b>	0.031	0.166
Doughnuts or muffins	-0.038	<b>0.317</b>	-0.010	<b>0.473</b>	-0.087	0.123
Fruit cake or malt loaf	0.020	0.099	0.017	0.113	0.062	0.287
Plain cakes	0.161	<b>0.415</b>	0.024	0.274	0.022	0.199
Cakes with icing	-0.022	0.263	0.118	0.272	-0.045	0.226
Cream cakes or gateaux	0.079	<b>0.371</b>	0.115	<b>0.616</b>	-0.022	0.110
Mousse	-0.061	0.262	0.069	0.055	-0.048	0.169
Jelly	0.048	<b>0.473</b>	-0.055	0.134	0.043	0.119
Milk puddings	0.122	<b>0.552</b>	-0.170	<b>0.560</b>	0.206	-0.122
Sponge puddings	0.123	<b>0.627</b>	0.064	0.193	0.087	0.155
Fruit tarts, crumbles or pies	<b>0.324</b>	<b>0.472</b>	-0.128	0.193	0.101	0.211
Custard	0.089	<b>0.466</b>	-0.043	<b>0.606</b>	0.087	-0.008
Cheesecake	0.167	<b>0.405</b>	0.026	<b>0.619</b>	0.008	0.019
Boiled, chewy sweets or chocolate sweets	-0.154	<b>0.356</b>	0.186	<b>0.321</b>	0.031	-0.025
Chocolate bars	-0.214	0.265	0.137	<b>0.308</b>	-0.093	-0.040
Wrapped ice creams	-0.125	<b>0.519</b>	0.063	<b>0.379</b>	0.037	0.087
Other ice cream	-0.156	<b>0.437</b>	0.112	0.279	0.044	-0.021
Iced lollies	-0.118	<b>0.484</b>	-0.031	<b>0.339</b>	0.045	-0.017

Factor loadings <-0.3 and >0.3 are highlighted

\*Consumed by <5% of girls

†Consumed by <5% of boys

## Appendix 1.3 Factor scores in relation to socio-economic deprivation

Table A1.3a Factor scores for components by Scottish Index of Multiple Deprivation in 5-11 year olds

	Scottish Index of Multiple Deprivation quintile					P-value*	P-value†
	1 <sup>st</sup> (least deprived)	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup> (most deprived)		
<b>Boys</b>							
Component 1 'Fruit & vegetables'							
Mean	0.238	-0.026	0.150	-0.042	-0.392	<b>0.002</b>	<b>0.003</b>
Lower 95% confidence limit	-0.099	-0.225	-0.055	-0.023	-0.582		
Upper 95% confidence limit	0.575	0.172	0.354	0.150	-0.203		
Component 2 'Snacks'							
Mean	-0.319	-0.105	-0.092	0.085	0.492	<b>0.003</b>	<b>&lt;0.001</b>
Lower 95% confidence limit	-0.538	-0.409	-0.278	-0.122	0.168		
Upper 95% confidence limit	-0.099	0.200	0.094	0.293	0.816		
Component 3 'Fish & sauce'							
Mean	0.006	-0.027	0.144	-0.164	0.019	<i>0.470</i>	<i>0.726</i>
Lower 95% confidence limit	-0.280	-0.200	-0.082	-0.391	-0.158		
Upper 95% confidence limit	0.293	0.146	0.369	0.063	0.196		
<b>Girls</b>							
Component 1 'Fruit & vegetables'							
Mean	0.295	0.117	-0.089	-0.160	-0.152	<b>0.028</b>	<b>0.003</b>
Lower 95% confidence limit	0.063	-0.151	-0.321	-0.318	-0.392		
Upper 95% confidence limit	0.527	0.386	0.143	-0.002	0.087		
Component 2 'Puddings'							
Mean	-0.167	-0.109	0.028	-0.001	0.254	<i>0.132</i>	<b>0.011</b>
Lower 95% confidence limit	-0.368	-0.286	-0.315	-0.221	-0.008		
Upper 95% confidence limit	0.034	0.068	0.371	0.219	0.515		
Component 3 'Snacks'							
Mean	-0.166	-0.023	-0.423	0.131	0.403	<b>0.001</b>	<b>0.003</b>
Lower 95% confidence limit	-0.400	-0.235	-0.720	-0.084	0.144		
Upper 95% confidence limit	0.068	0.188	-0.125	0.347	0.663		
<i>Base (weighted)</i>							
<i>Boys</i>	<i>73</i>	<i>62</i>	<i>75</i>	<i>75</i>	<i>64</i>		
<i>Girls</i>	<i>71</i>	<i>53</i>	<i>57</i>	<i>64</i>	<i>66</i>		
<i>Base (unweighted)</i>							
<i>Boys</i>	<i>83</i>	<i>70</i>	<i>83</i>	<i>82</i>	<i>60</i>		
<i>Girls</i>	<i>81</i>	<i>60</i>	<i>62</i>	<i>67</i>	<i>66</i>		

\*P-value for overall association between SIMD quintile and factor score

†P-value for linear association between SIMD quintile and factor score

**Table A1.3b** Factor scores for components by Scottish Index of Multiple Deprivation in 12-17 year olds

	Scottish Index of Multiple Deprivation quintile					P-value*	P-value†
	1 <sup>st</sup> (least deprived)	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup> (most deprived)		
<b>Boys</b>							
Component 1 'Vegetables'							
Mean	0.496	0.024	0.020	-0.380	-0.199	<b>0.010</b>	<b>0.002</b>
Lower 95% confidence limit	0.050	-0.189	-0.318	-0.630	-0.472		
Upper 95% confidence limit	0.942	0.236	0.357	-0.131	0.074		
Component 2 'Puddings'							
Mean	-0.222	-0.134	-0.052	0.308	0.147	<i>0.207</i>	<b>0.017</b>
Lower 95% confidence limit	-0.550	-0.341	-0.287	-0.120	-0.134		
Upper 95% confidence limit	0.106	0.074	0.183	0.737	0.428		
Component 3 'Starchy food & drinks'							
Mean	0.087	-0.111	-0.248	0.099	0.052	<i>0.120</i>	<i>0.813</i>
Lower 95% confidence limit	-0.266	-0.446	-0.404	-0.158	-0.378		
Upper 95% confidence limit	0.440	0.224	-0.092	0.356	0.481		
<b>Girls</b>							
Component 1 'Puddings'							
Mean	-0.229	-0.151	-0.046	-0.030	0.452	<i>0.116</i>	<b>0.007</b>
Lower 95% confidence limit	-0.491	-0.324	-0.300	-0.304	0.031		
Upper 95% confidence limit	0.032	0.022	0.209	0.244	0.873		
Component 2 'Fruit'							
Mean	0.138	-0.012	0.022	0.269	-0.372	<b>&lt;0.001</b>	<i>0.062</i>
Lower 95% confidence limit	-0.136	-0.196	-0.227	-0.241	-0.470		
Upper 95% confidence limit	0.413	0.173	0.271	0.779	-0.274		
Component 3 'Vegetables'							
Mean	0.213	0.157	-0.008	-0.038	-0.340	<b>0.001</b>	<b>0.004</b>
Lower 95% confidence limit	-0.021	-0.013	-0.234	-0.577	-0.491		
Upper 95% confidence limit	0.447	0.328	0.217	0.501	-0.189		
<i>Base (weighted)</i>							
<i>Boys</i>	<i>64</i>	<i>59</i>	<i>42</i>	<i>56</i>	<i>53</i>		
<i>Girls</i>	<i>57</i>	<i>69</i>	<i>42</i>	<i>43</i>	<i>58</i>		
<i>Base (unweighted)</i>							
<i>Boys</i>	<i>59</i>	<i>53</i>	<i>40</i>	<i>47</i>	<i>44</i>		
<i>Girls</i>	<i>55</i>	<i>67</i>	<i>44</i>	<i>41</i>	<i>52</i>		

\*P-value for overall association between SIMD quintile and factor score

†P-value for linear association between SIMD quintile and factor score

## **Section 2. Eating patterns of school children in Scotland: Secondary analysis of the diet diaries from the Survey of Sugar intake among Children in Scotland.**

**Jennie Macdiarmid, Jennifer Cameron and Leone Craig**

### **2.1 INTRODUCTION AND LITERATURE REVIEW**

The aim of the analysis was to describe the meal and snacking patterns of a sample of children in Scotland aged 5-17 years. The dietary data were from a four day non-weighed diet diary completed by a sub-sample of the children from the Survey of Sugar Intake among Children in Scotland (2008).

The specific objectives were:

- to review the literature for criteria used for defining meals and snacks in previous studies;
- to describe the average number of meal and snacking events per day and their nutrient composition;
- to explore differences in meal and snacking patterns and nutrient intake between term-time and the school holidays;
- to explore differences in meal and snacking patterns and nutrient intake between school days and weekend days during term-time;
- to describe the contribution of snacks consumed during school hours to total nutrient intake on school days;
- to investigate the relationship between the number of snacking events and dental health.

Since there is no single definition or classification for meals and snacking patterns the first part of this study involved reviewing the literature to find the different definitions that have been used in previous studies. The review was used to decide the most appropriate definition for the current analysis of meal and snacking patterns.

#### **A literature review of the definition of meals and snacks**

Many studies use the terms 'meals' and 'snacks' to describe eating patterns but there is no agreement on a clear meaning or definition of these terms. It is important to clarify the terminology if data are to be compared and translated into educational health messages for the public. The first part of the study involved reviewing the literature on the criteria used in previous studies to define the terms meals and snacks. A literature search was conducted on PubMed ([www.pubmed.gov](http://www.pubmed.gov)) for studies on the intake of meal and snacks (1980 onwards) using a range of search terms including, snack, snacking, meals, meal patterns, meal definition and breakfast.

Review of the identified papers revealed that researchers have previously tried to address the issue of defining meals and snacks and it appears that there are differences even in the perception and usage of the term snacks<sup>1,2</sup>. Chamontin *et al*<sup>1</sup> investigated the perceptions of three common snacking terms (a snack, snacking and a snack food) by randomised mailings to a sample of university addresses in England and discovered that there were consistent differences in their uses. The study found that the term 'snack' tends to be used vaguely, for example, it is feasible that 'having a snack' refers either to eating some food between meals or to a light meal. It was evident that the definition used to define a 'meal' or a 'snack' could have a significant effect on the outcome and interpretation of a study. Despite these complexities a simple literature review on children and snacks by Gregori & Maffei<sup>2</sup> found that 50% of studies (n=26) reviewed failed to provide a clear definition of a snack or snacking concept. McBride *et al*<sup>3</sup> found that the relationships between energy intake and eating frequency were dependent on the definition of a 'meal'; a correlation between eating frequency and energy intake was only significant with 'meals' defined as being food providing more than 375kJ.

The review of the literature identified a number of methods for defining an eating event as a 'meal' or a 'snack'. The most common methods used were time of day, pre-defined snack foods within a food frequency questionnaire (FFQ), self-reporting by participants (using various criteria) and food-group based classification (grouped depending on the type of food eaten and the combination of foods eaten together). A brief description of each method is given below.

**Time of day:** A large number of studies have classified eating episodes into 'meals' or 'snacks' based on the time of consumption. An example is a study on elite figure skaters in America using 3-day food diaries<sup>4</sup> where meals were coded as follows: breakfast as the first eating event between 06:00 and 08:59, lunch as the first eating event between 11:00 and 13:59, dinner as the first eating event between 16:00 and 19:59. Snacks were classified as

any food or drink consumed out with these times. This method does have a number of disadvantages. The difficulty is that people are subject to such a large range of external and social influences that the time of 'meal' consumption can be irregular, therefore making it difficult to code eating events correctly into 'meals' or 'snacks' by this method. Unfortunately the less structured eating pattern of a modern lifestyle may mean that time of day is not a reliable method in many cases and difficult to code retrospectively.

One of the main problems with using the time of day method was that meal patterns vary on weekend days or during the holidays, particularly breakfast which may be eaten later in the morning on these days and therefore at a time which is outside the 'breakfast' cut-off times. However, time of day is the most common method for defining breakfast in the literature. Haines *et al*<sup>6</sup> and Siega-Riz *et al*<sup>6</sup> defined breakfast as an eating event between 05:00 and 09:00, and 05:00 and 10:00 respectively. This has been slightly modified in other studies to take into account week and weekend days where breakfast is defined as an eating event between 05:00 and 10:00 on weekdays, and 05:00 and 11:00 at weekends<sup>7,8,9</sup>. Ruxton *et al*<sup>10</sup> defined breakfast consumption in school children as a solid item of food taken before attending school, or an eating event before 11am at weekends.

**Pre-defined snack foods:** Jimenez-Cruz *et al*<sup>11</sup> and Phillips *et al*<sup>12</sup> collected dietary data on school children (8-12 years) in Mexico and USA respectively. The studies used a food frequency questionnaire (FFQ) to look at high fat or energy dense snack food consumption. Specific foods were pre-defined within a section of the FFQ as snacks. Jimenez-Cruz *et al*<sup>12</sup> grouped the foods in the FFQ and included a section for high-fat containing snacks and sweets. The energy dense snack foods considered by Phillips *et al*<sup>11</sup> included cookies, pies, cakes, brownies, chocolate, candy, non-chocolate candy, ice cream sundaes, milkshakes, sherbet, potato chips, corn chips, and soda.

**Self-reporting by participants:** Some researchers have asked participants to self-define each eating event as a 'meal' or a 'snack'. In America Ziegler *et al*<sup>13,14</sup> and Skinner *et al*<sup>15</sup> collected dietary data on children from the age of 4 to 24 months to investigate eating patterns. These three studies all used 24hr recalls and asked parents the time and location of each eating occasion and whether they considered it 'breakfast', 'lunch', 'dinner', 'snack', or 'other eating occasion'. Snacks were further categorised by the researchers as morning snack (waking until noon or lunch), afternoon snack (noon or lunch until 18:00), and evening snack (from 18:00 or dinner to bedtime). Bellisle *et al*<sup>16</sup> conducted a study in adults in France to investigate the contribution of snacks and meals in the diet. Subjects filled out a 7-day food diary on four occasions and the participants were asked to identify each eating event as

either a 'meal' or a 'snack'. This method was also used by Hampl *et al*<sup>17</sup> in America who studied snacking patterns in 18-65 year olds using 24hr recall. Jahns *et al*<sup>18</sup> used a very similar technique as when investigating snacking prevalence in 2-18 year olds in America. During a 24hr recall the respondents were asked what time they began to eat, and then they were asked to identify what they would call that eating occasion (i.e. breakfast, lunch, dinner, or snack).

Due to the wide range of meanings of the term 'snack' this self-defining method can induce potential problems/inaccuracies. The terms 'snack' and 'snacking', although very similar, can imply different behaviours. For example, a 'snack' can refer to eating episodes which are generally smaller and less structured than a 'meal', whereas 'snacking' can refer to eating events consumed out with recognised meal times<sup>19</sup>. The differences in perceptions of the meaning of these terms can cause inconsistent classification in data collection and studies using this method have highlighted the conflicting views held by the general public about what constitutes a 'meal' or 'snack'<sup>20</sup>.

**Food based classification:** Another method of classification for meals or snacks is based on the type of food consumed; however the criteria used to categorise food grouping is not consistent. De Assis *et al*<sup>21</sup> investigated meal and snack choices in Brazilian shift workers. They collected dietary data using 24 hour recall and 1-day food diaries and used the content of each eating event to identify whether it was a meal or snack. Two types of meals and one type of snack were considered based on the nutrient density of foods. Meals had to include at least two food groups of high nutrient density. They were further classified into 'meals with three food groups of high nutrient density' and 'meals with two food groups of high density'. Snacks were composed of only one food category of high nutrient density. Using various criteria, Lennernäs & Andersson<sup>22</sup> created the food-based classification of eating episodes (FBCE). The FBCE was designed to be applied to dietary data collected by 24hr recall, food diary or dietary history methods. The concept consists of two elements:

- 1) Seven food categories (a-g) that differ from each other with respect to nutritional composition or 'profile' (see Table 2.1);
- 2) The combinations of food categories eaten together (see Table 2.2).

Depending on the combination of food categories eaten, an eating episode can be coded into one of the four categories for meals, or one of the four categories for snacks. A potential

limitation of the food based classification system is that the categorisation of foods is likely to vary between studies depending on the objectives of the study and on the eating culture in different countries.

*Tables 2.1 and 2.2*

**Table 2.1 Food categories and their nutrient properties used as the base for categorisation of eating events**

Category a	Animal origin	Meat and meat products, fish and shellfish, poultry, egg, milk and cheese	High nutrient density	Animal protein and fat, iron, zinc, calcium
Category b	Plant origin	Rice, pasta, bread, dried legumes, seeds, potatoes	High nutrient density	Starch, plant protein, dietary fibre
Category c	Plant origin	Green vegetables, fruit, berries, roots	High nutrient density, low energy density	Starch, carotenoids, ascorbic acid
Category d	Plant origin	Nuts, olives, avocado	High fat density	Plant fat, plant protein
Category e	Animal and plant origin	Cooking fat, spreads, creams, fatty sauces	High fat density	Fat
Category f	Plant origin	Products in which white sugar often is added, beverages containing alcohol, ice cream, sweets, chocolate, biscuits, sweet desserts	Low nutrient density	Sugar, fat, alcohol
Category g		Water, coffee, tea, unsweetened beverages	light No energy	No nutrients

**Table 2.2 Criteria for the categorisation of eating episodes based on the combination of food categories**

Category	Meals
a + b + c	Complete meal
a + b	Incomplete meal
a + c	Less-balanced meal
b + c	Vegetarian meal
	<b>Snacks</b>
a or b or c	High-quality snack
any of a or b or c and/or d and/or e and/or f	Mixed-quality snack
e and/or f	No quality snack
g	No energy snack

A more recent study classified food and drink into either ‘core’ or ‘non-core’ foods. Kelly *et al*<sup>23</sup> and Bell *et al*<sup>24</sup> grouped foods into core and non-core foods based on the definition from *The Australian Guide to Healthy Eating*. Core foods and drinks were defined as the main food groups recommended to be consumed daily and non-core were defined as foods and drinks that were considered surfeit to daily requirements (Table 2.3). In the majority of cases the authors found the distinction between core and non-core was clear but there were some foods that were found difficult to classify due to their original group classification but poor nutrient quality, for example sweetened breakfast cereals (core food), fried potatoes (non-core food) and fried fish (non-core). In these cases a consensus was reached among the authors for the best classification of these foods. It is inevitable when trying to group all food and drink items into a small number of categories that there will be foods that are difficult to classify and opinion on the classification will differ between researchers.

*Table 2.3*

**Table 2.3 Food categories based on the Australian Guide to Healthy Eating**

Core foods	Non-core foods
Fruit	Confectionery
Vegetables	Fast food restaurant meals
Milk and milk products (excl. cream, high-fat cheese, high-fat milk dishes)	Cakes, biscuits and muesli bars (excl. low fat savoury biscuits)
Meat, fish, poultry, eggs and nuts (excl. high-fat processed meat, sugar coated nuts)	Savoury crisps and pastries (excl. low fat corn snacks)
Breads, cereals, rice and pasta (excl. high-fat bread such as garlic bread, high-fat pasta meals)	Frozen milk products (excl. ice-cream & frozen yoghurt <5% fat)
Baby foods	Sugared drinks (excl. low-joule drinks and mineral water)
Juices (excl. fruit drinks)	Gravies and sauces
Yeast extracts	High-sugar / high-fat spreads
	Frozen/fried potato products
	Alcohol
	Tea & coffee

**Other definitions:** Other definitions for eating events include more detailed criteria that take into account social eating behaviours and the type of foods consumed. Rotenberg<sup>25</sup> used the criterion of whether the individual was accompanied by fellow diners to define a 'meal'; i.e. a 'meal' was defined as a planned social interaction centred on food. A 'snack' was defined as an eating event carried out individually. Berstein *et al*<sup>26</sup> defined 'meals' as eating episodes of greater than 375kJ, and de Castro<sup>27</sup> defined a 'meal' as an eating event of at least 210kJ. Some authors have used a combination of criteria to distinguish between breakfast, lunch, evening meal and a snack, for example Skinner *et al*<sup>28</sup> used the criteria of time as well as the types and quantity of foods consumed.

Three dietary surveys were conducted in 1980, 1990 and 2000 in the same seven schools in Northumberland (UK)<sup>29</sup>. In 1980 only two criteria were required (time of day of eating event and whether cutlery was used); in 1990 three criteria were used (time of day of eating event, energy contribution and situation in which the food was eaten) and by 2000 five criteria were included (time taken to eat, energy contribution, time of day, use of cutlery and the content of the eating event). This emphasises the lack of consistency and increasing complexity regarding meals and snacks definitions and makes comparisons between years difficult. Adams *et al*<sup>29</sup> therefore developed a new method for defining separate eating events. When the eating events of all three years (1980, 1990 and 2000) were compared there was a substantial eating event peak around midday, which showed almost no variation between the years. From this pattern they formulated a new definition which anchors around this eating peak at midday. The eating event comprising the most food items between 11:00 and 14:00 was identified as 'meal 2', if there happened to be more than one then the earliest event was

identified as 'meal 2'. The event with the most food items 3.5 to 6.5 hours prior to 'meal 2' was identified as 'meal 1', and the event with the most food items 5 to 8 hours after 'meal 2' was identified as 'meal 3'. All other events were identified as snacks.

This review of the literature has highlighted some of the complexities and problems facing researchers defining individual meals and snacks within a population. Each method described has clear advantages and limitations and the method selected will, to some extent, influence the subsequent eating patterns observed in the study. Furthermore, it has illustrated the difficulties in comparing meal and snacking patterns between different studies.

## 2.2 METHODS

As part of the Survey of Sugar Intake among Children in Scotland (2008) a sub-sample of the study population completed a 4-day non-weighed diet diary. Respondents were asked to collect dietary information on three weekdays and one weekend day, and children in the survey were aged from 3 to 17 years old. Full details of the methodology used to collect the dietary intake of children are available in the Survey report at <http://www.food.gov.uk/multimedia/pdfs/sugarintakescot2008rep.pdf>.

### Definition of meals and snacks

Reviewing the literature found a large number of different criteria to define meals and snacks. These include self-defined meals and snacks by participants, pre-defined by researchers, time of day and categorisation of food and drinks. The diet diaries did not define whether an eating event was a meal or a snack and therefore it was not possible from the data to retrospectively and objectively code each eating event into specific meals (i.e. breakfast, lunch and dinner).

Based on the literature review and the retrospective nature of our data, it was first thought that 'time of day' would be the most appropriate definition for the classification of meals and snacks in this study. The times used to classify meals were the same as those used in the study by Zeigler *et al*<sup>4</sup>; breakfast as the first eating event between 06:00 and 08.59, lunch as the first eating event between 11:00 and 13.59, dinner as the first eating event between 16:00 and 19:59. The classification of meals and snacks by time of day was tested for a small sub sample of the food diaries (n=25). This method of classifying breakfast, lunch and dinner, however, proved to be difficult. For example, if a child had a packet of crisps at 12:00 then fish and chips at 14:00, the packet of crisps would be coded as 'lunch' rather than the

fish and chips. Other issues in coding dinner using time of day proved difficult in this sample due in part to the large age range which this study population spanned (5-17 years old). Some of the younger children ate dinner early which was outside the defined times for 'dinner', therefore their main evening meal was coded as a 'snack' rather than 'dinner'. This review also highlighted that defining meals as breakfast, lunch and dinner without applying any pre-conceived notions of what foods are commonly eaten as breakfast, lunch and dinner would be difficult.

Reviewing the diet diary data it was agreed that the most appropriate method for defining meals and snacks was to use a food-based categorisation method. The concept of grouping foods into core and non-core foods described by Bell *et al*<sup>24</sup> and Kelly *et al*<sup>23</sup> formed the basis for describing eating events as a core eating event (i.e. a meal) or a non-core eating event (i.e. a snack). The criteria for core and non-core was altered since the aim of this study was to describe meal and snacking patterns across the day, rather than using 'unhealthy' food groups as the basis for non-core foods used in previous studies. Food groups that were judged as forming a staple part of a traditional meal were defined as core foods (see Table 2.4). Non-core foods were food and drinks that could be easily eaten out with a meal, although this did not exclude them from being eaten as part of a meal. It should be noted that the classification was not based on 'healthy' and 'unhealthy' foods and therefore a snack (non-core foods) should not necessary be seen as an unhealthy option.

*Table 2.4*

**Table 2.4 Classification of food and drinks into core food groups and non-core foods groups**

<b>Core food groups</b>	<b>Non-core foods groups</b>
Pasta, rice, pizza & other cereals	Biscuits, cakes & pastries
Bread, excluding wholemeal	Puddings
Wholemeal bread	Milk & cream
Wholegrain & high fibre cereals	Cheese
Other breakfast cereals, incl. cereal bars	Yogurts & fromage frais
Eggs & egg dishes	Ice cream
Meats & meat dishes, excluding processed meat	Confectionery
Processed meat, including sausages, burgers, coated chicken	Crisps & savoury snacks
Fish & fish dishes, excluding oily fish	Nuts & seeds
Oily fish & dishes	Sugar & preserves
Vegetables excluding potatoes & baked beans	Fruit, excluding fruit juice
Baked beans	Fruit juice
Chips, fried & roast potatoes, potato products	Soft drinks, not diet and not lower sugar
Other potatoes, potato salads & dishes	Soft drinks, diet and lower sugar
	Tea, coffee & water
	Fats & oils (margarine / butter)
	Soups & sauces

Each food and drink in the diary was coded as a core or a non-core food (see Appendix 2.1 for examples of the food and drinks in the food groups). A meal was defined as an eating event containing one or more core foods, though it could include both core and non-core foods. A snacking event was defined as an eating event containing only non-core foods but could consist of more than one non-core food item. It was possible for the same non-core food items to be coded both as part of a meal and as a snacking event depending on what other foods were consumed as part of the eating event. For example, a packet of crisps eaten alone would be classified as a snack but eaten with a sandwich would be part of a meal. To distinguish between individual eating events, each eating event was required to be separated by a minimum of 30 minutes when no food or drinks were consumed.

The food groups in Table 2.4 were pre-defined in the Survey of Sugar Intake among Children in Scotland (2008). In the majority of cases the classification of the food groups into core and non-core foods was considered straightforward. There were, however, some food groups that were less clear to categorise as they could be considered as either core or non-core. Bread, for example, was one food group that proved difficult to classify since it was viewed that it could be eaten as part of a snack or a meal. After careful consideration a consensus was reached among the researchers that this should be a core food. The justification was that by our definition of meals and snacks if toast was eaten with jam for breakfast or a cheese sandwich at lunchtime and bread was a non-core food then these eating events would be classified as a snack, which in our opinion should be a meal. The other category that was difficult to classify was soup and sauces. It could be argued that soups would be more appropriately a core food but it was in a food group that also contained condiments, such as tomato sauce and mayonnaises, which would not be considered a core food. However, if soup was eaten with bread then the eating event would be considered a meal. Within the food group soup made up less than a quarter of the food items eaten. Soup accounted for only 0.6% of all the food items reported in the diaries and on 67% of occasions soup was eaten as part of a meal. Since soup was not eaten regularly and in the majority of cases was part of a meal it was agreed that this food group would be classified as non-core. An example of the coding method used for the diaries to classify meals and snacks is shown in Appendix 2.2.

Food-based classification was considered the most appropriate method for the classification of meals and snacks to describe eating patterns. Given the age range of the children in this survey time of day was not appropriate, as described above. The children had not been asked to describe each eating event as part of completing the diet diary. An advantage of this method is that researchers are not defining individual eating events by simply viewing

the diaries which would be considered too subjective. As with all these methods using the food-based classification has limitations. As described above it is not always straightforward to classify all the foods clearly into core and non-core, even when a definition for core and non-core has been agreed. Another limitation of this method is that the eating patterns (i.e. meals and snacks) will obviously reflect the foods that have been chosen as core or non-core. The term 'snacks' often has negative connotations but with our definition this is not necessarily the case since fruit is a non-core food item and therefore could be a snack.

### **Definition of breakfast**

The only meal deemed possible to be coded separately was breakfast and the definition, adapted from Ruxton *et al*<sup>10</sup> was based on the time of day eaten. Breakfast was classified as the first eating event of the day up until and including 9.00am on school days and 11.00am on weekend days or during school holidays. To be classified as breakfast the eating event had to include a food item: consumption of only a beverage (e.g. milk, fruit juice, tea, coffee) did not constitute a breakfast by this definition.

### **Classification of term-time and school holidays**

The sample was grouped according to whether the child completed the diary during term-time or in the school holidays. Dates of school holidays were obtained from all the local education authorities in Scotland and the diaries were grouped using the dates from the local authority in which the child lived. These dates also took into account 'in-service' days when the child would not have attended school.

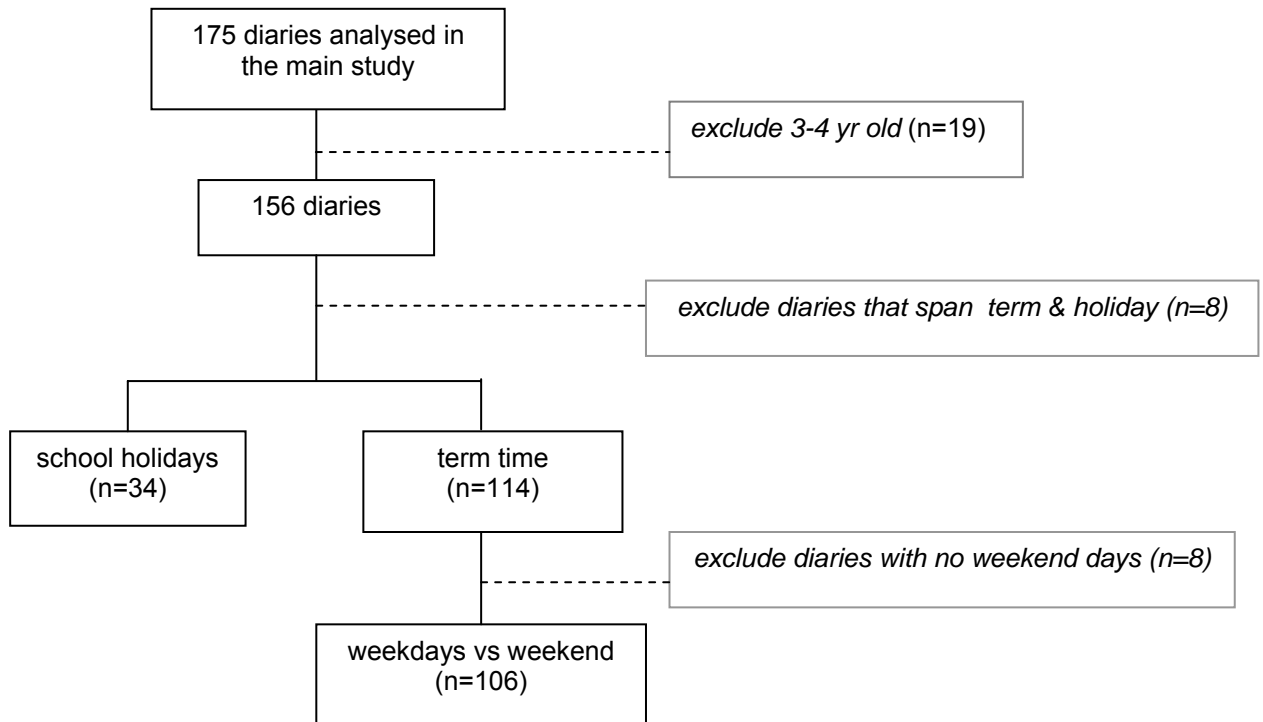
To investigate the contribution to total daily intake of snacks eaten during school hours, food and drinks consumed after 09:00 and before 15:00 were classified as eaten in school hours. All other foods were classified as out of school hours.

### **Sample**

Sixty percent of the diet diaries were returned as part of the Survey of Sugar Intake among Children in Scotland (2008). A total of 175 diet diaries were complete and suitable for analysis. For the purpose of this analysis children aged 3-4 years (n=19) were excluded since the focus was on school aged children (5-17 years). One hundred and fifty six diaries were included in the main analyses. For the comparison of term-time with school holidays diaries where the dietary reporting period spanned both term-time and holidays were excluded (n=8). A further eight diaries were excluded for the comparison of weekdays with weekend days during term-time because these diaries did not include a weekend day.

*Figure 2.1*

Figure 2.1 The sample included in the analyses.



### Data analysis

To be consistent throughout this section of the report unweighted data were used for all the analyses, which included both parametric and non-parametric statistical methods. It was not possible to carry out non-parametric tests on weighted data and due to the distribution of these data it was not possible to transform the data to be used in parametric tests. The decision to use parametric or non-parametric data was based on the distribution of the data and the range of variance within the variable. When the data were not normally distributed or the variability of the data and the number of data points within these variables was limited non-parametric tests were performed, for example with the number of meals and snacks eaten per day. Parametric tests were appropriately used when the distribution of the data were considered normally distributed (e.g. nutrients). Data were analysed using SPSS version 15.0.

The average number of meals and snacking events per day was calculated for each child. As an alternative way of looking at the data, meals and snacks were also considered in terms of individual days (total number of diary days) rather than the average of four days for each child. Each child completed four diary days which when summed together gave a total of

624 individual diet diary days for the whole sample. This allowed us to calculate the percentage of total days that different numbers of meals and snacks were eaten.

Associations between the number of meal and snacking events per child per day and age groups (5-11 years and 12-17 years), sex and Scottish Index of Multiple Deprivation (SIMD) quintiles were assessed using non-parametric tests (Mann-Whitney tests and Jonckheere-Terpstra test for trend). Energy and nutrient intake (% food energy of fat, saturated fatty acids (SFA) and non-milk extrinsic sugar (NMES)) from meals and snacks were compared using paired t-tests. The percentage contribution of energy and nutrients to total daily intake from snacking events was assessed between age and sex subgroups using general linear models (ANOVA). The food and drinks most commonly consumed within a snacking event are described and is expressed as the percentage of children consuming food or drink from each of non-core food groups (Table 2.4). This does not take into account the amount of food eaten or the number of food items eaten within a single snacking event. A single snacking event could contain several non-core foods, for example a packet of crisps and a glass of fruit juice.

Associations between breakfast consumption and age and sex subgroups were examined using the Pearson chi-squared statistic. Breakfast consumers were grouped into those who ate breakfast on all four days (i.e. everyday) and those who ate breakfast on fewer than four days (0-3 days). The food and drinks most commonly consumed for breakfast are described. This is presented as the percentage of children eating any of the core and non-core foods listed in Table 2.4 for breakfast. Breakfast typically comprised more than one food item.

Differences in the number of meal and snacking events on weekdays during term-time and school holidays were tested using the Mann Whitney statistic and differences in the daily energy and nutrient intakes assessed using general linear models (ANCOVA: adjusted for age, sex and SIMD quintiles). Further comparisons were made of the number of meal and snacking events per day between weekdays and weekend days during term time (Wilcoxon signed-rank test). Differences in the total daily energy and nutrient intake (% energy from fat, SFA and NMES) on weekdays and weekend days were assessed using paired t-tests.

The average number of snacking events during school hours and out of school hours was compared using the Wilcoxon signed-rank test. The percentage contribution to total daily intake of energy and nutrients from snacking events was calculated.

The relationship between dental decay and the number of eating and snacking events was assessed using logistic regression, adjusting for age, sex and SIMD. Age is a continuous variable and SIMD and sex are both categorical. Children were categorised according to whether or not they had ever received treatment for decay, with treatment for decay being defined as fillings and/or teeth extraction due to decay (i.e. no treatment vs. any treatment).

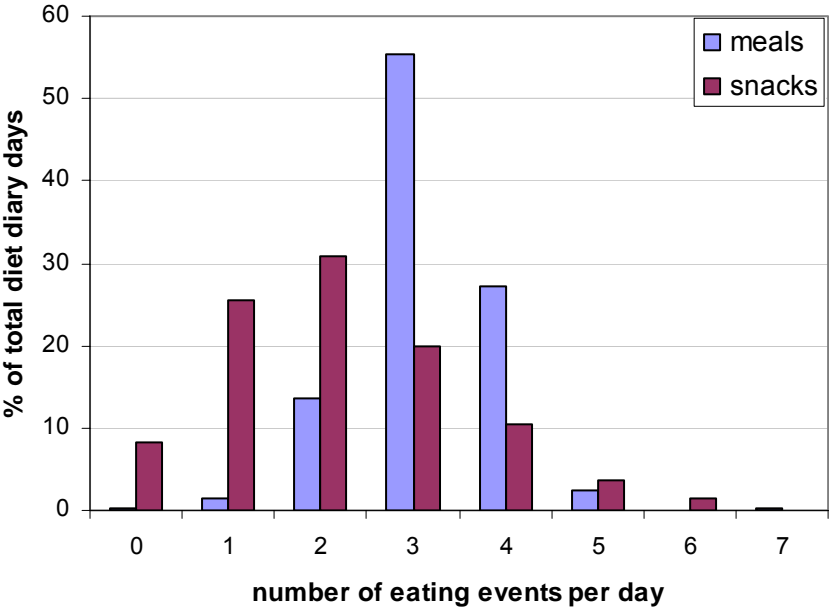
### 2.3 RESULTS

#### Meal and snack consumption of children

Figure 2.2 shows the variation in the number of meals and snacks eaten per day, expressed as a percentage of total number of diet diary days (n=624 days). Three meals were eaten on 55% of the diary days and on 56% of days one or two snacks were eaten.

Figure 2.2

Figure 2.2: The number of meals and snacks eaten per day



The median number of eating events per child per day was 5.3 and comprised 3.3 meals and 2.0 snacks (Table 2.5). Boys ate significantly more meals per day than girls but there was no difference between sexes in the number of snacks. The total number of eating events per day was higher among younger children but there was no difference between age groups in the number of meals or snacks. The lack of significance between age groups is due to the wide variation in the number of meals rather than difference in the medians. There was a significant trend across SIMD quintiles for the total number of eating events per day and the number of meals eaten, with more eating events and fewer meals among children from least

deprived areas. The reverse trend was seen for snacking, with children from more deprived areas eating fewer snacks than children from less deprived areas (Table 2.6). The total daily energy intake did not differ significantly across SIMD groups in this sample ( $p=0.146$ ).

Tables 2.5 and 2.6

Table 2.5 The median number of meals and snacks eaten per child per day

	All	Sex		<i>P</i>	Age		<i>p</i>
		Boys	Girls		5-11 yrs	12-17 yrs	
<b>Total eating events</b>							
median	5.3	5.3	5.3	<i>0.379</i>	5.4	5.0	<b><i>0.034</i></b>
IQR	4.8 – 6.0	4.8 – 6.0	4.8 – 5.8		4.8 – 6.2	4.5 – 5.8	
min/max	3.3 / 8.0	3.5 / 8.0	3.3 / 7.5		3.3 / 8.0	3.5 / 7.5	
<b>Meals</b>							
median	3.3	3.3	3.0	<b><i>0.032</i></b>	3.3	3.0	<i>0.227</i>
IQR	2.8 – 3.5	3.0 – 3.5	2.8 – 3.5		3.0 – 3.5	2.8 – 3.5	
min/max	1.0 / 4.8	1.0 / 4.5	1.8 / 4.8		1.5 / 4.5	1.0 / 4.8	
<b>Snacking events</b>							
median	2.0	2.0	2.0	<i>0.891</i>	2.1	2.0	<i>0.123</i>
IQR	1.5 – 2.8	1.5 – 2.8	1.5 – 2.8		1.5 – 3.0	1.3 – 2.7	
min/max	0.0 / 5.0	0.0 / 4.8	0.0 / 5.0		0.0 / 5.0	0.0 / 4.8	
<i>Base (unweighted)</i>	<i>156</i>	<i>81</i>	<i>75</i>		<i>88</i>	<i>68</i>	

Table 2.6 The median number of meals and snacks per child per day by SIMD quintiles

	1	2	3	4	5	<i>p for trend</i>
	least deprived				most deprived	
<b>Total eating events</b>						
median	5.6	5.0	5.0	5.3	5.0	<b><i>0.019</i></b>
IQR	5.0 – 6.3	4.5 – 5.9	4.1 – 6.0	4.5 – 6.0	4.8 – 5.7	
min/max	4.0 / 7.5	3.5 / 7.5	3.8 / 8.0	3.3 / 7.3	3.5 / 6.8	
<b>Meals</b>						
median	3.0	3.3	3.0	3.3	3.5	<b><i>0.003</i></b>
IQR	2.8 – 3.3	3.0 – 3.5	2.8 – 3.3	3.0 – 3.8	2.8 – 3.8	
min/max	1.8 / 4.0	2.3 / 3.8	1.5 / 4.5	1.0 / 4.8	2.5 / 4.0	
<b>Snacking events</b>						
median	2.8	2.0	2.0	2.0	1.9	<b><i>&lt;0.001</i></b>
IQR	2.0 – 3.5	1.4 – 2.5	1.5 – 2.9	1.5 – 2.8	1.0 – 2.3	
min/max	1.0 / 5.0	0.5 / 4.5	0.8 / 3.5	0.0 / 4.0	0.0 / 4.0	
<i>Base (unweighted)</i>	<i>36</i>	<i>33</i>	<i>28</i>	<i>35</i>	<i>24</i>	

Figure 2.3 shows the number of meals eaten on a single day in the diet diaries by SIMD quintiles. The data are expressed as a percentage of the total diet diary days ( $n=624$ ), rather than the average number per child over four days as in Table 2.5. Children from less deprived areas were more likely to eat three meals per day than children from more deprived areas (from least deprived to most deprived: 62%, 64%, 58%, 44%, 48%,  $p=0.003$ ).

Figure 2.3

Figure 2.3: the number of meals eaten per day by SIMD quintiles

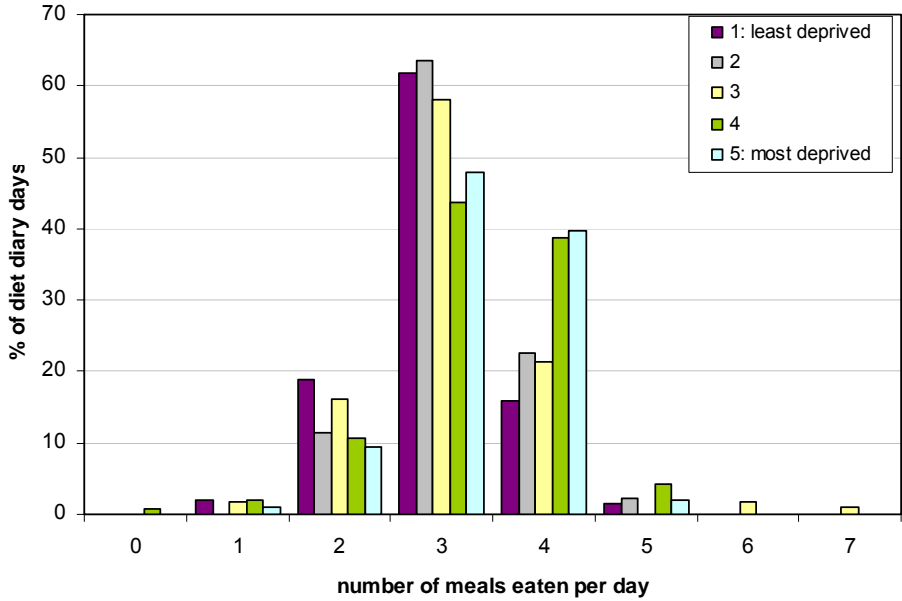
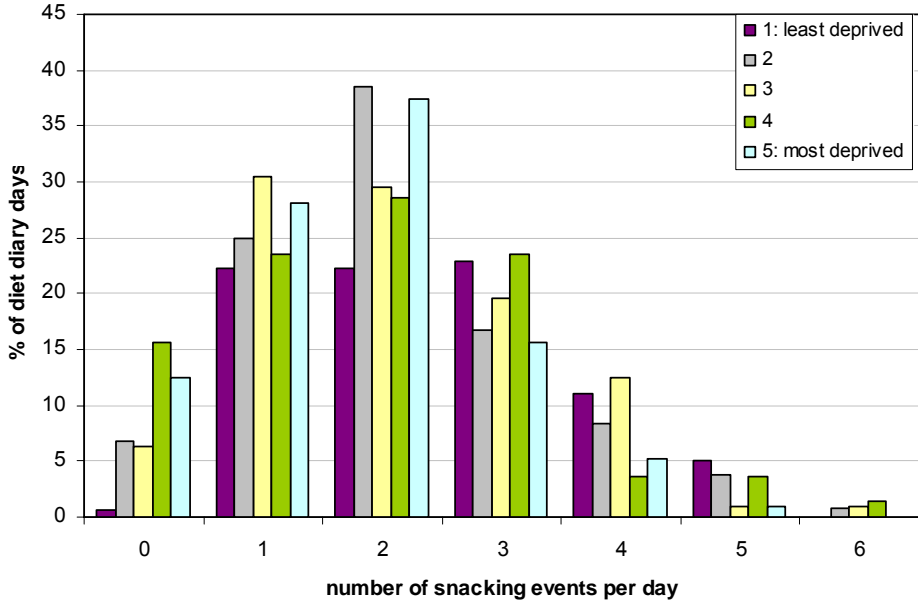


Figure 2.4 shows the total number of snacks per day by SIMD quintiles (expressed as a percentage of the total diary days, rather than per person). The snacking pattern is less pronounced than for the meals in Figure 2.4, but still illustrates that children in the least deprived areas on average tend to have more snacks in a day than children from more deprived areas.

Figure 2.4

Figure 2.4: the number of snacks per day by SIMD quintiles



### Number of items in a meal and a snack

Meals and snacks tended to consist of several food and drink items. A meal contained a median (inter-quartile range) of 4 (3-5) food items, made up of 2 (1-2) core items and 2 (1-3) non-core items. Only 3% of all meals reported in the diaries contained only one food item and no non-core items. These foods were typically pizza (19.3%), breakfast cereal bars (19.3%), bread or toast (14.0%), instant rice or noodles (12.3%) and breakfast cereals (10.5%). A snack contained a median of 2 (1-2) food or drink items.

### Nutrient composition of meals and snacks

Meals contributed more energy to the total daily intake than snacks but snacks proportionally had a significantly higher saturated fatty acids and NMES (% food energy) content (Table 2.7). The average intake of NMES (% food energy) from snacking events was more than twice as high as that of meals. Meals and snacks did not differ in their content of total fat (% food energy). A high proportion of NMES comes from food and drinks eaten as part of a snack.

Table 2.7

Table 2.7 The mean daily intake of energy and nutrients from meals and snacks				
	All	Meals	Snacks	<i>p</i>
<b>Total Energy (kJ)</b>				
Mean	6942	5440	1505	<i>&lt;0.001</i>
95% CI	6651 – 7234	5176 – 5703	1371 – 1640	
<b>Total fat (% food energy)</b>				
Mean	33.7	33.6	33.6	<i>0.934</i>
95% CI	33.0 – 34.5	32.8 – 34.5	32.2 – 35.1	
<b>Saturated fatty acids (% food energy)</b>				
Mean	14.3	13.7	16.0	<i>&lt;0.001</i>
95% CI	13.8 – 14.7	13.2 – 14.1	15.3 – 16.8	
<b>NMES (% food energy)</b>				
Mean	15.3	11.5	28.6	<i>&lt;0.001</i>
95% CI	14.3 – 16.3	10.6 – 12.4	26.3 – 30.8	
<i>Base (unweighted)</i>	<i>156</i>	<i>156</i>	<i>156</i>	

Snacks accounted for 21.4% of total daily energy intake of children and this did not vary significantly between boys and girls or age groups (Table 2.8). The contribution of snacks to the total daily intake of fat was significantly higher among girls (23.7%) than boys (19.8%) but did not differ by age group. Foods consumed within snacks accounted for 38.9% of the total daily intake of NMES and this did not differ significantly between boys and girls or age groups.

Table 2.8

**Table 2.8 The percentage contribution to daily intake of total energy and nutrients from snacks**

	All	Sex		<i>p</i>	Age		<i>P</i>
		Boys	Girls		5-11 yrs	12-17 yrs	
<b>% total energy intake from snacks</b>							
Mean	21.4	20.3	22.6	<i>0.185</i>	22.5	19.9	<i>0.148</i>
95% CI	19.7 – 23.1	17.8 – 22.7	20.1 – 25.1		20.3 – 24.8	17.2 – 22.7	
<b>% of total fat intake from snacks</b>							
Mean	21.7	19.8	23.7	<b><i>0.044</i></b>	22.8	20.2	<i>0.193</i>
95% CI	19.7 – 23.6	17.0 – 22.5	21.0 – 26.3		20.3 – 25.3	17.2 – 23.2	
<b>% of saturated fatty acid intake from snacks</b>							
Mean	24.4	22.6	26.3	<i>0.089</i>	25.6	22.8	<i>0.210</i>
95% CI	22.2 – 26.6	19.5 – 25.7	23.3 – 29.4		22.7 – 28.5	19.5 – 26.1	
<b>% of NMES intake from snacks</b>							
Mean	38.9	38.8	39.0	<i>0.951</i>	41.1	36.1	<i>0.118</i>
95% CI	35.8 – 42.1	34.3 – 43.3	34.5 – 43.5		37.0 – 45.2	31.2 – 41.0	
<i>Base (unweighted)</i>	156	81	75		88	68	

### **Foods eaten as snacks**

Ninety eight percent of children had at least one snack during the reporting period. Table 2.9 shows the foods most commonly eaten during snacks (only non-core foods eaten by more than 5% of the children are represented). Over seventy percent of children ate biscuits, cakes and pastries, and crisps and savoury snacks as part of a snack. Confectionery and fruit were also frequently eaten as snacks. Non-diet soft drinks were consumed within a snacking event by 45.8% of children.

The type of food and drinks eaten as snacks by boys and girls did not differ significantly. A higher percentage of younger children ate crisps and savoury snacks and fruit as part of a snacking event than older children. Older children were more likely to eat cheese and puddings as part of a snack than younger children.

The non-core foods were also eaten by children as part of a meal. For example, 62% of children ate biscuits, cakes and pastries, 34% ate crisps and savoury snacks and 44% ate confectionery as part of a meal.

*Table 2.9*

**Table 2.9 The percentage of children that ate one or more of the foods as part of a snack over the 4 day reporting period**

Food groups	All (% consuming)	Sex			Age		
		Boys	Girls	<i>P</i>	5-11 yrs	12-17 yrs	<i>P</i>
Biscuits, cakes & pastries	77.1	77.2	77.0	0.978	78.2	75.8	0.726
Crisps & savoury snacks	71.9	68.4	75.7	0.314	80.5	60.6	0.007
Confectionery	69.9	64.6	75.7	0.134	70.1	69.7	0.955
Fruit, excluding fruit juice	68.6	65.8	71.6	0.440	78.2	56.1	0.004
Milk & cream	53.6	49.4	58.1	0.279	56.3	50.0	0.437
Soft drinks, not diet & not lower sugar	45.8	50.6	40.5	0.210	48.3	42.4	0.472
Soft drinks, diet & lower sugar	42.5	44.3	40.5	0.638	43.7	40.9	0.731
Ice cream	28.8	32.9	24.3	0.241	32.2	24.2	0.282
Fruit juice	28.1	26.6	29.7	0.665	31.0	24.2	0.355
Yogurt & fromage frais	24.8	25.3	24.3	0.887	23.0	27.3	0.544
Sugars & preserves	13.1	11.4	14.9	0.524	14.9	10.6	0.955
Cheese	11.8	11.4	12.2	0.883	16.1	6.1	0.058
Puddings	7.8	7.6	8.1	0.906	11.5	3.0	0.054
<i>Base (consumers)</i>	153	79	74		87	66	

## Breakfast consumption

The majority of children (83.3%) ate breakfast everyday and less than 2% did not eat any breakfast on all 4 days of the recording period (Table 2.10). Older children were less likely to eat breakfast everyday than younger children but there was no significant difference in the proportion of boys and girls eating breakfast everyday. Girls in the older age group were less likely than boys to eat breakfast everyday but the difference was not statistically significant (70% vs. 76%,  $p=0.558$ ). The number of children eating breakfast everyday did not differ by SIMD group.

*Table 2.10*

Table 2.10 The percentage of children eating breakfast over the 4 days of recording the diet diary

	All (%)	Sex		Age			
		Boys	Girls	5-11 yrs	12-17 yrs		
<b>Number of days breakfast eaten</b>							
0 days	1.9	2.5	1.3	0.0	4.4		
1 day	1.3	1.2	1.3	1.1	1.5		
2 days	3.8	3.7	4.0	1.1	7.4		
3 days	9.6	8.6	10.7	6.8	13.2		
4 days	83.3	84.0	82.7	90.9	73.5		
<i>Base (unweighted)</i>	<i>156</i>	<i>81</i>	<i>75</i>	<i>88</i>	<i>68</i>		
<b>Breakfast eaten everyday (%)</b>	83.3	84.0	82.7	<i>p = 0.830</i>	90.9	73.5	<i>p = 0.004</i>

Table 2.11 shows the foods most commonly eaten for breakfast (foods eaten by less than 5% are not reported). Breakfast cereals were the most common food eaten for breakfast, with 60.8% of children eating breakfast cereals (not whole grain or high fibre / sweetened) and 54.2% eating wholegrain and high fibre breakfast cereals at least once during the 4 day reporting period. Bread (not wholemeal) was also commonly eaten at breakfast (47.7%). The majority of children (93.2%) consumed milk as part of their breakfast and 32.0% had fruit juice. A smaller proportion of children drank soft drinks for breakfast (diet and low sugar drinks: 19.6% and not diet or not lower sugar: 13.7%). Only 2.6% of children ate confectionery and 0.7% ate crisps or savoury snacks as part of their breakfast.

There were very few differences in the type of foods eaten for breakfast between boys and girls. The only difference was that boys were more likely than girls to eat meat and meat dishes for breakfast but this was not common even in the boys (17.7%). Similarly the foods eaten for breakfast did not differ significantly by age group, with the exception of milk and cream, and biscuits, cakes and pastries which were more commonly eaten by younger children.

Table 2.11

**Table 2.11 The percentage of children who ate foods from one or more of the food groups for breakfast during the 4 day reporting period**

Food group	All (% consuming)	Sex			Age		
		Boys	Girls	<i>p</i>	5-11 yrs	12-17 yrs	<i>p</i>
Milk & cream	93.2	89.9	94.6	0.278	96.6	86.2	<b>0.018</b>
Other breakfast cereals, incl. cereal bars	60.8	58.2	62.2	0.503	63.6	56.9	0.400
Wholegrain & high fibre cereals	54.2	59.5	48.7	0.178	56.8	50.8	0.458
Bread excluding wholemeal	47.7	40.5	55.4	0.065	47.7	47.7	0.997
Fats & oils (margarine/butter)	35.3	32.9	37.8	0.524	35.2	35.4	0.984
Fruit juice including smoothies	32.0	27.8	36.5	0.252	28.4	36.9	0.265
Sugar & preserves	24.2	26.6	21.6	0.474	25.0	23.1	0.784
Fruit, excluding fruit juice	19.6	16.5	23.0	0.310	21.6	16.9	0.472
Soft drinks, diet & lower sugar	19.6	20.3	18.9	0.835	20.5	18.5	0.759
Biscuits, cakes & pastries	14.4	11.4	17.6	0.277	20.5	6.2	<b>0.013</b>
Yogurt & fromage frais	13.1	13.9	12.2	0.747	14.8	10.8	0.468
Soft drinks, not diet & not lower sugar	13.7	12.7	13.5	0.692	14.8	12.3	0.661
Meats & meat dishes excluding processed meat	12.4	17.7	6.6	<b>0.040</b>	10.2	15.4	0.339
Egg and egg dishes	13.1	10.1	16.2	0.264	14.8	10.8	0.468
Processed meat including sausages, burgers, coated chicken	10.5	11.4	9.5	0.696	10.2	10.8	0.914
Cheese	7.2	6.3	8.1	0.670	3.4	12.3	<i>n/a*</i>
Wholemeal bread	6.5	7.6	5.4	<i>n/a*</i>	4.5	9.2	<i>n/a*</i>
<b>Base (consumers)</b>	<b>153</b>	<b>79</b>	<b>74</b>		<b>88</b>	<b>65</b>	

\* test not valid (expected count less than 5)

### Term-time and school holidays

The median number of meals and snacks per day on weekdays did not differ between term-time and the school holidays (Table 2.12). The proportion of children eating breakfast in term-time compared with the school holidays did not differ. The average daily energy intake and intake of total fat, saturated fatty acids and NMES (as percentage food energy) did not differ between term-time and the school holidays (Table 2.13).

Tables 2.12 and 2.13

**Table 2.12** The median number of meals and snacks per child per day during term-time and the school holidays (weekdays only)

	Term-time	School holidays	<i>p</i>
<b>Meals</b>			
median	3.0	3.3	<i>0.232</i>
IQR	3.0 – 3.7	3.0 – 3.7	
min/max	1.7/4.8	0.7/4.0	
<b>Snacks</b>			
median	2.0	2.0	<i>0.457</i>
IQR	1.5 – 3.0	1.3 – 2.8	
min/max	0.0/4.7	0.0/6.0	
<i>Base (unweighted)</i>	<i>114</i>	<i>34</i>	

**Table 2.13** The average daily intake of energy and nutrients during term-time and the school holidays (weekdays only)

	Term-time	School holidays	<i>p</i> *
<b>Total Energy (kJ)</b>			
Mean	7061	7057	<i>0.823</i>
95% CI	6747 – 7374	6108 – 8006	
<b>Total fat (% food energy)</b>			
Mean	33.4	34.4	<i>0.401</i>
95% CI	32.4 – 34.3	32.6 – 36.1	
<b>Saturated fatty acids (% food energy)</b>			
Mean	14.2	14.5	<i>0.604</i>
95% CI	13.7 – 14.8	13.6 – 15.5	
<b>NMES (% food energy)</b>			
Mean	15.7	14.3	<i>0.334</i>
95% CI	14.6 – 16.9	11.6 – 17.0	
<i>Base (unweighted)</i>	<i>114</i>	<i>34</i>	

\* adjusted for age, sex & SIMD

### Weekdays and weekend days during term-time

Children tended to eat slightly more meals per day on weekdays than weekend days during term-time (Table 2.14). There was a slightly higher number of snacks on weekdays but this did not reach statistical significance and there was no difference in the proportion of children eating breakfast on weekdays compared with the weekend. Despite the slightly higher number of meals eaten on weekdays there was no difference in the average daily energy intake or intake of total fat, saturated fatty acids and NMES (as percentage food energy) between weekdays and weekend days (Table 2.15). Three children ate no snacks on weekdays and nine ate none on weekend days.

*Tables 2.14 and 2.15*

**Table 2.14** The median number of meals and snacks per day on weekdays and weekend days during term-time

	Weekdays	Weekend days	<i>p</i>
<b>Meals</b>			
median	3.0	3.0	<b>0.015</b>
IQR	3.0 – 3.7	3.0 – 3.0	
min/max	1.7/4.3	1.0/5.0	
<b>Snacks</b>			
median	2.2	2.0	0.074
IQR	1.7 – 3.0	1.0 – 3.0	
min/max	0.0/4.7	0.0/6.0	
<i>Base (unweighted)</i>	106	106	

**Table 2.15** The average daily intake of energy and nutrients on weekdays and weekend days during term-time

	Weekdays	Weekend days	<i>p</i>
<b>Total Energy (kJ)</b>			
Mean	7014	6775	0.167
95% CI	6681 – 7346	6400 – 7150	
<b>Total fat (% food energy)</b>			
Mean	33.1	32.8	0.697
95% CI	32.2 – 34.1	31.4 – 34.3	
<b>Saturated fatty acids (% food energy)</b>			
Mean	14.2	13.6	0.182
95% CI	13.6 – 14.7	12.9 – 14.3	
<b>NMES (% food energy)</b>			
Mean	15.9	16.3	0.634
95% CI	14.7 – 17.1	14.5 – 18.1	
<i>Base (unweighted)</i>	106	106	

### Meals and snacks eaten during school hours

Children had fewer snacks during school hours than out of school hours. Typically 1.0 snack was eaten during school hours and 1.3 snacks eaten out of school hours (Table 2.16). Seventeen percent of the children ate no snacks during school hours. All the food and drinks consumed during school hours accounted for 36.2% of the total daily energy intake and 42.7% of the total daily intake of NMES (Table 2.17). Snacks consumed during school hours accounted for only 5.7% of the total daily intake of NMES.

*Tables 2.16 and 2.17*

Table 2.16 The median number of snacks per day during and out of school hours

	During school hours	Out of school hours	<i>P</i>
<b>Snacking events</b>			
median	1.0	1.3	<i>&lt;0.001</i>
IQR	0.3 – 1.0	0.7 – 2.0	
min/max	0.0 / 2.7	0.0 / 4.0	
<i>Base (unweighted)</i>	<i>114</i>	<i>114</i>	

Table 2.17 Percentage contribution to total daily nutrient intake from meals & snacks during school hours

	Meals during school hours	Snacks during school hours	Total intake during school hours
<b>% of total daily energy intake</b>			
median	29.2	7.1	36.2
IQR	23.6 – 35.4	2.6 – 11.3	30.9 – 44.0
min/max	4.7 / 61.1	0.0 / 22.9	16.4 / 67.5
<b>% of total daily fat intake</b>			
median	29.9	7.6	37.1
IQR	22.3 – 38.3	1.7 – 13.4	29.6 – 48.1
min/max	3.4 / 70.8	0.0 / 26.0	11.9 / 70.8
<b>% of total daily saturated fatty acid intake</b>			
median	28.5	8.5	37.2
IQR	19.5 – 36.0	1.5 – 12.7	27.5 – 46.4
min/max	2.2 / 83.1	0.0 / 33.2	6.1 / 83.1
<b>% of total daily NMES intake</b>			
median	30.1	5.7	42.7
IQR	21.0 – 42.5	0.0 – 18.4	29.8 – 56.5
min/max	1.0 / 78.6	0.0 / 55.0	4.0 / 84.8
<i>Base (unweighted)</i>	<i>114</i>	<i>114</i>	<i>114</i>

## Dental Decay

Neither the average number of total eating events or snacking events per day was associated with treatment for dental decay (fillings and/or extraction due to decay) (Table 2.18).

Table 2.18

Table 2.18 Average number of eating events & snacks eaten by dental treatment

	Never had treatment for decay	Received for decay	treatment <i>P</i> (unadjusted)	<i>P</i> (adjusted)*
<b>Total eating events</b>				
median	5.3	5.3	<i>0.819</i>	<i>0.245</i>
IQR	4.8 – 6.0	4.8 – 6.0		
min/max	3.5 / 7.5	3.3 / 8.0		
<b>Snacks</b>				
median	2.0	2.0	<i>0.739</i>	<i>0.196</i>
IQR	1.5 – 2.8	1.5 – 3.0		
min/max	0.0 / 5.0	0.0 / 4.3		
<i>Base (unweighted)</i>	<i>69</i>	<i>82</i>		

\* logistic regression adjusted for age, sex and SIMD

## 2.4 DISCUSSION

There is no standard method in the literature for defining meals and snacks and the criteria used in this study was considered to be the most appropriate for the objectives of the study and the type of data. The eating patterns described in this study, however, will be influenced by the food based categorisation method used to define snacks and meals and this should be taken into account when interpreting the meal and snacking patterns. Snacks are often associated with negative connotations (e.g. high fat, high sugar, high salt products, 'empty calories') and subsequently negative health consequences but again this depends on the definition used for snacks which is inconsistent between studies. A snack (an eating event consisting of only non-core food items) could include non-core foods or drinks which are perceived either as 'unhealthy' (e.g. crisps, confectionery) or 'healthy' (e.g. fruit) food or drink. A snack is not necessarily an unhealthy eating event, which was illustrated by the fact that 69% of children ate fruit as part of a snack.

The study found that the eating pattern of most children conformed to the typical UK pattern of three meals a day. Children ate an average of three meals and two snacks per day over the four day reporting period resulting in five eating episodes per day. Chaplin & Smith<sup>30</sup> also reported that children aged 4-11 years in the UK had an average of 5.1 eating episodes per day. Boys tended to eat slightly more meals than girls but they ate a similar number of snacks and number of meals and snacks eaten per day did not vary between age groups. Children from the most deprived areas tended to eat more meals but fewer snacks than children from less deprived areas. Some caution may need to be applied when interpreting the results comparing SIMD groups as the response rate in the most deprived quintile was lower (31%) than those in the other quintiles (52%) which suggests that there could be greater response bias in this group.

Snacks contributed 21% of the total daily energy intake of the children and this did not vary significantly between girls and boys or with age. Other studies have shown that snacks contribute a similar proportion of energy to the total daily energy intake in children; ranging from 21% in children aged 15-16 years<sup>31</sup> to 27% in children aged from 4-13 years<sup>10,32</sup>.

Snacks accounted for 22%, 24% and 39% of the total daily intake of total fat, saturated fatty acids and NMES, respectively, making snacks proportionally higher in saturated fatty acids and NMES than meals. On average snacks comprised two non-core food or drink items and

the food groups: biscuit, cakes and pastries, crisps and savoury snacks, confectionery and fruit were most commonly eaten by children as snacks. These foods were not eaten exclusively as snacks but often as part of a meal which typically included two core items and two non-core items. Direct comparison with other studies of the nutrient profile of snacks is difficult as their composition is dependent on the food groups included in the definition of a snack.

The nutrient composition of snacks compared with meals was proportionally higher in NMES and saturated fatty acids but did not differ for total fat. It is hard to attribute this to specific food groups because foods eaten as snacks (non-core foods) were also consumed within meals. Meals, as might be expected from their definition as having one or more core foods, were more nutritionally balanced and closer to the Scottish Dietary Targets for saturated fatty acids and NMES intake than snacks.

It is often stated anecdotally that many children do not eat breakfast or eat a nutritionally poor breakfast. This assumption was not supported by this study. Over 83% of children ate breakfast everyday with less than 2% not eating breakfast at all during the reporting period. The percentage of children eating breakfast everyday did not differ between SIMD groups. Older children were less likely to eat breakfast everyday than younger children but even in this group over 70% ate breakfast everyday with less than 5% never eating breakfast. Foods most commonly eaten at breakfast were breakfast cereals, bread, milk and fruit juice and less than 3% of children ate foods such as confectionery and crisps for breakfast. This again conflicts with many of the anecdotal statements about the types of foods children are consuming before school for breakfast. Approximately a fifth of the children had fruit as part of their breakfast.

The results of this study, however, are consistent with other reports in the literature which show that only a relatively small proportion of children don't eat breakfast. A number of large studies in the UK have reported that less than 10% of children regularly skipped or hardly ever eat breakfast<sup>33-36</sup>. Breakfast consumption tends to decrease with age, particularly among adolescent girls who are more likely to skip breakfast<sup>6,37</sup> and regular consumption tends to be lower among adults than children<sup>5, 38,39</sup>.

The criteria used to define breakfast clearly influences the proportion reported as eating breakfast. In our study a strict criterion was used (i.e. a solid food item had to be consumed within a specified time period and a drink alone would not qualify as breakfast) but still 83% were classified as eating breakfast everyday. Despite difficulties in comparing data due to

the variety of definitions used for breakfast between studies the results appear to be relatively consistent suggesting that only a small proportion of children do not eat breakfast regularly.

Eating patterns among this group of children were found to be relatively stable. The number of meals and snacks eaten and the daily intake of energy and intake of total fat, saturated fatty acids and NMES (as percentage food energy) did not vary on days during term-time or during the school holidays. Children tended to eat slightly more meals during the week than at weekends but despite this very small difference the daily energy intake and intakes of total fat, saturated fatty acids and NMES (as percentage food energy) did not differ between weekdays and weekend days.

Children ate fewer snacks in school hours than out of school hours and snacks eaten in school only accounted for 5.7% of the total daily intake of NMES. The total intake of NMES during school accounted for 43% of the daily intake, which was disproportionately higher to the total energy intake consumed during school hours (36%). It was not possible from the data to identify the type of meals being consumed during school hours, for example school lunch, packed lunch or food eaten outside of school and therefore the type of meal could explain the higher intake of NMES consumed during school hours.

There are some limitations to this study. A major issue with all dietary assessment studies is the possibility of misreporting dietary intake and this can not be overlooked in this study. Sixty three percent of those invited to complete a diary provided complete data. The sample size of the study considering the type of dietary assessment method used is relatively large but subgroup analysis (particularly by SIMD quintiles) did leave individual groups quite small.

As highlighted in the literature review there are many different ways to classify snacks and meals. For the data available in this study we considered that the food based classification for categorising eating events into meals and snacks was most appropriate. There are, however, limitations to this methodology not least that there is no standard categorisation of food and drinks. This can vary depending on the main purpose of the study and consideration of traditional eating patterns in different countries. For example, snacks may be categorised as to 'unhealthy' foods (e.g. high fat, high sugar, high salt), foods viewed as surplus to dietary needs or on their convenience of foods (e.g. foods that are portable).

## **2.5 CONCLUSION**

The eating patterns of this sample of children in Scotland were consistent with traditional meal patterns in the UK of three meals per day, with additional snacks and this did not alter between term-time and the school holidays. The majority of children ate breakfast regularly with only a very small percentage never eating breakfast. Snacks accounted for a high proportion of the total daily NMES intake in the diet of children relative to the contribution of total energy, fat and saturated fatty acids.

## 2.6 REFERENCES FOR SECTION 2

1. Chamontin A, Pretzer G, Booth DA (2003). Ambiguity of 'snack' in British usage. *Appetite*. 41: 21-29.
2. Gregori D & Maffeis MD (2007). Snacking and obesity: urgency of a definition to explore such a relationship. *J Am Diet Assoc*.107(4): 562
3. McBride A, Wise A, McNeill G, James WPT (1990). The pattern of food consumption related to energy intake. *J Hum Nutr Dietet*. 3: 27-32
4. Ziegler PJ, Jonnalagadda SS, Nelson JA, Lawrence C, Baciak B (2002). Contribution of meals and snacks to nutrient intake of male and female elite figure skaters during peak competitive season. *J Am Col Nutr*. 21(2):114-119.
5. Haines PS, Guilkey DK, Popkin BM (1996). Trends in breakfast consumption in US adults between 1965 and 1991. *J Am Diet Assoc*. 96: 464-70.
6. Siega-Riz AM, Popkin BM, Carson T (1998). Trends in breakfast consumption for children in the United States from 1965 to 1991. *Am J Clin Nutr*. 67: 748S-56S.
7. Affenito SG, Thomson DR, Barton BA, Franko DL, Daniels SR, Obarzanek E, Schreiber GB, Striegel-Moore RH (2005). Breakfast consumption by African American and white adolescent girls correlates positively with calcium and fibre intake and negatively with body mass index. *J Am Diet Assoc*. 105: 938-945.
8. Albertson AM, Franko DL, Thompson D, Eldridge AL, Holschuh N, Affenito SG, Bauserman R, Striegel-Moore RH (2007). Longitudinal patterns on breakfast eating in black and white adolescent girls. *Obesity*. 15: 2282-2292.
9. Barton BA, Eldridge AL, Thompson D, Affenito SG, Striegel-Moore RH, Franko DL, Albertson AM, Crockett SJ (2005). The relationship of breakfast and cereal consumption to the nutrient intake and body mass index: The National Heart, Lung, and Blood Institute Growth and Health Study. *J Am Diet Assoc*. 105: 1383-1389.
10. Ruxton CHS, O'Sullivan KR, Kirk TR, Belton NR (1996). The contribution of breakfast to the diets of a sample of 136 primary-schoolchildren in Edinburgh. *Br J Nutr*. 75: 419-431.
11. Jimenez-Cruz A, Bacardi-Gascon M, Jones EG (2002). Consumption of fruits, vegetables, soft drinks, and high-fat containing snacks among Mexican children on the Mexico-U.S border. *Arch Med Res*. 33:74-80.
12. Phillips SM, Bandini LG, Naumova EN, Cyr H, Colclough S, Dietz WH, Must A (2004). Energy-dense snack food intake in adolescence: longitudinal relationship to weight and fatness. *Obes Res*. 12(3): 461-472.
13. Ziegler P, Briefel R, Ponza M, Novak T, Hendricks K (2006). Nutrient intakes and food patterns of toddlers lunches and snacks: influence of location. *J Am Diet Assoc*. 106:S124-S134.
14. Ziegler P, Hanson C, Ponza M, Novak T, Hendricks K (2006). Feeding infants and toddlers study: meal and snack intakes of Hispanic and non-Hispanic infants and toddlers. *J Am Diet Assoc*. 106:S107-S123.

15. Skinner JD, Ziegler JD, Pacs S, Devaney B (2004). Meal and snack patterns of infants and toddlers. *J Am Diet Assoc.* 104:S65-S70
16. Bellisle F, Dalix AM, Mennen L, Galan P, Hercberg S, de Castro JM, Gausseres N (2003). Contribution of snacks and meals in the diet of French adults: a diet-diary study. *Physiol Behav.* 79:183-189.
17. Hampl JS, Heaton CLB, Taylor CA (2003). Snacking patterns influence energy and nutrient intakes but not body mass index. *J Hum Nutr Dietet.* 16:3-11.
18. Jahns L, Siega-Riz AM, Popkin BM (2001). The increasing prevalence of snacking among US children from 1977 to 1996. *J Pediatr.* 138:493-8.
19. Gatenby SJ (1997). Eating frequency: methodological and dietary aspects. *Br J Nutr.* 77: S7-S20.
20. Gatenby SJ, Anderson AO, Walker AD, Southon S, Mela DJ (1995). 'Meals' and 'snacks': implications for eating patterns in adults. *Appetite.* 24: 292.
21. De Assis MAA, Nahas MV, Bellisle F, Kupek E (2003). Meals, snacks and food choices in Brazilian shift workers with high energy expenditure. *J Hum Nutr Dietet.* 16:283-289.
22. Lennernas M & Anderson I (1999). Food-based classification of eating episodes (FBCE). *Appetite.* 32:53-65.
23. Kelly B, King L, Bauman A, Smith BJ, Flood V (2007). The effects of different regulation systems on television advertising to children. *Aust NZ J Public Health.* 31: 340-3.
24. Bell AC, Kremer PJ, Magarey AM, Swinburn BA (2005). Contribution of 'noncore' foods and beverages to the energy intake and weight status of Australian children. *Eur J Clin Nutr.* 59(5): 639-45.
25. Rotenberg R (1981). The impact of industrialisation on meals patterns in Vienna, Austria. *Ecol Food Nutr.* 11: 25-35.
26. Bernstein IL, Zimmerman JC, Czeisler CA, Weitzman ED (1981). Meal patterns in 'free-running' humans. *Physiol Behav.* 27: 621-623.
27. de Castro JM (1993). Genetic influences on daily intake and meal patterns in humans. *Physiol Behav.* 53: 777-782.
28. Skinner JD, Salvetti NN, Ezell JM, Penfield MP, Costello CA (1985). Appalachian adolescents' eating patterns and nutrient intakes. *J Am Diet Assoc.* 85:1093-1099.
29. Adams J, O'Keeffe M, Adamson A (2005). Change in snacking habits and obesity over 20 years in children aged 11 to 12 years. FSA report.
30. Chaplin K & Smith A (2006) Definitions and perceptions of snacking. *Appetite.* 47: 257
31. Sjoberg A, Hallberg L, Høglund D, Hulthen L (2003). Meal pattern, food choice, nutrient intake and lifestyle factors in The Goteborg Adolescence Study. *Eur J Clin Nutr.* 57: 1569-1578
32. Summerbell CD, Moody RC, Shanks J, Stock MJ, Geissler C (1995). Sources of energy from meals versus snacks in 220 people in four age groups. *Eur J Clin Nutr.* 49(1): 33-41

33. Tapper K, Murphy S, Lynch R, Clark R, Moore GF, Moore L (2008). Development of a scale to measure 9-11 year olds' attitudes towards breakfast. *Eur J Clin Nutr.* 62: 511-518.
34. Nelson M, Lowes K, Hwang V, Nutrition Group, School meals review panel (2007). The contribution of school meals to food consumption and nutrient intakes of young people aged 4-18 years in England. *Public Health Nutr.* 10(7): 652- 662
35. Ruxton CHS & Kirk TR (1997) Breakfast: a review of associations with measures of dietary intake, physiology and biochemistry. *Br J Nutr.* 78: 199-213.
36. Shemilt I, Harvey I, Shepstone L, Swift L, Reading R, Mugford M, Belderson P, Norris N, Thoburn J, Robinson J (2004). A national evaluation of school breakfast clubs: evidence from a cluster randomised controlled trial and an observational analysis. *Child care Hlth Dev.* 30(5): 413-427
37. Savige G, MacFarlane A, Ball K, Worsley A, Crawford D (2007). Snacking behaviours of adolescents and their association with skipping meals. *IJBNPA.* 4:36.
38. Cho S, Dietrich M, Brown CJP, Clark CA, Black GB (2003). The effect of breakfast type on total daily energy intake and body mass index: results from the third National Health and Nutrition Examination Survey (NHANES III). *J Am Coll Nutr.* 22 (4): 296-302.
39. Morgan KJ, Zabik ME, Stampely GL (1986). The role of breakfast in the diet adequacy of the U.S. adult population. *J Am Coll Nutr.* 5(6) : 551-63

## 2.7 APPENDICES FOR SECTION 2

**Appendix 2.1 : Examples of the type of foods included in each of the food groups**

<b>Core Foods</b>	<b>Examples of the foods in each group</b>
Pasta, rice, pizza & other cereals	Other cereals include bran, oats and Yorkshire pudding
Bread, excluding wholemeal	White bread, granary bread, garlic bread, English muffins, bagels and naan
Wholemeal bread	Wholemeal breads
Wholegrain & high fibre cereals	All bran, muesli, shredded wheat, porridge etc.
Other breakfast cereals	Non high fibre / whole grain and sweetened e.g. Cornflakes, coco pops, sugar puffs, plus pop tarts and cereal bars
Eggs & egg dishes	Quiche, eggy bread, meringue and pavlova
Meats & meat dishes, excluding processed meat	Bacon, ham, minced beef, liver and casseroles
Processed meat, including sausages, burgers, coated chicken	Chicken nuggets, burgers, sausages, meat pies, black pudding, haggis and salami
Fish & fish dishes, excluding oily fish	Cod, haddock, plaice, shellfish, prawns, canned tuna, fish fingers/ fish cakes / fish pie
Oily fish & dishes	Herring, kippers, mackerel, salmon, fresh tuna and sardines
Vegetables excluding potatoes & baked beans	All types of raw, cooked and frozen vegetables, beans, lentils, tofu, soya, quorn, nut burgers / roasts
Baked beans	Baked beans
Chips, fried & roast potatoes, potato products	Fried waffles, croquettes, fritters and hash browns
Other potatoes, potato salads & dishes	Potatoes boiled, mashed or baked. Potato salad. Grilled or baked waffles, croquettes, fritters and hash browns
<b>Non-Core Foods</b>	
Biscuits, cakes & pastries	Biscuits (sweet & savoury), cakes, bread sticks, fruit pies, Danish pastries, scones, doughnuts, fruit cake and croissants
Puddings	Milk pudding, jelly, mousse, trifle, pancakes, sponge, cheesecake.
Milk & cream	Includes flavoured milks, soya and milk alternatives
Cheese	All types including reduced fat and flavoured cheese
Yogurts & fromage frais	Including yogurt drinks, frozen yogurt and yogurt mousse
Ice cream	Including non-dairy and ice-cream containing lollies
Confectionery	Chocolate, pastilles, chewy sweets, boiled sweets etc.
Crisps & savoury snacks	Potato and cereal based snacks, savoury popcorn, twiglets etc.
Nuts & seeds	Including dried fruit & nut mixes
Sugar & preserves	Fruit spreads, honey, marzipan etc.
Fruit, excluding fruit juice	All types of raw, baked, stewed, dried or canned fruit
Fruit juice	Including smoothies
Soft drinks, not diet and not lower sugar	Squash, cordials and carbonated drinks (high juice, regular)
Soft drinks, diet and lower sugar	Diet and reduced sugar, sugar free carbonated and non-carbonated
Tea, coffee & water	Tea, coffee & water
Fats & oils	Margarine, butter
Soups & sauces	Soups homemade, dried or cartons, pasta sauces, condiments e.g. tomato / brown sause, mayonnaise and pickles

Appendix 2.2: An example of the coding method used to classify eating events into meals and snacks

600

DATE 4/8/06 DAY OF WEEK FRIDAY		Core Food	Non-Core Food	Amount	Amount Left Over	OFFICE USE ONLY
Meal	11am	PK N MIX NESTLE CEREAL (COOKIE CRISP)	ASDA NO ADDED SUGAR PIL ORANGES	1 PK (30g)		milk 40g 3910 131g 30g
				GLASS B		5000 2351 160g 40g
Snack	12:30pm	ASDA NAS DILUTE ORANGE		GLASS B		5000 2351 160g 40g
Meal	1:15pm	OMLETTE - EGGS WITH MILK - SEMISKIMMED, CHEESE, HAM, HERBS		2		omlette 771 140g Ham 450g 23g
Snack	3pm	ASDA NAS DILUTE ORANGE		GLASS B		5000 2351 160g 40g
Meal	5pm	SPAGHETTI BOLOGNESE - MINCE, ONION, RED & GREEN PEPPERS, JAR ASDA SAUCE	SPAGHETTI	PICT 10 X 2		5814 186g
			GLASS WATER WITH ICE	PICT 2 X 2		34 110g
				GLASS B		5000 200g
Meal	8:30pm	2 SLICES KINGSMILL WHITE BREAD	CHOC SPREAD			120 72g
						2211 34g

10

11

# **Section 3. School meals in Scotland: Secondary analysis of the 24-hour recall data from the Survey of Sugar Intake among Children in Scotland**

Bridget Holmes and Michael Nelson

The authors would like to acknowledge Lesley Wells for her advice during the preparation of the data files.

## **3.1 INTRODUCTION**

### **3.1.1 School meals in Scotland**

A recent report published by the Scottish Executive in 2007 provided up-to-date information on the uptake of school meals in Scotland. The report specified that of the pupils present on the survey day, 46% took a meal supplied by the school (either free or purchased). 16% of pupils were registered for free school meals, 17.1% were identified by local authorities as being entitled to free school meals. Of those identified as entitled to the uptake of free school meals, 67.5% took a free school meal on the survey day, equating to 11.5% of all pupils.<sup>1</sup>

The diet of schoolchildren in Scotland has been the focus of several policy initiatives, notably the Scottish Executive's *Hungry for Success: A Whole School Approach to School Meals*,<sup>2</sup> launched in 2003, which aimed to improve the nutritional content and uptake of school meals by the 'establishment of monitored, nutrient-based standards known as the Scottish Nutrient Standards for School Lunches'.<sup>2</sup> These nutrient standards provided figures for the recommended energy and nutrient content of an average school lunch provided for children in school over a period of one week.

From August 2008, the Schools (Health Promotion and Nutrition) (Scotland) Act 2007 will place a legal duty on education authorities in Scotland to ensure that the food and drinks provided in schools meet updated nutritional requirements.<sup>3</sup> The nutritional requirements go beyond the current policy of '*Hungry for Success: A Whole School*

*Approach to School Meals in Scotland*<sup>2</sup> and include foods and drinks provided in other school food outlets. These new Regulations will not apply to food or drink brought onto the school premises by parents or pupils e.g. packed lunches or food bought by a pupil from a shop. However, the Scottish Government has produced guidance for parents on preparing a healthy packed lunch for children, in order to support the ethos of the health promoting schools.<sup>4</sup>

The National Diet and Nutrition Survey (NDNS) of children aged 4-18 years<sup>5</sup> (which covers England, Wales, Scotland and Northern Ireland) showed that in 1997, between one-quarter and one-third of the daily intake of energy, fat, non-starch polysaccharide (NSP), iron, calcium, vitamin C and folate came from the meal the child obtained at school. Typically contributions were greater in those receiving free school meals and those not eating breakfast<sup>5</sup> highlighting the importance that school meals have in a balanced diet. Improving children's diet can make a major impact on the health of children, including health later in life. School meals have an important role to play in both supporting the nutrient intakes of vulnerable children at risk of under-nutrition, and to promote healthier eating to all children.<sup>5</sup>

With recent negative publicity surrounding school meals after a popular British television series, parents may opt to provide packed lunches for their children rather than school meals as a healthier alternative. However, there has been little evaluation to date comparing the food and nutrient content of packed lunches with school meals, especially in Scotland, and no published research to date has investigated lunchtime food consumed off the school premises.

Towards the latter part of 2007, FSAS commissioned some secondary analysis to be undertaken on the data from the Survey of Sugar Intake among Children in Scotland in order to investigate several topics that had not been covered by the main report. This included investigating the different types of school meals and their contribution to food and nutrient intake of Scottish children. This report forms one of three undertaken as part of this secondary analysis.

### **3.1.2 The 24-hour recall**

The 24-hour recall method used in the main study was the 'multiple pass' method, as used in the Low Income Diet and Nutrition Survey (LIDNS).<sup>6</sup> Information was

collected in three phases in a single interview, allowing the respondent three opportunities to recall what they ate and drank over the previous 24 hour period.

In the first instance participants were asked to provide a 'quick list' (first pass) of all the items they had eaten or drunk on the previous day, from midnight to midnight. Second, the interviewer went through the 'quick list' gathering further details to identify fully each item and to quantify the amount consumed. Portion weights were determined from food photographs<sup>7</sup>, household measures or weights from labels or packets. The 'third pass' involved the interviewer going through the list of food and drink recalled and probing for additional items consumed.

After the third pass, the respondent was asked to select place names from a show card for each item or eating/drinking occasion (as appropriate). This was to enable the interviewer to 'source' code items. The source codes identified where the item was consumed, for example at home, school, work or elsewhere and where the food came from, for example home, work, takeaway outlet, or other retail outlet. Table 3.1 shows the place names and codes. Further details are given in the main report.

*Table 3.1*

**Table 3.1. Place names and codes used in the 24-hour recall interview**

Place	
<b>A</b>	Home, own food supply
<b>B</b>	Home, take-away brought in
<b>C</b>	Home, other food brought in, free
<b>D</b>	Friend's or Relative's house
<b>E</b>	Restaurant or Cafe
<b>F</b>	School (bought food or drink)
<b>G</b>	School (food or drink from home)
<b>H</b>	School (free/other)
<b>I</b>	Work (bought food or drink)
<b>J</b>	Work (food or drink from home)
<b>K</b>	Work (free/other)
<b>L</b>	Pub, bar, lounge, hotel, club
<b>M</b>	Take-away eaten away from home
<b>N</b>	Other place (bought food or drink)
<b>O</b>	Other place (food or drink from home)
<b>P</b>	Other place (free/other)

The present report investigates the different types of lunch consumed by children living in Scotland. Children were grouped according to the Place name and code. The three groups available for comparison are:

- 1) Children consuming bought or free school meals (described as 'school lunch');
- 2) Children consuming packed lunches at school, food or drink from home (described as 'packed lunch');
- 3) Children consuming food in all other places, e.g. home, friends, café, take-away (described as 'lunch out of school').

The report makes a number of comparisons across three lunch groups, in two age groups (5-11 and 12-17 years). 5-11 year olds were classified as primary school age and 12-17 year olds as secondary school age. The comparisons include:

- Intake of nutrients during lunchtime and across the full day
- Proportions of food and nutrients consumed during lunchtime
- Nutrient intakes as a percentage of the Dietary Reference Value (DRV)<sup>8</sup> across the full day
- Percent of energy from nutrients during lunchtime and across the full day
- A comparison of the lunches according to the new Scottish Nutrient Standards for School Lunches<sup>3</sup>.

The main aim of the report was to describe the foods consumed and the nutrient intake on school days, for the children taking school lunches and the children taking packed lunches. A secondary aim was to make comparisons with a third group, consisting of children taking lunch at another location or from another source (the 'lunch out of school' group). In addition, the nutrient intakes by lunch group were compared with the new Scottish Nutrient Standards for School Lunches.<sup>3</sup>

## **3.2 METHODS**

The main report to the Survey of Sugar Intake among Children in Scotland details the derivation of food consumption and nutrient intake data from the 24-hour recalls. The methods specific to the secondary analysis are provided here.

### **3.2.1 Data cleaning and preparation**

Several stages and assumptions were involved in the preparation of the data file for analysis and these are described below. Note the difference in the description of food items from the *food level file* (each food item has a separate line in the file) and respondents from the *respondent level file* (each respondent has a separate line in

the file) since a series of aggregations were undertaken during the preparation and these have not been described. The numbers of respondents included and excluded at each stage are shown in Figure 1.

#### Stage 1: Data cleaning of place name and times

Paper 24-hour recall records were used to check any missing place names and times in the food level file. Of the 7995 food items in the file, 148 had a missing place name and 25 had a missing time. On further inspection, the number of missing place names was reduced to 138 and the number of missing times was reduced to 19.

#### Stage 2: Grouping of food and drinks according to the place name

All items of food and drink were grouped according to their place name. Three groups were created:

1. School food (bought or free/other). This group consisted of foods with place codes F and H.
2. School food (food or drink from home i.e. 'packed lunch'). This group consisted of foods with place code G.
3. Home, friends, relatives or other. This group consisted of the remaining place codes, A,B,C,D,E,I,J,K,L,M,N,O,P.

Although several methods and groupings were investigated, when split by age, numbers did not permit this level of grouping and three groups were created to address the main aim of the analysis. A further fourth group was created consisting of items with missing place codes, to be used in Stage 6.

#### Stage 3: Day of the week

1792 food items were consumed on a Sunday and 192 on a Saturday. Respondents with food items consumed on a Saturday or Sunday were removed from the data file resulting in 6011 food items remaining.

#### Stage 4: Term time vs. non term time

Researchers at the University of Aberdeen contacted all of the local education authorities across Scotland to obtain school term dates during the fieldwork period of the study. Dates of the 24-hour recalls were then classified as either term or non-term. Of the 6011 food items in the file, 1749 items were consumed during non term time i.e. during school holidays or in-service days, resulting in a remaining 4262 food

items consumed during term time. For 191 food items (15 respondents) there appeared to be some level of disagreement of the place name with codes F, G and H (school codes) being used during non-term time (Table 3.2). Possible reasons for this are provided in the discussion.

*Table 3.2*

**Table 3.2. Misclassification of term and non-term time food items, by place of food or drink consumption**

Place food or drink consumed		Term time	Non-term time	Total
A	Home, own food supply	2552	1096	3648
B	Home, take-away brought in	49	17	66
C	Home, other food brought in, free	2	10	12
D	Friend's or Relative's house	153	150	303
E	Restaurant or Cafe	58	53	111
F	School (bought food or drink)	276	26	302
G	School (food or drink from home)	548	14	562
H	School (free/other)	236	151	387
I	Work (bought food or drink)	8	0	8
J	Work (food or drink from home)	9	6	15
K	Work (free/other)	0	1	1
L	Pub, bar, lounge, hotel, club	7	19	26
M	Take-away eaten away from home	51	37	88
N	Other place (bought food or drink)	127	53	180
O	Other place (food or drink from home)	35	35	70
P	Other place (free/other)	88	7	95
Q	Missing	63	74	137
Total food items		4262	1749	6011

Potentially misclassified items

Inspection of the corresponding serial numbers (unique respondent identifiers) revealed the numbers of respondents with possible incorrect place code classification to be:

- Code F - 3 respondents
- Code G - 1 respondent
- Code H - 11 respondents

Respondents with H incorrectly coded were mainly from one area and therefore the bulk of the misclassification may have been made by a single interviewer. The researchers feel that 'H' was possibly used incorrectly to mean 'Home'. The respondents with potentially misclassified codes were removed from the data file.

Stage 5: Create lunchtime variable

Lunchtime was defined as ranging from 11.30am-2pm. A 'lunchtime' variable was created to identify respondents consuming food or drink during this time. Of the 4262

items of food in the data file, 3124 were consumed outside of the lunchtime period with 1138 food items consumed during 'lunchtime'.

#### Stage 6: Identify contribution of lunchtime food to energy intake by place code

In some instances food items consumed during the lunchtime period had more than one place code since the place code not only identifies 'place' of consumption but also the 'source'. For example, a child may consume items from place codes F (school (bought food or drink)) and G (school (food or drink from home)).

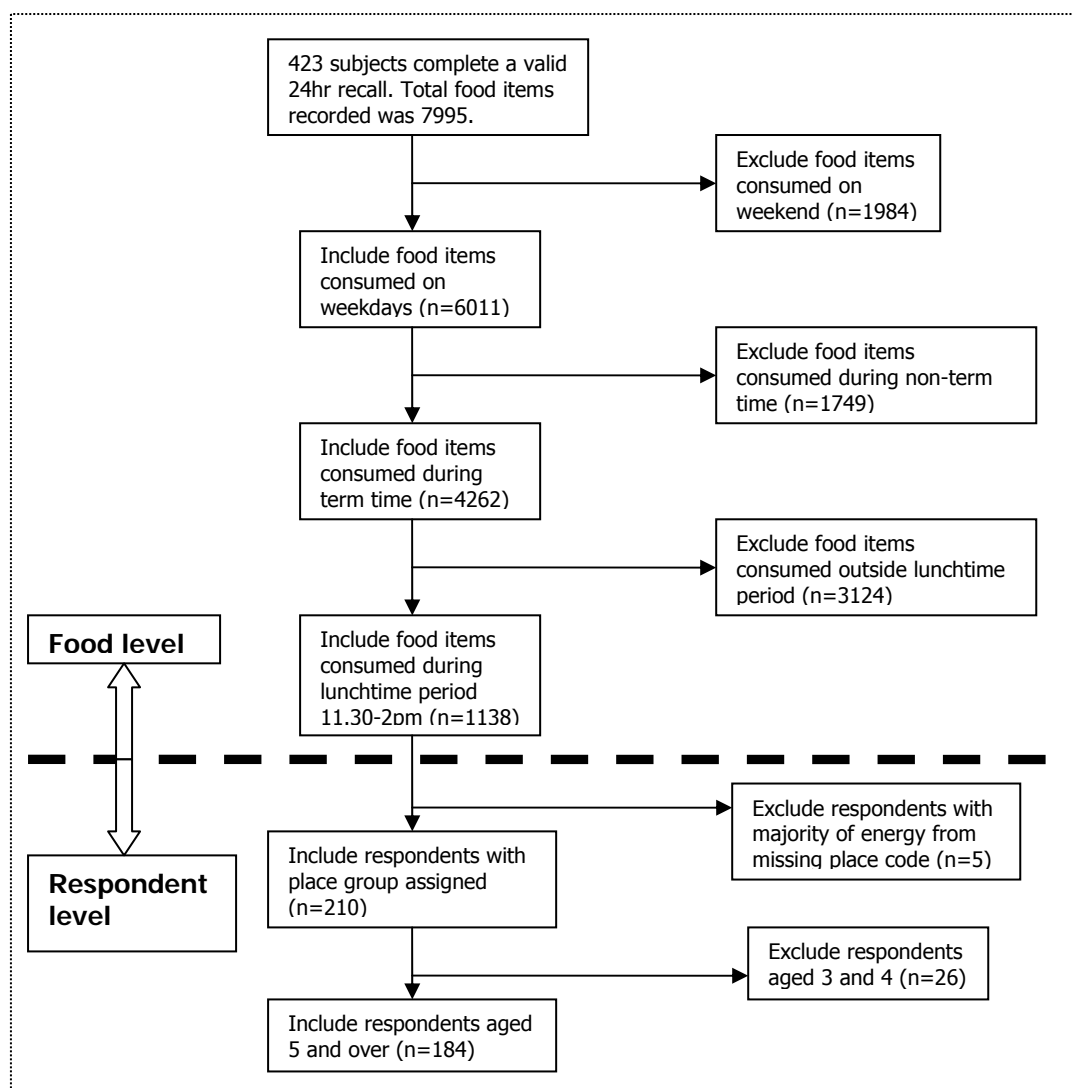
The decision on which group respondents should be classified into was based on which place code contributed the greatest proportion to energy intake during the lunchtime period. For 5 cases the majority of energy intake came from data with a missing place code (as identified from stage 2); these respondents were therefore excluded leaving 210 respondents remaining in the data file.

#### Stage 7: Children aged 3 and 4 years

26 children aged under 5 years were removed from the data file on the basis of school starting age in Scotland. The final number of respondents available for the analysis was 184; 105 of these were aged 5-11 years and 79 were aged 12-17 years.

*Figure 3.1*

Figure 3.1. Number of food items and/or respondents at each stage of the data preparation



### 3.2.2 Data presentation and statistical analysis

Data were analysed using SPSS version 15.0 (SPSS Inc, Chicago, Ill) and analyses presented in the report have been weighted. The weighting took account of the selection and response bias in the 24-h recall sample (not the overall survey). In terms of response, of the sub-sample of 429 respondents asked to complete a 24-hour recall, 424 (99%) did so and complete data were available for 423. Participants completing the 24-h recall were more representative of the whole population before weighting compared to the other dietary methods completed in the main survey (See Section 3.1 in the main survey report).

Comparisons have been made separately for children aged 5-11 and 12-17 but with sexes combined. Comparisons between the lunch groups were made using complex models, general linear models (ANOVA) unless otherwise stated. All food group analysis is based on all consumers i.e. consumers and non-consumers. In some tables the percentage of consumers has been provided for reference.

Data for food and nutrients are presented untransformed following the system used in the LIDNS survey. The authors recognize that this system is less suitable where the number of consumers of a food is low and bases are small and for this reason it is recommended that readers do not place too much emphasis on the levels of significance, but use them to give an indication of where the main differences between the lunch types lie. Absolute nutrient tables and tables presenting intakes as a percentage of the Dietary Reference Values (DRV) show both the mean and median distribution and indicate any nutrients not normally distributed. Skewness was defined as a skewness statistic greater than 2.

Caution should be exercised when interpreting the results for primary school children consuming lunch out of school and secondary school children consuming packed lunches due to particularly small numbers in these groups.

## **3.3 Results**

### **3.3.1 Characteristics of the sample**

Table 3.3 shows the percentage of boys and girls consuming different types of lunch by age. A chi-squared analysis revealed no significant differences in the proportion of boys and girls across the lunch groups although it appeared that a lower proportion of boys consumed bought or free school lunches and more lunches out of school compared with girls. For both primary and secondary school children the most common place and source of food within the 'lunch out of school' group was 'home, own food supply'. For secondary school children, however, 'take-away eaten away from home' and 'other place (bought food or drink)' were also common sources of lunch food.

*Table 3.3*

**Table 3.3. Percentage of children consuming different types of lunches during weekday term time, by sex and age**

		School lunch	Packed lunch	Lunch out of school	Base (weighted)	Base (unweighted)	p value
<b>5-11 years</b>							
Male	%	38	43	19	53	58	0.814
Female	%	34	49	17	43	47	
<b>12-17 years</b>							
Male	%	26	20	54	43	40	0.269
Female	%	43	16	42	43	39	
<b>All children</b>							
Male	%	33	32	35	96	98	0.586
Female	%	38	32	29	85	86	

Table 3.4 shows the percentage of children consuming the different types of lunch by the Scottish Index of Multiple Deprivation<sup>9</sup> (SIMD). Data in the main survey was analysed by SIMD which identifies small area concentrations of multiple deprivation across all of Scotland. For the main report, the index has been separated into quintiles and each case has been assigned a quintile based on the residential postcode. Quintiles are percentiles which divide a distribution into fifths. For example, those respondents whose postcode falls into the first quintile are said to live in one of the 20% least deprived areas in Scotland and those in the fifth quintile are said to live in one of the 20% most deprived areas in Scotland. Although there were no significant differences in the proportion of children consuming different types of lunch by SIMD in a chi-squared analysis, some patterns were observed. More primary and secondary school children consuming school lunches were in the more deprived quintiles.

*Table 3.4*

**Table 3.4. Percentage of children consuming different types of lunches during weekday term time, by Scottish Index of Multiple Deprivation**

	Scottish Index of Multiple Deprivation quintile					p value
	1st (least deprived)	2nd	3rd	4th	5th (most deprived)	
<b>5-11 years</b>						
School lunch	% 32	26	38	44	40	0.659
Packed lunch	% 68	58	41	40	36	
Lunch out of school	% -	16	21	16	24	
<b>12-17 years</b>						
School lunch	% 36	41	21	29	39	0.580
Packed lunch	% 28	-	8	19	22	
Lunch out of school	% 36	59	72	52	38	
<b>All children</b>						
School lunch	% 34	31	31	35	40	0.885
Packed lunch	% 44	37	28	29	29	
Lunch out of school	% 22	31	41	36	31	

Base (weighted)					
5-11 years	10	20	19	14	33
12-17 years	16	11	13	17	28
All children	16	11	13	17	28
Base (unweighted)					
5-11 years	12	23	19	16	35
12-17 years	14	10	12	15	28
All children	14	10	12	15	28

- No observations

### 3.3.2 Food consumed

Tables 3.5 and 3.6 show the mean quantities of all food consumed (in grams) on the day of the 24-hour recall, by type of lunch for children (sexes combined) aged 5-11 and 12-17, respectively. Both tables show the mean quantities of food consumed during the lunchtime period and across the full day.

Data presented in the report are based on food only data i.e. not including supplements. 24% of primary school children and 6% of secondary school children reported to have taken one or more dietary supplements on the day of the 24-hour recall. There was no significant difference in supplement intake by the groups consuming different types of lunches. For primary school children the percentage reporting to take one or more supplements was 16% in the school lunch group, 30% in the packed lunch group and 25% in the group having lunch out of school. The equivalent percentages for secondary school children were 4%, 7% and 7%.

#### Quantities of food consumed at lunchtime for primary school children

Results for primary school children presented in Table 3.5 indicate a number of differences in the quantities of food consumed by type of lunch, particularly over the lunchtime period. Differences seen during the lunchtime period were not necessarily reflected in the day's intake.

Children who consumed school lunches consumed greater amounts of milk and cream, eggs and egg dishes, vegetables, chips, fried and roast potatoes, other potatoes, and fruit juice compared with the other children. The largest differences were seen when comparing those consuming a school lunch with those consuming a packed lunch for milk and cream (69g vs. 13g) and chips, fried and roast potatoes (14g vs. 0g), and when comparing with those consuming lunch out of school for vegetables (18g vs. 3g) and fruit juice (104 vs. 4g).

Children who had a packed lunch consumed greater amounts of wholemeal bread, yoghurt, fromage frais and dairy desserts, meat and meat dishes and fruit compared with other children. The largest differences across the three groups were seen when comparing those consuming a packed lunch with those consuming a school lunch for fats and oils (6g vs. 1g), fruit (73g vs. 21g) and diet and lower sugar soft drinks (including flavoured water) (68g vs. 12g), and when comparing with those consuming lunch out of school for wholemeal bread (8g vs. 0g) and meat and meat dishes (19g vs. 3g).

Children who consumed lunch out of school consumed greater amounts of white and other bread, crisps and savoury snacks and non diet soft drinks compared with other children although numbers in this group were small.

#### Quantities of food consumed over the day for primary school children

Far fewer differences were observed across the groups over the day. Over the day the intake of fruit in the packed lunch group was over double that of the school lunch group (143g vs. 63g). The higher intake of fruit juice in the school lunch group seen during lunchtime was much reduced over the day compared to the packed lunch group (220g vs. 210g) but remained compared to the group consuming lunch out of school (220g vs. 55g).

For foods such as yoghurt, fromage frais and dairy desserts, meat and meat dishes, vegetables, chips and 'other potatoes', there remained a noticeable difference between the groups in the same direction as the lunchtime intakes.

Differences in intakes of crisps and savoury snacks across the groups reduced considerably over the day. For non-diet soft drinks, intakes were still greatest in the group consuming lunch out of school (325g), followed by those consuming school lunches (186g) and lowest in those consuming packed lunches (138g). For diet and lower sugar soft drinks (including flavoured water), intakes were greatest in the school lunch group (272g), followed by the group consuming lunch out of school (243g) and lowest in the packed lunch group (226g).

*Table 3.5*

**Table 3.5. Mean intake (g) of food consumed (consumers and non-consumers) and percentage of consumers at lunchtime only and over the full day during weekday term time, for children aged 5-11, by type of lunch\***

Food group		Lunchtime only			Full day		
		Type of lunch			Type of lunch		
		School lunch	Packed lunch	Lunch out of school	School lunch	Packed lunch	Lunch out of school
Pasta, rice, pizza and other cereals	Mean (g)	24	6	17	104	66	90
	SD	61	27	56	147	90	133
	% consumer	18	6	9	55	44	51
White and other bread	Mean (g)	19	43	45	53	69	84
	SD	30	36	47	44	55	71
	% consumer	33	65	66	75	75	83
Wholemeal bread	Mean (g)	1	8	0	2	14	0
	SD	5	19	0	8	26	0
	% consumer	3	18	0	10	25	0
Wholegrain and high fibre cereals	Mean (g)	0	0	0	31	14	29
	SD	0	0	0	80	24	63
	% consumer	0	0	0	31	40	42
Other breakfast cereals	Mean (g)	0	0	0	15	14	15
	SD	0	0	0	26	22	23
	% consumer	0	0	0	40	44	44
Biscuits, fruit pies, buns, cakes and pastries	Mean (g)	10	13	9	35	42	33
	SD	26	17	16	45	44	43
	% consumer	26	44	35	73	77	63
Puddings	Mean (g)	10	1	6	19	6	6
	SD	29	10	31	48	23	31
	% consumer	11	2	4	16	7	4
Milk and cream	Mean (g)	69	13	31	281	255	268
	SD	118	49	81	235	228	169
	% consumer	30	6	16	88	86	91
Cheese	Mean (g)	7	11	6	11	13	13
	SD	19	18	16	22	19	22
	% consumer	15	32	12	28	41	28
Yoghurt, fromage frais and dairy desserts	Mean (g)	5	46	5	25	74	30
	SD	28	60	23	56	109	62
	% consumer	4	54	5	26	58	22
Ice cream	Mean (g)	3	0	8	9	18	27
	SD	15	0	23	28	30	40
	% consumer	4	0	11	12	30	34
Eggs and egg dishes	Mean (g)	2	1	0	4	3	3
	SD	8	8	0	15	12	12
	% consumer	5	3	0	7	7	6
Fats and oils	Mean (g)	1	6	5	8	11	11
	SD	3	6	8	10	9	17
	% consumer	15	67	44	50	79	49
Meats and meat dishes, excluding processed meat	Mean (g)	16	19	3	41	70	19
	SD	42	27	11	73	105	43
	% consumer	25	45	9	44	70	22
Processed meat including sausages, burgers, coated chicken	Mean (g)	6	9	25	45	36	57
	SD	23	28	38	58	87	79
	% consumer	7	13	40	51	31	48
Fish and fish dishes, excluding oily fish	Mean (g)	18	4	5	24	20	21
	SD	44	13	17	48	48	41
	% consumer	22	9	11	29	20	25
Oily fish and dishes	Mean (g)	0	0	0	0	2	0
	SD	0	0	0	0	10	0
	% consumer	0	0	0	0	2	0
Vegetables excluding potatoes and baked beans	Mean (g)	18	9	3	53	45	17
	SD	34	25	9	84	61	40
	% consumer	29	20	14	48	53	27
Baked beans	Mean (g)	0	0	0	12	2	21
	SD	0	0	0	48	13	58
	% consumer	0	0	0	7	2	14
Chips, fried and roast potatoes and potato products	Mean (g)	14	0	11	61	32	41
	SD	39	0	34	90	61	59
	% consumer	13	0	11	41	35	42
Other potatoes, potato salads and dishes	Mean (g)	45	0	0	64	32	33
	SD	82	0	0	112	63	78

**Table 3.5. Mean intake (g) of food consumed (consumers and non-consumers) and percentage of consumers at lunchtime only and over the full day during weekday term time, for children aged 5-11, by type of lunch\***

Food group		Lunchtime only			Full day		
		Type of lunch			Type of lunch		
		School lunch	Packed lunch	Lunch out of school	School lunch	Packed lunch	Lunch out of school
	% consumer	31	0	0	35	26	16
Crisps and savory snacks	Mean (g)	0	7	8	19	20	23
	SD	0	12	13	18	22	26
	% consumer	0	30	32	60	55	58
Fruit, excluding fruit juice	Mean (g)	21	73	55	63	143	127
	SD	42	74	117	91	141	161
	% consumer	22	61	26	46	77	50
Table sugar and preserves	Mean (g)	0	1	2	4	5	7
	SD	0	4	7	15	10	13
	% consumer	0	4	8	17	30	40
Confectionery	Mean (g)	1	2	8	21	34	25
	SD	4	7	13	32	66	22
	% consumer	3	10	31	44	52	64
Fruit juice	Mean (g)	104	48	4	220	210	55
	SD	123	91	18	231	273	92
	% consumer	48	24	5	64	51	35
Soft drinks, not diet	Mean (g)	9	64	88	186	138	325
	SD	43	98	173	187	184	549
	% consumer	5	33	23	61	50	46
Soft drinks, diet and lower sugar	Mean (g)	12	68	63	272	226	243
	SD	45	122	127	329	318	273
	% consumer	7	28	25	61	50	61
Tea, coffee and water	Mean (g)	66	29	60	333	289	109
	SD	149	81	138	384	286	180
	% consumer	23	26	24	72	79	39
Soups and sauces	Mean (g)	25	1	3	35	21	16
	SD	69	4	4	78	47	21
	% consumer	28	12	34	39	45	69
Base (weighted)		35	43	17	35	43	17
Base (unweighted)		38	48	19	38	48	19

. Variance for all groups is zero. Statistical testing cannot be undertaken.

Food groups not shown in the table include alcoholic drinks (including low alcohol), beverages (dry weight) and nuts and seeds.

\* Mean values include non-consumers and therefore represent the average intake in the population not a typical intake in an individual.

### Quantities of food consumed at lunchtime for secondary school children

Results for secondary school children presented in Table 3.6 indicate far fewer differences in the quantities of food consumed at lunchtime compared with primary school children. As for primary school children, differences seen during the lunchtime period were not necessarily reflected in the day's intake.

Intakes of pasta, rice and pizza were greater in the school lunch group (29g), and the group consuming lunch out of school (34g) compared with the packed lunch group (0g). Intake of soups and sauces also followed this pattern.

Children who consumed a packed lunch consumed greater amounts of fruit (58g) compared with the group consuming lunch out of school (32g) and much greater amounts compared with the group consuming school lunches (6g). Children who

consumed a packed lunch consumed greater amounts of yoghurt, fromage frais and dairy desserts compared with other children although again numbers in the packed lunch group are small.

Children consuming lunch out of school consumed greater amounts of processed meat and non-diet soft drinks compared with other children.

#### Quantities of food consumed over the day for secondary school children

For secondary school children few differences were observed across the groups over the day. Intake of chips, fried and roast potatoes in the school lunch group (99g) was over double that of intake in the packed lunch group (43g) and the group consuming lunch out of school (41g). For foods such as pasta, rice and pizza, yoghurt, fromage frais and dairy desserts, fruit and non diet soft drinks, there was a noticeable difference that remained between the groups across the day. Direction of processed meat intake was reversed with those taking a packed lunch having the highest intakes.

*Table 3.6*

**Table 3.6. Mean intake (g) of food consumed (consumers and non-consumers) and percentage of consumers at lunchtime only and over the full day during weekday term time, for children aged 12-17, by type of lunch\***

Food group		Lunchtime only			Full day		
		Type of lunch			Type of lunch		
		School lunch	Packed lunch	Lunch out of school	School lunch	Packed lunch	Lunch out of school
Pasta, rice, pizza and other cereals	Mean (g)	29	0	34	125	63	124
	SD	74	0	96	167	132	134
	% consumer	18	0	12	45	30	57
White and other bread	Mean (g)	32	31	30	68	59	66
	SD	35	31	36	55	60	56
	% consumer	52	58	46	77	58	79
Wholemeal bread	Mean (g)	2	29	3	5	45	6
	SD	11	46	14	16	84	25
	% consumer	4	36	4	11	41	6
Wholegrain and high fibre cereals	Mean (g)	0	0	0	10	40	6
	SD	0	0	0	27	99	14
	% consumer	0	0	0	16	32	14
Other breakfast cereals	Mean (g)	0	4	2	7	11	9
	SD	0	11	10	15	16	18
	% consumer	0	14	3	21	38	28
Biscuits, fruit pies, buns, cakes and pastries	Mean (g)	13	3	11	33	37	20
	SD	29	8	28	37	41	30
	% consumer	25	15	19	67	68	44
Puddings	Mean (g)	3	0	0	5	5	8
	SD	17	0	0	20	18	32
	% consumer	4	0	0	7	6	7
Milk and cream	Mean (g)	6	0	25	242	88	148
	SD	33	0	79	299	128	182
	% consumer	6	0	9	73	56	61
Cheese	Mean (g)	11	30	7	20	51	20
	SD	21	69	15	32	139	30
	% consumer	25	34	26	39	34	45
Yoghurt, fromage frais and dairy desserts	Mean (g)	0	48	0	24	79	24
	SD	0	94	0	49	136	55
	% consumer	0	25	0	23	32	19
Ice cream	Mean (g)	0	0	1	3	5	12
	SD	0	0	9	15	19	31
	% consumer	0	0	2	5	6	17
Eggs and egg dishes	Mean (g)	0	0	0	9	0	11
	SD	0	0	0	26	0	35
	% consumer	0	0	0	14	0	12
Fats and oils	Mean (g)	4	6	5	8	15	10
	SD	6	5	10	11	19	11
	% consumer	29	68	38	49	72	68
Meats and meat dishes, excluding processed meat	Mean (g)	34	20	19	107	74	103
	SD	78	22	61	123	75	119
	% consumer	36	53	24	64	73	66
Processed meat including sausages, burgers, coated chicken	Mean (g)	6	0	21	47	64	53
	SD	25	0	43	70	90	77
	% consumer	10	0	24	37	48	43
Fish and fish dishes, excluding oily fish	Mean (g)	6	6	3	20	6	7
	SD	17	14	12	55	14	26
	% consumer	11	15	6	18	22	9
Oily fish and dishes	Mean (g)	0	0	0	6	12	0
	SD	0	0	0	35	49	0
	% consumer	0	0	0	3	6	0
Vegetables excluding potatoes and baked beans	Mean (g)	6	3	4	34	57	30
	SD	14	7	17	55	119	52
	% consumer	23	19	9	49	38	34
Baked beans	Mean (g)	0	0	0	3	7	6
	SD	0	0	0	17	27	33
	% consumer	0	0	0	3	7	3
Chips, fried and roast potatoes and potato products	Mean (g)	17	0	5	99	43	41
	SD	49	0	24	96	87	68
	% consumer	12	0	5	60	27	31

**Table 3.6. Mean intake (g) of food consumed (consumers and non-consumers) and percentage of consumers at lunchtime only and over the full day during weekday term time, for children aged 12-17, by type of lunch\***

Food group		Lunchtime only			Full day		
		Type of lunch			Type of lunch		
		School lunch	Packed lunch	Lunch out of school	School lunch	Packed lunch	Lunch out of school
Other potatoes, potato salads and dishes	Mean (g)	15	0	7	34	20	61
	SD	47	0	48	80	46	99
	% consumer	10	0	2	19	18	33
Crisps and savory snacks	Mean (g)	7	8	4	15	28	16
	SD	15	13	11	18	22	27
	% consumer	24	31	13	53	73	38
Fruit, excluding fruit juice	Mean (g)	6	58	32	62	85	63
	SD	25	71	107	118	112	127
	% consumer	6	45	12	36	45	32
Table sugar and preserves	Mean (g)	0	0	1	4	2	4
	SD	0	0	3	7	4	9
	% consumer	2	0	4	33	20	23
Confectionery	Mean (g)	7	9	9	38	41	35
	SD	24	17	22	59	68	58
	% consumer	9	26	17	42	72	55
Fruit juice	Mean (g)	9	0	19	141	115	82
	SD	48	0	79	236	249	201
	% consumer	4	0	6	36	27	22
Soft drinks, not diet	Mean (g)	58	106	177	268	267	435
	SD	141	110	189	305	303	465
	% consumer	17	50	53	61	55	71
Soft drinks, diet and lower sugar	Mean (g)	111	60	72	274	357	275
	SD	179	147	155	287	380	459
	% consumer	33	17	21	58	68	38
Tea, coffee and water	Mean (g)	179	77	97	579	365	541
	SD	242	119	226	654	465	644
	% consumer	48	45	18	74	59	69
Soups and sauces	Mean (g)	19	2	17	41	43	36
	SD	55	4	48	77	98	68
	% consumer	23	22	29	52	64	48
Base (weighted)		29	15	41	29	15	41
Base (unweighted)		27	15	37	27	15	37

. Variance for all groups is zero. Statistical testing cannot be undertaken.

Food groups not shown in the table include alcoholic drinks (including low alcohol), beverages (dry weight) and nuts and seeds.

\* Mean values include non-consumers and therefore represent the average intake in the population not a typical intake in an individual.

### 3.3.3 Mean nutrient intakes

Tables 3.7 and 3.8 show the mean and median daily intakes of selected nutrients on the day of the 24-hour recall, by type of lunch for children (sexes combined) aged 5-11 and 12-17, respectively. Both tables show the mean and median nutrient intakes during the lunchtime period only and across the full day. For a number of the nutrients, the range of intakes within age groups was wide and the distribution was skewed, in some cases reflecting the limited distribution of the nutrient in foods (e.g. vitamin A). Caution should be exercised when interpreting the results for primary school children consuming lunch out of school and secondary school children consuming packed lunches since bases in these groups are small.

### Mean nutrient intakes at lunchtime for primary school children

Given the number of significant differences seen across the groups during the lunchtime food intake there were surprisingly few significant differences in nutrient intakes for primary school children. Generally over the lunchtime period, intakes of macronutrients were higher more often in the group consuming lunch out of school with intakes lowest in those consuming a school lunch. The converse was seen for micronutrient intakes with generally higher intakes seen more often in those consuming a school lunch and lowest most often in those consuming lunch out of school.

Children consuming packed lunches and lunch out of school had higher mean intakes of total sugars at lunchtime (both groups 38g) compared with those consuming a school lunch (28g). Intakes of NMEs were greater in the group consuming lunch out of school (not significant) while intakes of intrinsic milk sugars (IMS) were greater in the packed lunch group reflecting higher fruit intakes.

Higher mean intakes of folate were observed in the school lunch group, with intakes lowest in the group consuming lunch out of school. Mean intakes of sodium were similar in the packed lunch group (871mg) and the group consuming lunch out of school (839mg), both greater than intakes in the school lunch group (609mg).

### Mean nutrient intakes over the day for primary school children

While intakes of macronutrients over the day generally remained higher on more occasions in the group consuming lunch out of school, intake of micronutrients were higher most often in the packed lunch group and lowest most often in those consuming lunch out of school.

Significant differences observed across the groups during lunchtime for total sugars, IMS, folate and sodium were no longer significant across the day's intake. The distribution of vitamin A was skewed with median intakes considerably lower than the mean. Intake of vitamin A gained significance across the day's intake with those consuming school lunches having the highest median intakes and those consuming lunches out of school with the lowest.

*Table 3.7*

**Table 3.7. Average nutrient intake at lunchtime only and over the full day during weekday term time, for children aged 5-11, by type of lunch**

Nutrient (unit)	Lunchtime only				Full day				
		Type of lunch				Type of lunch			
		School lunch	Packed lunch	Lunch out of school	p value	School lunch	Packed lunch	Lunch out of school	p value
Energy (kcal)	Mean	470	521	547	0.606	1760	1775	1866	0.798
	Median	429	488	490		1717	1757	1692	
	SD	243	198	291		515	495	659	
Protein (g)	Mean	18.9	18.8	15.8	0.671	58.8	61.2	56.3	0.424
	Median	16.3	17.4	15.5		53.4	58.1	57.9	
	SD	11.5	7.7	10.9		23.3	19.2	17.8	
Fat (g)	Mean	17.7	19.9	21.2	0.674	68.5	65.2	69.8	0.783
	Median	14.1	15.8	21.6		64.5	61.8	65.5	
	SD	12.4	13.8	12.4		25.8	27.2	24.7	
Carbohydrate (g)	Mean	63	71	78	0.382	242	251	270	0.643
	Median	60	72	61		233	253	254	
	SD	33	24	46		66	71	114	
Non-starch polysaccharide (g)	Mean	3.1	3.5	3.2	0.584	11.4	11.8	12.0	0.843
	Median	2.6	3.4	2.6		11.1	11.5	11.8	
	SD	2.2	1.4	2.3		4.8	3.7	5.0	
Total sugars (g) <sup>b</sup>	Mean	28	38	38	<b>0.038</b>	114	131	129	0.253
	Median	26	38	38		106	121	112	
	SD	18	18	29		41	53	91	
Non-milk extrinsic sugars (g) <sup>b</sup>	Mean	19	22	26	0.467	79	85	88	0.798
	Median	18	24	21		77	80	70	
	SD	17	13	25		37	46	82	
Intrinsic and milk sugars (g)	Mean	9	16	12	<b>0.014</b>	35	46	41	0.108
	Median	8	13	7		30	43	35	
	SD	8	12	12		17	25	22	
Saturated fatty acids (g)	Mean	7.3	8.7	8.9	0.653	28.6	28.5	29.1	0.980
	Median	5.1	6.2	8.4		25.1	26.6	25.9	
	SD	6.2	6.5	6.0		11.5	13.3	11.2	
Vitamin A (ug) <sup>a,b</sup>	Mean	183	133	92	0.148	594	571	344	<b>0.034</b>
	Median	105	81	72		402	358	288	
	SD	237	175	95		682	587	221	
Folate (ug)	Mean	58	41	34	<b>0.003</b>	221	207	202	0.694
	Median	54	38	29		212	194	202	
	SD	35	18	25		84	68	87	
Vitamin C (mg)	Mean	28.7	35.6	21.6	0.105	91.6	121.2	102.9	0.125
	Median	15.5	19.5	8.8		83.8	102.7	83.8	
	SD	26.9	36.2	25.9		52.3	81.3	86.3	
Iron (mg)	Mean	2.1	2.1	2.0	0.864	9.5	10.2	10.2	0.677
	Median	2.0	2.2	1.9		8.5	9.2	10.0	
	SD	1.1	0.9	1.4		3.8	3.3	4.0	
Calcium (mg)	Mean	298	274	243	0.720	940	958	953	0.984
	Median	258	220	203		813	954	1061	
	SD	230	173	202		410	381	392	
Sodium (mg) <sup>c</sup>	Mean	609	871	839	<b>0.042</b>	2286	2307	2427	0.804
	Median	577	791	678		2116	2059	2251	
	SD	378	522	622		746	1081	1134	
Zinc (mg) <sup>a</sup>	Mean	2.2	2.2	1.8	0.593	6.9	7.3	6.6	0.631
	Median	1.7	2.0	1.7		5.8	6.7	6.3	
	SD	2.0	1.2	1.4		3.6	3.0	2.7	
Base (weighted)		35	43	17		35	43	17	
Base (unweighted)		38	48	19		38	48	19	

<sup>a</sup> Not normally distributed for lunchtime only values

<sup>b</sup> Not normally distributed for full day values

<sup>c</sup> Does not include sodium from salt added at the table

#### Mean nutrient intakes at lunchtime for secondary school children

As was the case for primary school children, intakes of macronutrients over the lunchtime period were higher more often in the group consuming lunch out of school with lowest intakes in those consuming a school lunch (Table 3.8). The converse was seen for micronutrient intakes with higher intakes seen more often in those consuming a packed lunch and lowest most often in those consuming lunch out of school.

In line with the results seen in primary school children, secondary school children consuming packed lunches (35g) and lunch out of school (39g) had higher mean intakes of total sugars at lunchtime compared with those consuming a school lunch (22g). Intakes of NMES were again greater in the group consuming lunch out of school (not significant) while intakes of intrinsic and milk sugars were again greater in the packed lunch group.

#### Mean nutrient intakes over the day for secondary school children

Intakes of macronutrients and micronutrients over the day were generally higher on more occasions in the group consuming school lunches and lunch out of school.

Significant differences observed across the groups during lunchtime for total sugars were no longer significant across the day's intake while the difference remained significant for intrinsic and milk sugars. Intake of sodium gained significance across the day's intake with those consuming packed lunches having the highest mean intakes (3197mg) and those consuming lunch out of school with the lowest (2237mg).

*Table 3.8*

**Table 3.8. Average nutrient intake at lunchtime only and over the full day during weekday term time, for children aged 12-17, by type of lunch**

Nutrient (unit)		Lunchtime only				Full day			
		Type of lunch		Lunch out of school	p value	Type of lunch		Lunch out of school	p value
	Mean	School lunch	Packed lunch			School lunch	Packed lunch		
Energy (kcal)	Mean	515	561	567	0.689	2006	2095	1872	0.081
	Median	560	441	541		1948	1819	1886	
	SD	226	359	251		612	767	506	
Protein (g) <sup>a</sup>	Mean	18.8	22.8	15.9	0.164	76.0	71.4	62.6	0.152
	Median	17.6	17.7	14.6		74.2	61.4	57.5	
	SD	12.7	18.2	9.5		31.3	41.3	19.8	
Fat (g)	Mean	21.7	23.8	23.5	0.852	78.6	91.7	77.0	0.313
	Median	21.6	18.5	21.6		69.0	84.1	77.5	
	SD	12.2	23.6	15.2		31.0	44.5	27.5	
Carbohydrate (g)	Mean	65	68	78	0.348	265	262	247	0.578
	Median	61	55	68		292	237	251	
	SD	35	36	35		94	91	72	
Non-starch polysaccharide (g)	Mean	2.9	3.5	3.1	0.630	12.4	13.4	10.7	0.136
	Median	2.9	2.4	2.7		10.9	13.0	9.9	
	SD	1.6	2.3	2.1		5.9	6.0	3.9	
Total sugars (g)	Mean	22	35	39	<b>0.039</b>	113	124	116	0.848
	Median	12	30	34		104	109	109	
	SD	22	28	28		54	75	61	
Non-milk extrinsic sugars (g)	Mean	17	21	30	0.085	80	87	88	0.824
	Median	7	20	25		69	62	81	
	SD	22	19	26		50	63	61	
Intrinsic and milk sugars (g)	Mean	5	14	8	<b>0.048</b>	33	37	28	<b>0.047</b>
	Median	3	8	5		30	41	27	
	SD	5	13	9		20	20	14	
Saturated fatty acids (g) <sup>a,b</sup>	Mean	8.4	12.3	8.6	0.694	32.1	40.7	29.9	0.220
	Median	7.1	8.8	8.1		30.4	35.1	30.8	
	SD	5.5	15.7	6.6		14.8	29.7	11.5	
Vitamin A (ug) <sup>a,b</sup>	Mean	158	161	154	0.981	466	677	532	0.656
	Median	110	80	84		416	461	373	
	SD	151	229	206		344	670	530	
Folate (ug)	Mean	45	52	43	0.644	198	205	174	0.424
	Median	38	42	35		180	172	168	
	SD	27	36	39		95	115	69	
Vitamin C (mg) <sup>a,b</sup>	Mean	14.7	30.3	32.6	0.260	103.1	96.0	92.7	0.947
	Median	6.8	17.5	6.5		60.4	48.5	50.4	
	SD	25.7	35.2	99.7		115.3	134.1	141.2	
Iron (mg)	Mean	2.0	2.3	2.1	0.725	9.3	10.0	9.0	0.638
	Median	1.9	2.0	1.8		8.9	9.9	8.6	
	SD	1.0	1.3	1.2		3.6	4.1	2.9	
Calcium (mg) <sup>a,b</sup>	Mean	208	440	216	0.351	918	1123	821	0.277
	Median	145	316	142		924	908	749	
	SD	196	547	173		440	1034	352	
Sodium (mg) <sup>c</sup>	Mean	828	926	733	0.580	2445	3197	2237	<b>0.047</b>
	Median	816	669	696		2405	3003	2067	
	SD	442	744	492		838	1511	978	
Zinc (mg) <sup>a,b</sup>	Mean	1.9	2.6	1.7	0.378	7.4	8.4	6.8	0.450
	Median	1.5	1.7	1.2		6.7	6.5	6.2	
	SD	1.2	3.0	1.1		3.0	7.1	2.0	
Base (weighted)		29	15	41		29	15	41	
Base (unweighted)		27	15	37		27	15	37	

<sup>a</sup> Not normally distributed for lunchtime only values

<sup>b</sup> Not normally distributed for full day values

<sup>c</sup> Does not include sodium from salt added at the table

### Percentage of nutrient intake consumed at lunchtime

Table A3.1 (see appendix) shows the percentage of absolute nutrient intakes consumed during the lunchtime period by the lunch groups, for primary and secondary school children (sexes combined). For both primary and secondary school children very few significant differences were observed. A selection of the differences is presented graphically in Figures 3.2 and 3.3 for 5-11 and 12-17 year olds, respectively.

#### Primary school children

- The main difference in the primary school children was for sodium, with 38% of the sodium intake consumed at lunchtime for those children having packed lunches, closely followed by children consuming lunch out of school (37%) and finally children consuming school lunches (27%).
- Children in the school lunch group consumed 28% of their intake of folate at lunchtime compared to 22% for children consuming packed lunches and 18% for children consuming lunch out of school, respectively (p0.064).

#### Secondary school children

- Children consuming lunch out of school consumed 34% of their total sugar intake and 36% of their NMES intake at lunchtime compared to 28% and 24% for those consuming packed lunches and 20% and 21% for those consuming school lunches, respectively.
- Children in the packed lunch group consumed 33% of their IMS intake at lunchtime compared to 29% consuming lunch out of school and 15% for those consuming school lunches.

*Figures 3.2 and 3.3*

Figure 3.2 Percentage of nutrient intake (selected nutrients) consumed during lunchtime weekday term time, for children aged 5-11, by type of lunch (\* p <0.05, \*\* p<0.01)

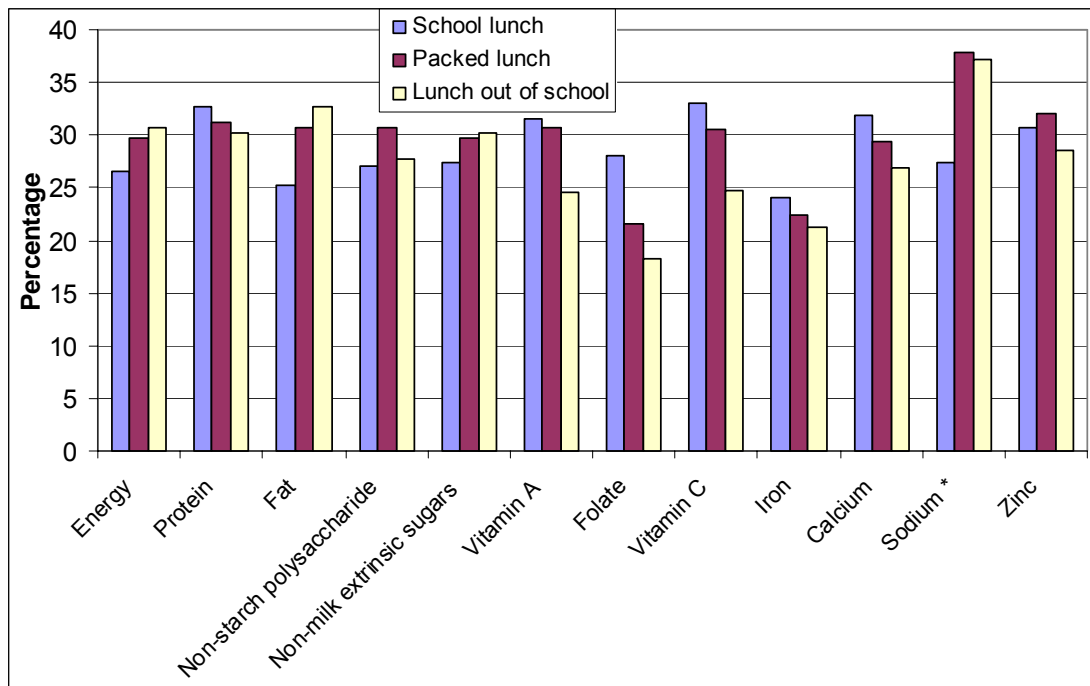
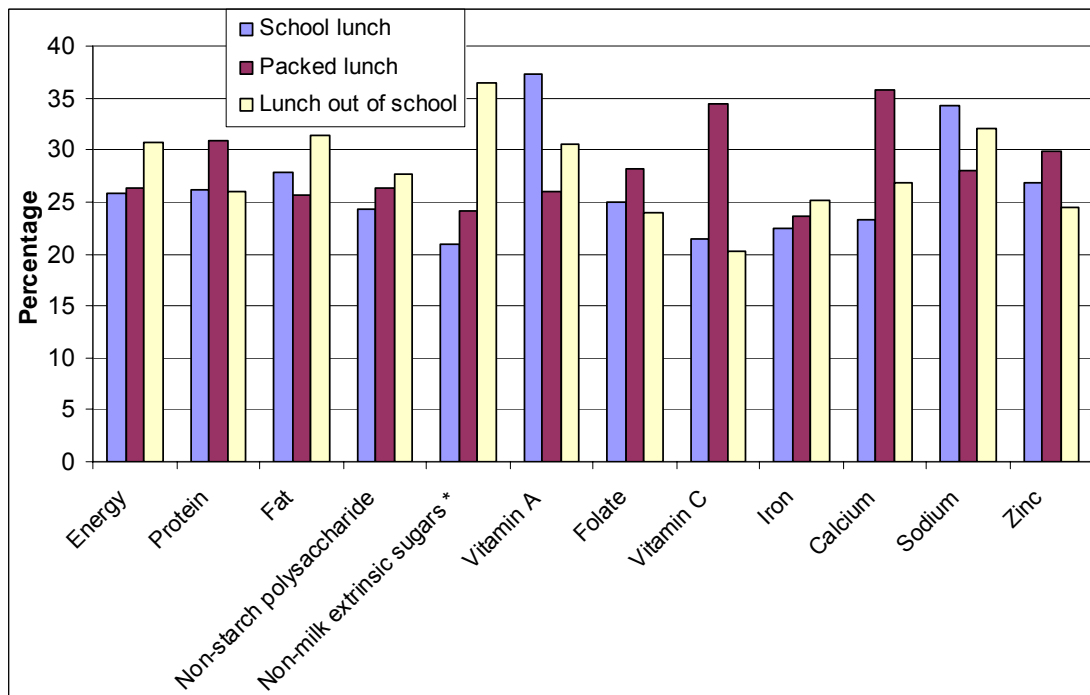


Figure 3.3 Percentage of nutrient intake (selected nutrients) consumed during lunchtime weekday term time, for children aged 12-17, by type of lunch (\* p <0.05, \*\* p<0.01)



### **3.3.4 Nutrient intakes as a percentage of the Dietary Reference Values**

#### Dietary Reference Values

Dietary Reference Values (DRVs) comprise a series of estimates of the amount of energy and nutrients needed by different groups of healthy people in the UK population. Included within this definition are three types of estimates: Reference Nutrient Intakes (RNIs), Estimated Average Requirements (EARs) and Lower Reference Nutrient Intakes (LRNIs).

The EAR is used in particular for energy. For a given population group, it is expected that approximately 50% of each sex and age group will have energy requirements above the EAR and 50% will have requirements below the EAR. The mean energy intake for a given group in which all members were meeting their individual requirements would, therefore, be expected to be equal to the EAR. The RNI used for protein, vitamins or minerals is the amount of that nutrient that is sufficient, or more than sufficient, for most of the group to which they apply, about 97% of the people in the group for whom the RNI is defined. They are not minimum targets. The LRNI for a vitamin or mineral is the amount of that nutrient that is enough for roughly 3% in a group who have low needs. For further information see Department of Health (1991).<sup>8</sup> The Discussion provides an explanation as to why the LRNI has not been used in this analysis.

Energy intake as a percentage of the EAR and protein, vitamin and mineral intakes as a percentage of the RNI were calculated for each respondent individually, using the EAR or RNI appropriate for their sex and age. Medians are quoted in the text where absolute intakes were skewed in their distribution.

#### Nutrient intakes as a percentage of the DRV for primary school children

Few differences in intakes as a percentage of the DRV across the lunch groups reached significance, either at lunchtime or over the day for primary school children (Table A3.2, see appendix). Results over the day are also shown graphically in Figure 3.4.

As for absolute nutrient intakes, contribution to the DRV for children consuming school lunches tended to be higher more often than for the other children, although there were exceptions to this e.g. packed lunches contributed greater amounts of vitamin C.

The significant differences included a higher mean percent of the RNI for folate from the school lunches (44%) compared to 29% from packed lunches and 25% from lunches out of school. Packed lunches and lunch out of school supplied a mean of 80% of the RNI for sodium, well above that of children consuming school lunches (58%) (not significant).

Over the day, intakes generally exceeded the DRV and across the groups no significant differences were seen. Mean intakes of energy were close to the EAR for children consuming school lunches and packed lunches, 98% and 99% respectively, while for children consuming lunch out of school, intakes exceeded the EAR (103%). While mean intakes for vitamin A exceeded the RNI for school lunches (126%) and packed lunches (119%), mean intakes fell below the RNI for those consuming lunch out of school (73%) ( $p=0.051$ ). Median intakes for all three groups fell below the RNI, particularly for children consuming lunch out of school (55%).

Significant differences observed during the lunchtime period in folate intakes were no longer significant across the day. Additionally, the large contribution that packed lunches and lunch out of school contributed to sodium during the lunchtime period was not reflected in intakes as a percentage of the RNI over the day.

#### Nutrient intakes as a percentage of the DRV for secondary school children

As for primary school children, the significant differences in intakes as a percentage of the DRV were very few, although some notable findings between the groups were observed (Table A3.3 (see appendix) and Figure 3.5).

In contrast to the results seen in the primary school children, intakes as a percentage of the DRV tended to be highest during the lunchtime period for those consuming packed lunches, although numbers in this group were small. Contribution made to the DRV by all groups at lunchtime was generally lower than that observed in primary school children. This was also the case across the full day, with intakes falling below the RNI for all three groups for vitamin A, iron and zinc. For sodium mean daily intakes as a percentage of the RNI were significantly different across the groups (school lunch 153%, packed lunch 200%, lunch out of school 140% respectively).

As for the lunchtime period, intakes as a percentage of the DRV across the full day in the packed lunch group tended to be highest and intakes in the group consuming lunch out of school tended to be lowest. Mean intakes for folate and median intakes

for calcium fell below the RNI for the group consuming lunch out of school although differences across the groups were not significant. Mean intake of energy was also notably lower than the EAR for this group (85%), while for the other two groups mean intakes were 97% and 99% of the EAR (p 0.052).

Figures 3.4 and 3.5

Figure 3.4. Average nutrient intake as a percentage of the Dietary Reference Value (DRV) (Estimated Average Requirement or Reference Nutrient Intake) over the full day, for children aged 5-11 years, by type of lunch

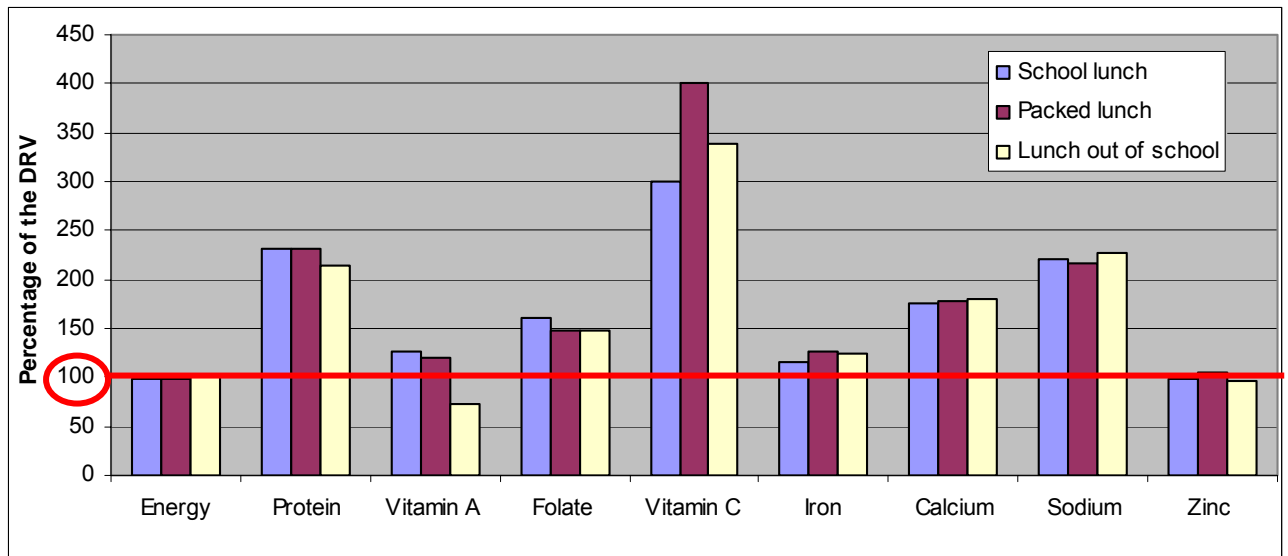
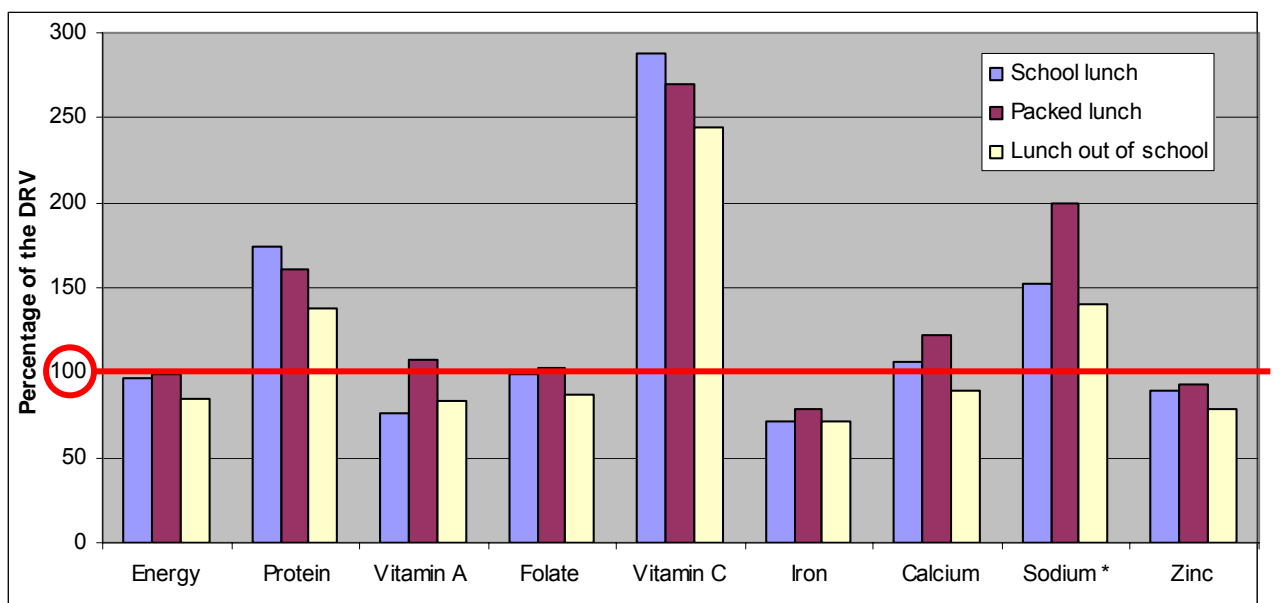


Figure 3.5. Average nutrient intake as a percentage of the Dietary Reference Value (DRV) (Estimated Average Requirement or Reference Nutrient Intake) over the full day, for children aged 12-17 years, by type of lunch



### **Nutrient intakes as a percentage of energy**

The current UK recommendation is that total fat should provide no more than 35% of food energy, saturated fat should provide no more than 11% of food energy, total carbohydrates should provide on average 50% of food energy and intake of NMES should be limited to not more than or 11% of food energy.<sup>8</sup>

Table 3.9 shows the average percent energy from nutrients at lunchtime and over the day for primary and secondary school children. Few differences across the groups were seen, both during lunchtime and over the full day.

For primary school children, over lunchtime, protein intake as a percent of food energy was lower in the group consuming lunch out of school (10.7%) compared with those consuming a packed lunch (14.9%) and those consuming a school lunch (16.3%). Total fat, carbohydrate and NMES as a percentage of food energy consumed at lunchtime were highest in the group consuming lunch out of school, while intakes of saturated fat as a percentage of food energy was highest in the packed lunch group (not significant).

Over the full day, protein intakes as a percentage of food energy remained lowest in the group consuming lunch out of school (significant), while differences between the groups in intakes of total fat, saturated fat, carbohydrate, and NMES were, although sometimes still apparent, much reduced. Intakes for all three primary lunch groups exceeded the UK recommendations of not more than 11% of food energy from saturated fat, and of not more than 11% of food energy from NMES.

A similar pattern was observed amongst secondary school children, over the lunchtime period protein intake as a percent of food energy was lower in the group consuming lunch out of school (10.8% (median)) and while not significant, intakes of carbohydrate and NMES as a percentage of food energy were higher. Median intakes as a percent of food energy of saturated fat were higher in the packed lunch group (not significant).

Similar patterns to those observed over the lunchtime period were also observed over the full day, although none of the differences were significant. Intakes for all three groups exceeded the UK recommendations of not more than 11% of food energy from saturated fat, and of not more than 11% of food energy from NMES.

Intakes for those consuming packed lunches and lunch out of school also exceeded UK recommendations of not more than 35% of food energy from total fat.

Table 3.9

Table 3.9. Average percent energy from nutrients at lunchtime only and over the full day during weekday term time, for children aged 5-11 and 12-17, by type of lunch

Nutrient		Lunchtime only				Full day			
		Type of lunch			p value	Type of lunch			p value
		School lunch	Packed lunch	Lunch out of school		School lunch	Packed lunch	Lunch out of school	
<b>5-11 year olds</b>									
% food energy from protein	Mean	16.3	14.9	10.7	<b>0.013</b>	13.3	14.2	12.3	<b>0.023</b>
	Median	15.1	14.0	11.0		12.9	13.2	12.1	
	SD	6.9	4.4	5.4		3.0	4.7	3.4	
% food energy from total fat	Mean	31.8	32.9	33.3	0.904	34.6	32.3	34.1	0.268
	Median	32.4	30.9	36.2		35.4	30.5	32.0	
	SD	12.9	10.2	14.8		5.1	6.7	7.1	
% food energy from saturated fatty acids	Mean	12.5	14.5	14.0	0.456	14.4	14.0	14.0	0.882
	Median	12.9	12.9	12.6		14.6	14.1	14.3	
	SD	6.7	6.5	7.3		3.1	4.2	3.3	
% food energy from total carbohydrate	Mean	52.0	52.2	56.0	0.728	52.1	53.5	53.6	0.636
	Median	50.7	54.3	52.3		52.3	55.2	53.8	
	SD	15.7	10.9	18.0		6.0	8.0	6.1	
% food energy from non-milk extrinsic sugars	Mean	17.9	16.1	22.2	0.488	17.2	17.5	16.5	0.855
	Median	14.1	16.1	13.2		17.9	16.7	15.9	
	SD	19.4	9.0	27.3		7.2	7.0	7.4	
<b>12-17 year olds</b>									
% food energy from protein	Mean	14.9	16.4	11.3	<b>0.028</b>	16.0	13.4	13.8	0.413
	Median	12.2	15.6	10.8		14.4	12.2	12.8	
	SD	9.8	5.3	5.8		7.1	3.7	4.0	
% food energy from total fat	Mean	35.7	34.9	35.7	0.982	34.8	38.6	36.6	0.223
	Median	36.9	34.0	38.0		34.7	35.8	36.5	
	SD	14.6	12.6	14.0		6.4	8.0	6.4	
% food energy from saturated fatty acids	Mean	14.2	17.1	12.9	0.332	14.2	16.5	14.2	0.352
	Median	12.9	14.1	12.5		13.5	15.3	14.7	
	SD	8.2	9.4	6.4		4.6	5.6	3.8	
% food energy from total carbohydrate	Mean	49.2	48.7	53.0	0.487	49.1	48.0	49.6	0.856
	Median	49.9	54.0	52.1		49.5	51.3	49.8	
	SD	14.5	13.6	16.0		8.3	9.0	6.2	
% food energy from non-milk extrinsic sugars	Mean	14.2	14.1	20.6	0.359	15.0	15.2	17.3	0.501
	Median	5.5	13.0	17.0		14.4	14.6	17.6	
	SD	20.2	12.9	18.6		8.0	7.3	9.6	
Base (weighted)									
5-11 years		35	43	17		35	43	17	
12-17 years		29	15	41		29	15	41	
Base (unweighted)									
5-11 years		38	48	19		38	48	19	
12-17 years		27	15	37		27	15	37	

### 3.3.5 Comparison of intakes with the Scottish Nutrient Standards

Table 3.10 shows the Scottish Nutrient Standards for School Lunches with nutrient values for primary and secondary school children.<sup>3</sup> The new standards provide both nutrient and food based standards for school lunches and packed lunches provided by the Local Authority but comparisons have only been made to the nutrient standards in this report. The standards have been used as a basis for comparison for all three lunch groups. It is anticipated that these comparisons will provide a useful benchmark for future surveys that may assess the impact of the new standards on nutrient intake of school lunches.

Table 3.10

Table 3.10. Scottish Nutrient Standards for School Lunches<sup>a</sup>

Nutrient (unit)	Nutrient Standard	Min/ max	Primary Schools	Secondary Schools
Energy (kcal)	30% of the EAR	+/-10%	557	664
Total fat (g)	Not more than 35% of food energy	Max.	21.7	25.8
Saturated fat (g)	Not more than 11% of food energy	Max.	6.8	8.1
Total carbohydrate (g)	Not less than 50% of food energy	Min.	74.3	88.5
Non-milk extrinsic sugars (g)	Not more than 11% of food energy	Max.	16.3	19.5
Non-starch polysaccharide (g)	Not less than 30% of the calculated reference value	Min.	4.5	5.3
Protein (g)	Not less than 30% of the RNI	Min.	8.5	13.6
Iron (mg)	Not less than 30% of the RNI	Min.	3	4.4
Calcium (mg)	Not less than 30% of the RNI	Min.	165	300
Vitamin A (ug)	Not less than 30% of the RNI	Min.	150	187
Vitamin C (mg)	Not less than 30% of the RNI	Min.	9	11.0
Folate (ug)	Not less than 30% of the RNI	Min.	45	60
Sodium (mg)	Not more than 38% of the SACN recommendation (and by 2010, not more than 35% of the SACN recommendation)	Max.	745 (686)	894 (824)
Zinc (mg)	Not less than 30% of the RNI	Min.	2.1	2.8

<sup>a</sup> Schools (Health Promotion and Nutrition) (Scotland) Act 2007- Nutritional Requirements. 2008.

The Nutrient Standards for school lunches sets out the amount of energy (calories) and nutrients required to be provided in a school lunch, averaged over five consecutive days.

EAR = Estimated Average Requirement, RNI = Reference Nutrient Intake, SACN = Scientific Advisory Committee on Nutrition, Max. = maximum, Min. = minimum, kcal = kilocalories, g = grams, mg = milligrams, ug = micrograms.

Table A3.4 (see appendix) shows the percentage of children aged 5-11 and 12-17 who met the Scottish Nutrient Standards for School Lunches based on one day of data, by the type of school lunch. Generally, the proportion of children meeting the standards was low, and there were few significant differences when making comparisons across the types of lunch. In general, a lower proportion of children aged 12-17 met the nutrient standards compared with children aged 5-11. The expectation is not that the standards are met every single day, more so that the average of the five days for which the standards are based upon meets the

standards. Consideration should be given to the fact that the comparisons made here are based on a single day only. Additionally, the standards are based on school meal provision rather than consumption. Therefore, even where nutrient intakes of children do not meet the standards it cannot be assumed that school caterers are not providing meals that meet the standards.

#### *Primary school children and the Scottish Nutrient Standards*

The standard that was met by the highest percentage of children was for protein with the packed lunch group having the highest percentage (98%) compared to 88% for the school lunches and 71% for the lunches eaten out of school. For energy, very few children met the standard of 30% of the EAR being provided by the lunch (+/- 10% of the 30%) with only 12% in the school lunch group and 25% in the packed lunch group meeting the standard. In the majority of cases energy intakes were too low (energy intakes in 65% of those consuming school lunches and 53% for both those consuming packed lunches and lunch out of school were too low). None of the children in the group having lunch out of school met the energy standard. More children in this group had intakes that exceeded the energy requirement (47%) compared with the others. The proportion of children who met the standard for folate was markedly higher in the school lunch group (61%) with around one third of other children meeting the standard. Similarly for the sodium requirement, a much greater proportion of children consuming school lunches met the standard, 74%, compared with around half of other children.

Other notable (but not significant) differences included a greater proportion of children meeting the carbohydrate, calcium and vitamin C standards but fewer meeting the standard for NMES in the packed lunch group and a greater proportion of children meeting the vitamin A standard in the school lunch group. Fewer children in the group consuming lunch out of school met the standards for total fat, saturated fat, vitamin C and A.

Only around one quarter of primary school children (24-31%) met the nutrient standard for NSP, while only around one fifth (16-23%) met the nutrient standard for iron.

#### *Secondary school children and the Scottish Nutrient Standards*

The pattern was similar for secondary school children although fewer significant differences were seen. For energy, again very few children met the standard with

only 12% in the school lunch group and 24% in the group having lunch out of school while none of the children in the packed lunch group met the standard. As for the primary school children, more secondary school children had energy intakes that were too low to meet the standards (energy intakes in 73% of those consuming school lunches and packed lunches and 63% in those consuming lunch out of school were too low).

The only other significant difference across the groups was for vitamin C where three-quarters of children consuming packed lunches met the standard, while less than two-fifths met the standard in the other two groups.

The nutrient standards for protein and total fat were met by the highest percentage of children. Generally, it appeared that a greater proportion of secondary school children consuming packed lunches met the nutrient standards compared to the other lunch groups. A greater proportion of children in the packed lunch (66%) and the group consuming lunch out of school (69%) met the standard for sodium compared with the school lunch group (52%). In the majority of cases, except where outlined above, the percentage of secondary school children meeting the standards for NSP, iron, calcium, vitamin A and C, folate and zinc was low.

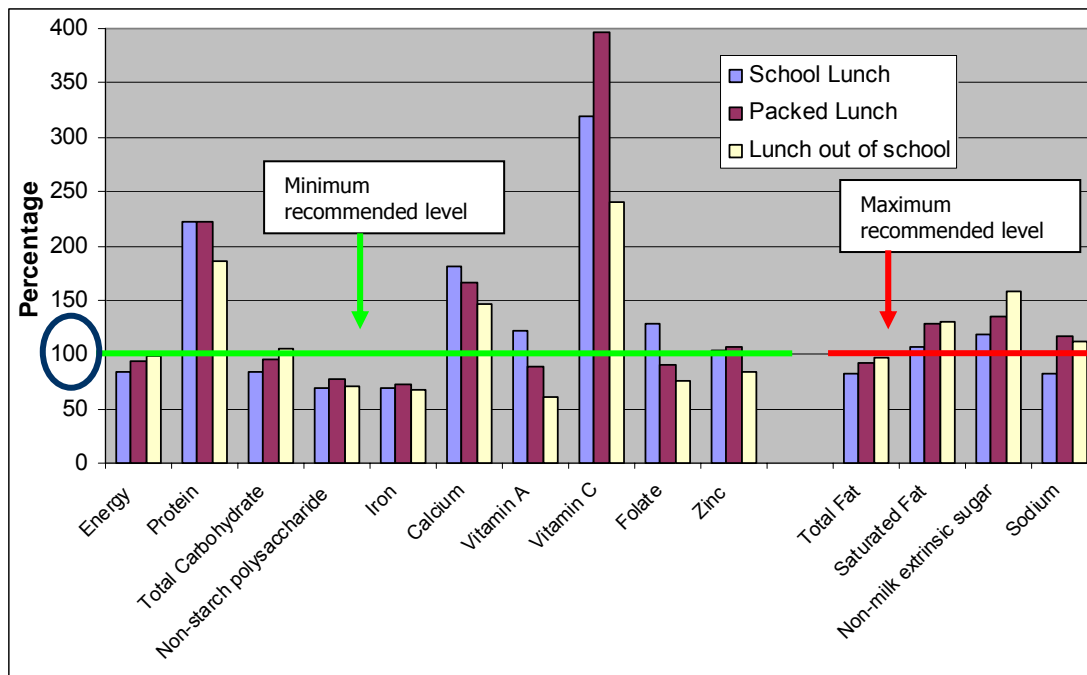
Table A3.5 (see appendix) shows the total percentage of children meeting the Scottish Nutrient Standards for School Lunches along with the mean number of standards met by the three lunch groups. Of the fourteen nutrient standards, no primary or secondary school children in any of the lunch groups met 12 or more of the standards although the data is based on only one day's intake. A higher mean number of standards were met in primary school children compared with secondary. In both primary and secondary school children, the group consuming lunch out of school met the fewest standards. For primary school children, a higher mean number of standards were met in the group consuming school lunches while for secondary school children a higher mean number of standards were met in the group consuming packed lunches.

Figures 3.6 and 3.7 show the mean lunchtime nutrient intake as a percentage of the Scottish Nutrient Standards for School Lunches for children aged 5-11 and 12-17 years, respectively. The mean lunchtime nutrient values reflect the low percentages of children meeting the standards as presented in Table A3.4 (see appendix), especially for secondary school children. For example, our results show that mean

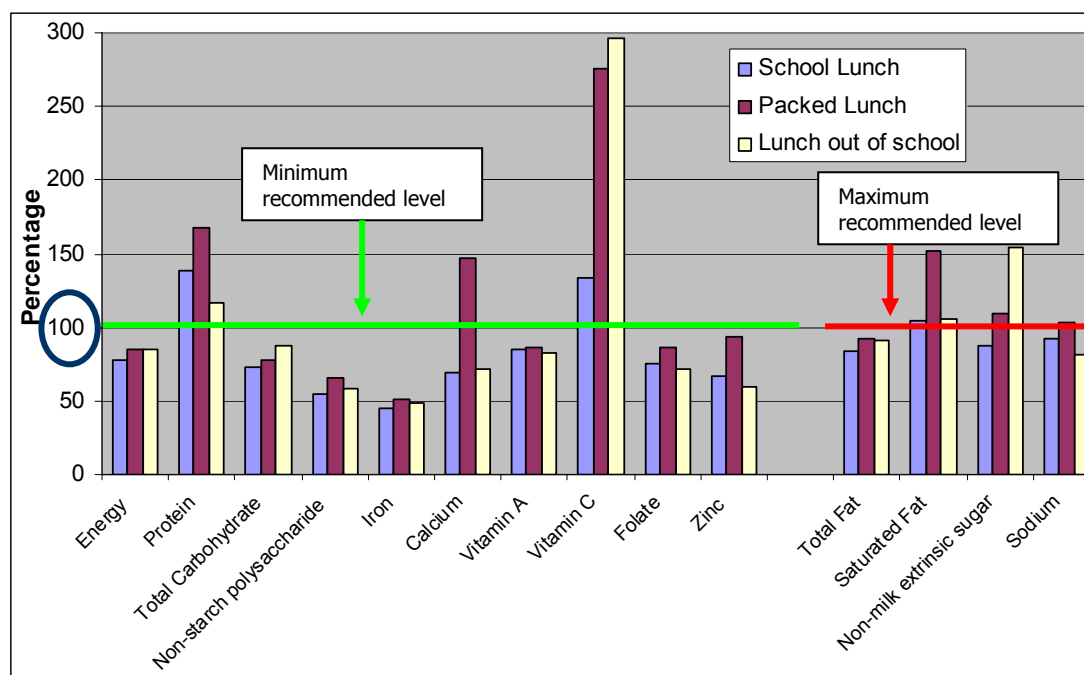
intakes fell below the standards for energy, NSP and iron for all lunch groups in both primary and secondary school children, and folate, zinc and total carbohydrate for all lunch groups in secondary school children.

Mean lunchtime nutrient intakes as a percentage of the Scottish Nutrient Standards were generally lowest for iron and NSP compared with the other nutrients for both primary and secondary school children. Mean intakes as a percentage of the Scottish Nutrient Standards for some groups reflect the very low percentages that met the standards, for example no primary school children consuming lunch out of school met the energy standard (Table A3.4), while the mean energy intake for this group was 98% (Figure 3.6).

Figure 3.6. Mean lunchtime nutrient intake as a percentage of the Scottish Nutrient Standards for School Lunches, for children aged 5-11 years, by type of lunch



**Figure 3.7. Mean lunchtime nutrient intake as a percentage of the Scottish Nutrient Standards for School Lunches, for children aged 12-17 years, by type of lunch**



### 3.4 DISCUSSION

The main differences seen during lunchtime for primary school children include a greater consumption of milk and cream, eggs and egg dishes, vegetables, chips, fried and roast potatoes and fruit juice in those consuming school lunches. These patterns of consumption were reflected in the nutrient intakes with generally lower macronutrient and higher micronutrient intakes compared with the other groups. Primary school children consuming school lunches had the lowest sodium intake. In the primary school children consuming packed lunches, a greater consumption of wholemeal bread, yoghurt, fromage frais and dairy desserts, meat and meat dishes, fruit and fats and oils was seen. This resulted in higher total sugar, intrinsic and milk sugars and vitamin C intakes (due to the higher fruit intakes), and high intakes of sodium likely to be due to the bread consumption. A high proportion of vitamin D and E was supplied by the packed lunches, probably due to the consumption of fats and oils in sandwiches. A greater consumption of white and other bread, crisps and savoury snacks and non-diet soft drinks was seen in the group consuming lunch out of school although numbers in this group were small. As a result of the food consumption patterns in this group, macronutrient intakes were generally highest while micronutrient intakes were lowest compared to the other groups. This group

had the highest intakes of NMES, probably due to the consumption of non-diet soft drinks and confectionery and high intakes of sodium mainly due to the consumption of white bread and crisps and savoury snacks.

For secondary school children, fewer differences were observed during the lunchtime period. Children consuming a school lunch had higher intakes of pasta, rice and pizza and soups and sauces with the lowest macronutrient intakes. Again, consistent with primary school children, secondary school children consuming packed lunches consumed greater amounts of fruit and yoghurt, fromage frais and dairy desserts, although numbers were small in this group. High intakes of total sugars and intrinsic and milk sugars can again be attributed mainly to higher fruit intakes in this group. Secondary school children consuming lunch out of school consumed a greater amount of processed meat and non-diet soft drinks. Consistent with primary school children, this group had the highest macronutrient intakes and the lowest micronutrient intakes with high intakes of total sugars and NMES likely to be due to intakes of non-diet soft drinks.

Differences observed in the proportion of primary and secondary school children meeting the Dietary Reference Values<sup>8</sup> generally followed the same pattern as the mean intakes described above. The proportions meeting the new Scottish Nutrient Standards for School Lunches<sup>3</sup> were low across all age and lunch groups but lower in secondary school children. The differences observed in food consumption and nutrient intake during lunchtime in the primary school children highlight the significant benefits of the school lunch as the healthier option. This finding is particularly pertinent to children from lower income or materially deprived families who often have a greater dependence on school meals in terms of micronutrient content. For secondary school children the healthier option is less clear but evidence presented here suggests packed lunches may offer the healthiest option although numbers in this group were small and should be interpreted with caution.

In 1999/2000 school lunches and packed lunches were compared in children aged 7 years.<sup>10</sup> The results revealed that, as with the present study, both types of school meals compared unfavourably with dietary guidelines available at that time. Children who consumed school lunches had higher lunchtime intakes of protein, NSP and most vitamins and minerals and lower intakes of energy, sugar and saturated fat than children consuming packed lunches. Mean intakes of iron and thiamin were higher in those consuming packed lunches. In comparison to the RNI, intakes were below

recommended levels for both groups for zinc, copper, magnesium and carbohydrate. Across the whole day, intakes of potassium and zinc were higher and intakes of sugar and saturated fat were lower in those consuming school lunches.<sup>10</sup> In terms of food intakes, the most commonly consumed foods in those consuming school lunches included buns, cakes and pastries, sausages, burgers and pies, pasta, rice and pizza and backed beans. In those consuming packed lunches the most commonly consumed foods included white bread, fat spreads, crisps, sweet biscuits and fruit. The authors concluded the packed lunches provided a less healthy nutrient profile compared to school lunches in this age group.<sup>10</sup>

Recently published was an evaluation of the contribution of school meals to food consumption and nutrient intakes of young people aged 4-18 years in England.<sup>11</sup> The evaluation involved secondary analysis of the 1997 NDNS of Young People aged 4-18 years<sup>5</sup> and comparison with the findings from English primary and secondary school meals surveys carried out in 2004-2005<sup>12,13</sup>. Both primary and secondary school surveys in England showed that, whilst most schools met the 2001 Department for Education and Skills food based guidelines regarding provision<sup>14</sup>, the choices that the children made were nutritionally poor and often included high fat foods, chips and potatoes cooked in fat and soft drinks. Comparing the food choices made in 1997 with those made in 2004 and 2005 revealed that choices appear to be worse now with many changes in a less healthy direction, particularly in secondary schools although the authors acknowledge some differences may be due to methodology. The children's choices consistently failed to meet the Caroline Walker Trust guidelines<sup>15</sup> which gave recommended nutrient contents of an average school meal expressed in terms of the Dietary Reference Values for food energy and nutrients for the UK.<sup>8</sup> The introduction of the new guidelines in 2001 appeared to have little effect on the promotion of healthy eating in schoolchildren at lunchtime since, when given the choice, youngsters chose less healthy options having an overall detrimental effect on overall diet.<sup>11</sup>

Comparing the results for the present study with that of primary and secondary school children in the 1997 NDNS (which were split by sex), in terms of percentage of the Dietary Reference Values, primary school children in the present study had a higher percent of the EAR for energy (range 98-103% vs. 91-93%), vitamin C (range 300-400% vs. 252%-256%), calcium (range 177-180% vs. 134-149%) and zinc (range 96-104% vs. 81-89%). Intakes as a percentage of the DRV were similar for protein, vitamin A, folate, iron and sodium. A similar pattern was observed in

secondary school children with the exception of folate with higher intakes in the NDNS. Three groups of pupils – those living in households in receipt of benefits, those in receipt of free school meals and those not having breakfast had the poorest patterns of food consumption and nutrient intakes.<sup>11</sup>

Other research has indicated that a common problem with school meals is the failure to meet recommended guidelines. A comparison of two schools in England recently published concluded that, on average, children were served and consumed inadequate levels of many nutrients with 11 of the 17 nutrient guidelines not met in either school.<sup>18</sup>

A qualitative study involving semi-structured interviews with children aged 13-14 years living in disadvantaged areas in Scotland revealed that it was a dislike for queuing for food, the children's ability to budget for food at school and their desire to maximize time spent with friends that influenced food choice most. Girls in the study reported spending longer over lunchtime than boys and were also more likely to leave the school at lunchtime and walk to the local shops to buy food. Those children who went home for lunch reported that the reasons for this included breaking up the day, temporarily escaping and financial reasons (which included not wanting to take up their free school meal entitlement).<sup>19</sup>

A number of factors require further consideration when interpreting the results presented in this report. The most important factor to consider is the number of days of dietary data. The analysis presented here is based on one day of data only, and since individuals do not typically consume the same type and quantity of food and drink on a daily basis, error may be introduced when insufficient days are assessed to represent usual consumption covering weekdays and weekends. This may be more relevant to micronutrient intake rather than macronutrient intake, however, any loss of precision is likely to be consistent across the lunch groups so is not likely to affect cross group comparisons. For group estimates, the number of days is unlikely to have an important influence on mean or median estimates, provided the number of respondents in the group is reasonable, about 30 or more. Sample bases for some of the lunch groups were small, particularly in the 5-11 year olds consuming lunch out of school (n=19 unweighted), and in 12-17 year olds consuming a packed lunch (n=15 unweighted) and results in these groups should therefore be interpreted with caution as highlighted throughout the results. Where the number of consumers of a food is low and bases are small, it is recommend that readers do not place too much

emphasis on the levels of significance, but use them to give an indication of where the main differences between the lunch groups lie.

For analysis in relation to cut-offs (e.g. percentage of respondents not meeting the Lower Reference Nutrient Intake (LRNI))<sup>8</sup>, fewer days of information is likely to generate a different (usually higher) estimate of those falling below a given value. For this reason, comparisons in relation to percentage of respondents not meeting the LRNI have not been included here.

As described in the methods, a number of items of food and drink were classified using a school code during non-term time. There are a number of possible explanations for this including interviewer coding error or school-based holiday clubs. Additionally, since the child's home address was matched to the local education authority, no account was taken of children attending private schools or schools in different areas which could have had different term dates. Since no further verification of the data was possible, the corresponding subjects were removed from the data file. The main report of the survey itself showed a number of differences in food consumption and nutrient intake across the SIMD groups. Therefore, some of the differences observed in this report may be due partly to differences in the SIMD distribution across the lunch groups (see Table 3.4).

The collection of place names for each food or drink or eating and drinking occasion during the 24-hour recall was an effective and informative method that identified not only the place the food item was consumed but also the source of the item. The collection of place and source data would be relatively easy to introduce into dietary surveys and, if introduced into surveys carried out in children, would allow for continuous monitoring and comparisons with recommendations such as the Scottish Dietary Targets, Dietary Reference Values and the new food and nutrient standards for school lunches. Secondary analysis on past dietary surveys using the 24-hour recall with place and source data may also enable further comparisons to be made, utilizing this data source.

### **3.5 CONCLUSION**

As demonstrated by the results presented here, it is important to consider school lunches within the context of the whole day since on many occasions patterns observed during lunchtime were not reflected across the whole day. There appears to be a need to improve food and nutrient intakes of children taking all types of lunch at school, on or off the premises, and also of foods consumed out of school hours.

Our data have suggested that the group that appears to be worst off in terms of food consumption and nutrient intake is the group consuming food off the school premises at lunchtime, and this was the case for both primary and secondary school children. Generally, there were fewer differences than expected between the types of school lunches: primary school children tended to have a slightly healthier diet if they consumed school lunches, probably due to the restricted choices available at lunchtime, while for secondary school children, those consuming packed lunches appeared to have healthier diets, again most likely to be related to an increase in lunchtime food choices, although numbers in this group were small. One suggestion for the apparently healthier school lunches in the primary school children may relate to the date of implementation of the Hungry for Success guidelines which came into force in 2003 for primary schools in Scotland but not till 2006 for secondary schools.

The comparison against the Scottish Nutrient Standards for School Lunches revealed a low percentage of children meeting the standards across the age and lunch groups for most nutrients, highlighting the need for further research to identify strategies to improve their nutritional quality. Overall, there does not appear to be a single group that requires particular attention but a need to direct improvements at all school children living in Scotland. Further understanding of the barriers to meeting the nutritional strategies would provide useful insight. The introduction of the Schools (Health Promotion and Nutrition) Act 2007 is likely to have a significant positive effect on the nutritional quality of food provided in primary and secondary schools in Scotland in the future, and will hopefully increase school meal uptake and influence the food choices children make. It is recommended that the analyses carried out within this report should be used as a benchmark for comparison.

### 3.6 REFERENCES FOR SECTION 3

1. School meals in Scotland. Scottish Executive, 2007. Available at: <http://www.scotland.gov.uk/Resource/Doc/178917/0050919.pdf>
2. Hungry for Success - A Whole School Approach to School Meals in Scotland: Final Report of the Expert Panel on School Meals. 2002, updated 03/2006. Available at: <http://www.scotland.gov.uk/Publications/2003/02/16273/17566>
3. Schools (Health Promotion and Nutrition) (Scotland) Act 2007 - Nutritional Requirements. 2008 Available at: <http://www.scotland.gov.uk/Topics/Education/Schools/HLivi/foodnutrition>
4. Consultation Findings of Improving the Health and Nutrition of Scotland's Children: Schools (Nutrition and Health Promotion) (Scotland) Bill. 2006. Available at: <http://www.scotland.gov.uk/Publications/2006/09/08092433/8>
5. Gregory J, Lowe S, Bates CJ, Prentice A, Jackson LV. National Diet and Nutrition Survey; Young People aged 4-18 years. London : The Stationery Office, 2000.
6. Nelson M, Erens B, Bates B, Church S, Boshier T (eds). Low Income Diet and Nutrition Survey. London, TSO, 2007.
7. Nelson M, Atkinson M, Meyer J. Food portion sizes: a photographic atlas of food portion sizes. London: Food Standards Agency, 1997.
8. Department of Health. Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. London: HMSO, 1991. [Report on Health and Social Subjects: 41].
9. <http://www.scotland.gov.uk/Publications/2006/10/13142739/0>
10. Rogers IS, Ness AR, Hebditch K, Jones LR, Emmett PM. Quality of food eaten in English primary schools: school dinners vs packed lunches. *Eur J Clin Nutr* 2007; 61: 856-864.
11. Nelson M, Lowes K, Hwang V and member of the Nutrition Group, School Meals Review Panel, Department for Education and Skills. The contribution of school meals to food consumption and nutrient intakes of young people aged 4-18 years in England. *Publ Health Nutr* 2007; 10 (7); 652-662.
12. Nelson M, Bradbury J, Poulter J, Mcgee A, Mseble S, Jarvis L. School Meals in Secondary Schools in England. London: Department for Education and Skills, 2004.
13. Nelson M, Nicholas J, Suleiman S, Davies O, Prior G, Hall L et al. School Meals in Primary Schools in England. London: Department for Education and Skills, 2006.
14. Department for Education and Skills (DfES). Guidance to caterers for school lunch standards. London: DfES, 2001.
15. The Caroline Walker Trust. Nutritional Guidelines for School Meals. Report of an Expert Working Group. London: The Caroline Walker Trust, 1992.

16. Gatenby LA. Nutritional content of school meals in Hull and the East Riding of Yorkshire: a comparison of two schools. *J Hum Nutr Diet* 2007; 20; 538-548.
17. Wills W, Backett-Milburn K, Gregory S, Lawton J. The influence of the secondary school setting on the food practices of young teenagers from disadvantaged backgrounds in Scotland. *Heath Educ Res* 2005; 20 (4); 458 – 465.

### 3.7 APPENDIX FOR SECTION 3

**Table A3.1. Percentage of nutrient intake consumed during lunchtime weekday term time, for children aged 5-11 and 12-17, by type of lunch**

Nutrient		5-11 years				12-17 years			
		Type of lunch				Type of lunch			
		School lunch %	Packed lunch %	Lunch out of school %	p value	School lunch %	Packed lunch %	Lunch out of school %	p value
Energy	Mean	26	30	31	0.351	26	26	31	0.166
	SD	11	9	17		11	10	11	
Protein	Mean	33	31	30	0.855	26	31	26	0.400
	SD	14	10	21		16	9	15	
Fat	Mean	25	31	33	0.238	28	26	31	0.453
	SD	13	13	23		14	17	17	
Carbohydrate	Mean	26	29	29	0.266	26	26	32	0.134
	SD	12	10	15		14	10	12	
Non-starch polysaccharide	Mean	27	31	28	0.467	24	26	28	0.433
	SD	14	13	19		12	12	13	
Total sugars	Mean	26	31	31	0.412	20	28	34	<b>0.033</b>
	SD	17	15	19		19	18	18	
Non-milk extrinsic sugars	Mean	27	30	30	0.833	21	24	36	<b>0.046</b>
	SD	25	19	23		23	20	21	
Intrinsic and milk sugars	Mean	28	35	28	0.207	15	33	29	<b>0.003</b>
	SD	21	20	20		12	20	22	
Saturated fatty acids	Mean	25	31	32	0.216	27	28	30	0.825
	SD	16	15	22		17	18	18	
Vitamin A	Mean	32	31	25	0.513	37	26	30	0.053
	SD	23	22	17		23	17	25	
Folate	Mean	28	22	18	0.064	25	28	24	0.518
	SD	15	11	16		14	14	15	
Vitamin C	Mean	33	31	25	0.555	21	34	20	0.102
	SD	27	24	30		26	25	23	
Iron	Mean	24	22	21	0.729	22	24	25	0.730
	SD	12	11	14		12	13	13	
Calcium	Mean	32	29	27	0.643	23	36	27	0.137
	SD	20	15	18		17	18	18	
Sodium <sup>a</sup>	Mean	27	38	37	<b>0.010</b>	34	28	32	0.547
	SD	14	13	23		17	10	19	
Zinc	Mean	31	32	29	0.847	27	30	24	0.338
	SD	15	14	21		16	11	15	
Base (weighted)		35	43	17		29	15	41	
Base (unweighted)		38	48	19		27	15	37	

<sup>a</sup> Does not include sodium from salt added at the table

**Table A3.2. Average nutrient intake as a percentage of the Dietary Reference Value\* at lunchtime only and over the full day, during weekday term time, for children aged 5-11, by type of lunch**

Nutrient		Lunchtime only				Full day			
		Type of lunch				Type of lunch			
		School lunch %	Packed lunch %	Lunch out of school %	p value	School lunch %	Packed lunch %	Lunch out of school %	p value
Energy	Mean	26	29	30	0.642	98	99	103	0.819
	Median	24	27	28		96	96	98	
	SD	14	11	16		29	28	33	
Protein	Mean	76	70	61	0.698	231	231	214	0.547
	Median	62	67	54		187	221	207	
	SD	59	28	44		135	82	77	
Vitamin A	Mean	40	27	19	0.152	126	119	73	0.051
	Median	21	16	14		73	74	55	
	SD	52	35	20		149	124	49	
Thiamin	Mean	51	59	40	0.155	216	223	223	0.894
	Median	44	48	37		212	196	227	
	SD	34	39	28		81	89	84	
Riboflavin	Mean	40	34	29	0.462	180	181	184	0.979
	Median	37	28	18		148	174	186	
	SD	31	20	28		95	84	90	
Vitamin B <sub>6</sub>	Mean	56	44	32	0.049	219	212	199	0.625
	Median	45	43	36		209	203	209	
	SD	43	23	23		81	78	92	
Vitamin B <sub>12</sub>	Mean	151	96	90	0.274	487	471	493	0.916
	Median	104	79	53		440	447	498	
	SD	157	71	107		251	244	254	
Folate	Mean	44	29	25	0.025	161	149	147	0.657
	Median	36	26	20		141	137	137	
	SD	34	14	19		72	56	68	
Vitamin C	Mean	94	118	72	0.108	300	400	339	0.120
	Median	52	64	25		278	338	279	
	SD	88	121	87		172	271	287	
Iron	Mean	26	26	24	0.943	115	126	124	0.685
	Median	23	27	24		99	107	117	
	SD	16	11	17		53	54	52	
Calcium	Mean	57	50	46	0.731	177	179	180	0.991
	Median	53	39	39		140	183	173	
	SD	48	32	40		93	78	85	
Magnesium	Mean	35	36	31	0.780	124	124	119	0.890
	Median	30	34	30		105	114	104	
	SD	25	17	19		67	51	46	
Sodium <sup>a</sup>	Mean	58	80	80	0.092	221	216	227	0.918
	Median	55	70	56		192	199	193	
	SD	33	46	68		107	110	113	
Potassium	Mean	51	38	32	0.205	159	151	132	0.230
	Median	35	34	32		141	137	136	
	SD	47	21	24		96	73	52	
Zinc	Mean	32	32	26	0.674	98	104	96	0.647
	Median	26	28	24		88	95	96	
	SD	31	16	21		55	43	39	
Base (weighted)		35	43	17		35	43	17	
Base (unweighted)		38	48	19		38	48	19	

\*Estimated Average Requirement (EAR) for Energy and Reference Nutrient Intake (RNI) for all other nutrients.

<sup>a</sup> Does not include sodium from salt added at the table

**Table A3.3. Average nutrient intake as a percentage of the Dietary Reference Value\* at lunchtime only and over the full day, during weekday term time, for children aged 12-17, by type of lunch**

Nutrient		Lunchtime only			p value	Full day			p value
		Type of lunch				Type of lunch			
		School lunch %	Packed lunch %	Lunch out of school %		School lunch %	Packed lunch %	Lunch out of school %	
Energy	Mean	25	26	26	0.944	97	99	85	0.052
	Median	25	23	24		90	94	80	
	SD	11	14	12		31	32	27	
Protein	Mean	44	50	35	0.072	174	161	138	0.074
	Median	40	43	33		176	142	126	
	SD	31	31	22		71	69	47	
Vitamin A	Mean	26	25	24	0.869	77	108	83	0.706
	Median	18	13	14		69	77	60	
	SD	25	32	30		57	97	77	
Thiamin	Mean	45	41	40	0.791	168	188	163	0.241
	Median	42	38	29		147	179	138	
	SD	24	28	42		72	73	74	
Riboflavin	Mean	18	34	21	0.208	133	133	113	0.281
	Median	15	21	16		118	130	105	
	SD	16	27	22		77	70	50	
Vitamin B <sub>6</sub>	Mean	67	45	31	0.276	212	180	146	0.076
	Median	46	47	25		180	163	148	
	SD	146	32	31		168	98	58	
Vitamin B <sub>12</sub>	Mean	90	115	60	0.205	362	404	260	0.083
	Median	43	61	26		288	289	224	
	SD	150	183	77		270	406	148	
Folate	Mean	23	26	22	0.644	99	102	87	0.424
	Median	19	21	17		90	86	84	
	SD	13	18	20		47	58	34	
Vitamin C	Mean	40	84	85	0.266	288	270	244	0.890
	Median	19	50	18		154	139	142	
	SD	73	99	251		332	383	358	
Iron	Mean	15	17	17	0.529	71	79	71	0.709
	Median	13	16	14		64	87	73	
	SD	8	10	11		33	34	25	
Calcium	Mean	25	48	23	0.229	106	122	90	0.139
	Median	17	38	16		95	96	83	
	SD	24	55	18		54	103	36	
Magnesium	Mean	19	25	19	0.274	81	86	69	0.029
	Median	16	21	19		72	89	68	
	SD	9	16	10		27	35	18	
Sodium <sup>a</sup>	Mean	52	58	46	0.580	153	200	140	0.047
	Median	51	42	44		150	188	129	
	SD	28	46	31		52	94	61	
Potassium	Mean	18	19	16	0.575	85	77	67	0.089
	Median	16	21	13		82	78	66	
	SD	12	11	12		34	30	20	
Zinc	Mean	22	29	19	0.294	89	94	79	0.423
	Median	17	19	17		76	73	81	
	SD	14	32	12		39	73	21	
Base (weighted)		29	15	41		29	15	41	
Base (unweighted)		27	15	37		27	15	37	

\*Estimated Average Requirement (EAR) for Energy and Reference Nutrient Intake (RNI) for all other nutrients.

<sup>a</sup> Does not include sodium from salt added at the table

**Table A3.4. Percentage of children aged 5-11 and 12-17 meeting the Scottish Nutrient Standards for School Lunches based on one day only,<sup>a</sup> by type of school lunch**

Nutrient	5-11 years <sup>b</sup>				12-17 years <sup>c</sup>			
	Type of lunch		Lunch out of school		Type of lunch		Home, Friends, Relatives or other	
	School lunch % meeting rqts.	Packed lunch % meeting rqts.	Lunch out of school % meeting rqts.	p value	School lunch % meeting rqts.	Packed lunch % meeting rqts.	Home, Friends, Relatives or other % meeting rqts.	p value
Energy	12	25	0	<b>0.000</b>	12	0	24	<b>0.019</b>
Protein	88	98	71	<b>0.034</b>	62	79	58	0.343
Total fat	69	73	53	0.538	65	79	66	0.486
Saturated fat	61	55	43	0.415	57	46	51	0.741
Total carbohydrate	28	45	38	0.341	15	28	31	0.415
Non-milk extrinsic sugars	44	31	39	0.495	64	45	37	0.123
Non-starch polysaccharide	24	26	31	0.855	14	26	11	0.529
Iron	17	16	23	0.858	3	16	5	0.530
Calcium	62	72	60	0.695	27	59	29	0.185
Vitamin A	38	22	15	0.182	26	15	24	0.699
Vitamin C	71	76	52	0.171	38	75	38	<b>0.006</b>
Folate	61	36	33	<b>0.021</b>	26	20	15	0.465
Sodium <sup>d</sup>	74	48	53	<b>0.034</b>	52	66	69	0.464
Zinc	35	38	32	0.907	22	16	18	0.856
Base (weighted)	35	43	17		29	15	41	
Base (unweighted)	38	48	19		27	15	37	

<sup>a</sup> Schools (Health Promotion and Nutrition) (Scotland) Act 2007- Nutritional Requirements. 2008.

<sup>b</sup> Primary school nutrient standards applied

<sup>c</sup> Secondary school nutrient standards applied

<sup>d</sup> Does not include sodium from salt added at the table

rqts. = requirements.

**Table A3.5. Total number of Scottish Nutrient Standards for School Lunches<sup>a</sup> met as a percentage based on one day only, by children aged 5-11 and 12-17 and type of lunch**

Number of School Lunch Nutrient Standards met	5-11 year olds			12-17 year olds		
	Type of lunch		Lunch out of school	Type of lunch		Lunch out of school
	School lunch %	Packed lunch %	%	School lunch %	Packed lunch %	%
1	-	-	-	-	-	3
2	-	-	-	6	-	5
3	-	2	17	14	7	11
4	10	6	31	22	22	25
5	16	23	12	33	18	25
6	15	19	13	13	37	21
7	24	17	9	5	-	5
8	15	23	5	3	-	-
9	16	-	9	-	9	5
10	5	10	-	4	7	-
11	-	-	4	-	-	-
12	-	-	-	-	-	-
13	-	-	-	-	-	-
14	-	-	-	-	-	-
Mean	6.85	6.61	5.42	4.82	5.70	4.74
SD	1.71	1.74	2.24	1.71	1.94	1.69
Base (weighted)	35	43	17	29	15	41
Base (unweighted)	38	48	19	27	15	37

<sup>a</sup> Schools (Health Promotion and Nutrition) (Scotland) Act 2007- Nutritional Requirements. 2008.

- No observations.

## Section 4. Implications for Health Improvement

This analysis extends the findings from the main report on the Survey of Sugar Intake among children in Scotland. Distinct dietary patterns could be identified in school-age children, which differed slightly between age and sex groups. Although the main survey found little evidence for socio-economic differences in fat or NMES intake, clear associations were found between the dietary patterns and socio-economic factors, which suggests that food-based dietary guidelines may need to focus on different foods in different socio-economic sub-groups.

Meeting the target for NMES, total fat and saturated fatty acids was positively associated with 'healthier' dietary patterns and inversely associated with 'unhealthy' dietary patterns. In order to meet dietary targets, a high intake of 'healthier' foods should be combined with a lower intake of 'unhealthier' foods, therefore the focus should be on improving the balance of intake from all major food groups rather than on focusing on particular foods such as confectionery or fruit and vegetables.

The results of the present survey also highlight the very low numbers of children who are meeting the Scottish Dietary Targets particularly for NMES and saturated fatty acids which points to a need to address this for all children. There was a lack of a significant association between the education level of the main food provider and children's intakes of either total fat or saturated fatty acids. This would suggest that whilst the diets of children with more highly educated mothers may contain less NMES, they are no healthier in terms of intakes of fat, although the sources of fat may differ. The Agency has recently launched a public health campaign to raise awareness of the health risks of eating too much saturated fat: the evidence presented in this report has confirmed that this message applies to children as well as adults. The fact that all children who met the saturated fat target also met the total fat target supports the focus on changing saturate fat intake.

There were no consistent associations between dietary patterns and obesity, but the lack of an association should be interpreted with caution as the data is cross-sectional and no adjustment has been made for possible dieting and/or under-reporting.

The secondary analysis has in addition provided some more information on children's behaviour which has implications for public health policy in Scotland. Analysis of daily meal patterns of the children who completed a diet diary suggested that a pattern of three meals and two snacks was typical in all age and sex subgroups. This analysis also found little evidence that children in this group were not eating breakfast. Although 'breakfast' could include sweets or crisps, the majority of children were consuming traditional breakfast foods such as breakfast cereals which were eaten on 61% of the days recorded. Since there was a lower response rate for completing a diet diary, some bias in favour of those children with 'better' diets is possible in this analysis. Nevertheless, it is feasible that school breakfast clubs and/or the existence of easily prepared breakfast foods have helped to ensure that the majority of children do not start the school day hungry.

Snacks contributed around one-fifth of the total energy intake of the children which is similar to results of other studies (see Section 2). Although more than two-thirds of children ate fruit as part of a snack, snacks still contributed proportionately more saturated fatty acids and NMES than meals.

The contribution of snacks to the overall dietary intake of children in Scotland may warrant further investigation. It may be useful to gather more data on the snacks consumed and where they are obtained from, in order to provide evidence to policy makers on the current habits of parents and children in relation to snack foods so that advice can be appropriately targeted.

The Nutritional Requirements for Food and Drink in Schools (Scotland) Regulations 2008 now limits the types of snacks provided within school. The present study suggests that the same message needs to be applied to the rest of the day if children are to meet the nutritional recommendations for long-term health.