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A cross sectional survey of children's packed lunches in the UK: food and nutrient based results.

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Abstract

Background: Standards for school meals were recently introduced in the UK, however no such standards exist for packed lunches. This study measures the provision and consumption of a range of food types and nutrients in British children's packed lunches and compares the results with the prevailing school meal standards in England.

Methods: Cross-sectional survey data was collected from 1294 children, age 8 to 9 years, attending 89 British primary schools. 87 primary schools declined to take part in the study. The outcomes were the weight of food types and nutrients, provided and consumed in packed lunches and the proportion meeting the government food and nutrient school meal standards for England.

R**esults:** 14 out of 1294 (1.1%) of packed lunches met all the food based standards for school meals in England. 85% of children were provided with a sandwich, 19% with vegetables, 54% with fruit, 17% with cheese, 44% with a milk based dessert, 82% with restricted snacks (crisps or confectionery) and 61% with a sweetened drink. The nutrient standards most likely to be met were protein and vitamin C. The nutrient standards least likely to be met were non milk extrinsic sugars (NMES) and sodium. Girls were provided with, and consumed more, fruit, vegetables and milk based desserts. Children at schools with higher percentage free school meals eligibility (% FSME) were provided with, and consumed more, vegetables.

Conclusion: Few packed lunches meet the school meal standards. Future research should address policy, interventions, and programmes to educate parents about the nutritional content of packed lunches.

What is already known on this topic

The contents of packed lunches are poor in terms of food types and nutrient levels. New government requirements for school meals in England have recently been introduced generating concern that packed lunches will increasingly lag behind school meals in terms of their nutritional quality.

What this study adds

Accurate multi-level analysis of the contents of children's packed lunches across the UK. A comparison of children's packed lunches with the prevailing standards set for school meals. The vast majority of children brought packed lunches to school which did not meet the school meal standards for foods or nutrients.

Introduction

Obesity is a complex public health issue that is a growing threat to children's health. Obesity levels have doubled in the last 20 years with one in three British children now over weight, [1] prompting improvement of children's diets as a key element of current UK public health policy.[1] Causes of childhood obesity are multi-factorial and complex, however it is generally agreed that a sedentary lifestyle and diets too high in energy dense foods are major contributing factors. [2-6]

In response to research demonstrating that children do not make healthy food choices at lunchtime when faced with less healthy choices, [7] new standards for school meals were proposed by the School Meals Review Panel (SMRP), which formed in 2005. The report by the SMRP in October 2005, 'Turning the Tables' [8] proposed radical changes which would prohibit or restrict foods high in salt, sugars and fats, or made with poor quality meat, being served at school, and set minimum levels for the nutritional content of school meals. The new government standards largely adopt the SMRP and School Food Trust advice and recommendations. [9] Since September 2006, all school meal services in local authority schools in England have had to meet the interim food based standards and contain a portion of the following five food types; protein rich food, low fat starchy food, vegetables, fruit and dairy food. In addition, certain foods are restricted and lunches prepared at school cannot contain confectionery, savoury snacks or drinks other than water, pure fruit juice or milk. Since September 2008 standards for 14 nutrients, including energy, must be met in primary schools, together with the final food based standards. [9] An average school lunch must provide no more than the maximum amount for fat, saturated fat, NME sugars and sodium and must provide at least the minimum amount for carbohydrate, protein, fibre, vitamin A, vitamin C, folate, calcium, iron and zinc. Independent schools are expected to comply and regions across the UK have set up similar standards. If a packed lunch type meal is provided by the school, it must also follow the government standards for school meals.

On average around half of school pupils in the UK take a packed lunch from home, [10] which are not covered by the new school meal standards. According to Mintel, [11] this equates to 840 million lunches packed for children each year in the UK. With concerns over the nutritional content of school meals recently on the political agenda, packed lunches have been viewed by many parents as a healthier alternative. However, School Lunch Box Surveys in 2003 and 2004, commissioned by the Food standards Agency [12, 13] revealed that the majority of children did not bring packed lunches to school which met the prevailing school meal standards at the time. The 2004 survey found that a serving of fruit was contained in half of lunch boxes. In contrast, three quarters of packed lunches included a packet of crisps or a chocolate bar or both. Further studies, in the UK and elsewhere,

which have investigated food and nutrient based contents of packed lunches, have reported similar findings, with the most common features of packed lunches being that they are low in fruit and vegetables [14, 15] and high in fats, sugars and sodium. [14, 16, 17]

Packed lunches provided by schools must now meet the government food and nutrient based standards. Despite recent improvements in meals provided at school there are no plans to enforce similar requirements in lunches provided by parents. However, the food and nutrient based standards for school meals are used as a benchmark in this paper to assess the quality of packed lunches in this survey.

This cross sectional study is part of a cluster randomised controlled trial aiming to improve the food and nutrient content of children's lunch boxes [18, 19] and constitutes the baseline data collection for the trial. This study is unique, in that food and nutrients provided in the packed lunch are identified, as well as those consumed. The results are compared with the prevailing food and nutrient based standards for primary school meals introduced between 2006 and 2008 in England.

Methods

Recruitment and participants

Letters were sent to 176 randomly selected primary schools in the UK, stratified by region, inviting them to take part in a randomised controlled trial to improve the contents of children's packed lunches. Of these, 89 schools agreed to participate, 76 in England, 4 in Scotland, 6 in Wales and 3 in Northern Ireland. The schools in England were further stratified on two school variables to ensure a representative sample; the overall performance in the standard aptitude tests taken at key stage 2 (KS2 results) expressed as quintiles, and the percentage of free school meals eligibility (%FSME) for the whole school expressed as tertiles (up to 8%, up to 20% and above 20%). The remaining regions were not stratified as the numbers of schools involved were small. One class from year 4 (age 8 to 9 years) was randomly selected from each school and all children taking a packed lunch at least one day per week were eligible to participate. Children from this age group were chosen so that follow-up data could be collected one year later (end of year 4 to end of year 5). A letter was sent in May 2006 to all families requesting passive consent. Families were informed that an administrator would visit the school on one day in June 2006 to collect information on their child's packed lunch.

Data was collected from 1294 children by experienced National Foundation for Educational Research (NFER) administrators in June 2006. The 13 administrators were trained to work through the Lunch Box Evaluation questionnaire with each child. The questionnaire contained sections on drinks, sandwiches, vegetables, savoury foods, fruit and sweet foods, with a comprehensive list of food types within each section. The administrator weighed each food type provided in the packed lunch, without the container where possible, and recorded the weight of each food on the questionnaire. After lunch, remaining food portions were weighed to determine the weight of food consumed by each child. All the packed lunches of children in the same class were examined on the same day. Sandwiches were weighed in their entirety; an algorithm was then applied to estimate amounts of filling.

Analysis

The lunch box questionnaires were coded using the University of Leeds, Nutritional Epidemiology Group's in-house food composition analysis tool – DANTE, a Microsoft ACCESS based database which includes all of the McCance and Widdowson Composition of Foods tables, 6th edition [20] and additional recipe based foods. It has the potential for incorporating any new food items that are needed.

In order to deal with the complex variations in terms of possible sandwich composition a specific analysis approach was developed for this study. This took into account the wide variations in bread, filling and spread weights and was based on our knowledge of the weight of the complete sandwich. If the sandwich contained all three parts; bread, protein rich filling and spread, the proportions were broken down as 59%/33%/8% respectively, which are the proportions of each part of a meat or cheese sandwich based on average portion sizes. [21] If the sandwich contained a sweet non-protein filling, such as jam or chocolate spread the relative weights were 68%/19%/13% respectively. For savoury non protein filling (e.g. marmite), the relative weights were 80%/4%/16% respectively. If the sandwich had no filling the relative weights were 87% bread and 13% spread. All other foods in the packed lunch were weighed individually without a container wherever possible.

The weights of food types and levels of nutrients provided were compared with the food and nutrient government standards for school meals in England. The results for food types compared with standards are presented as the proportion meeting all government standards and the proportion meeting various elements of the food standards. Nutrients provided were compared with each individual nutrient standard for school meals as well as the proportion meeting all 14 nutrient standards.

Multilevel modelling was employed to take into account the clustering of children within schools using MlwiN version 2.1. [22, 23] This made it possible to obtain more accurate means and confidence intervals for each food type and nutrient allowing for the fact that pupils at the same school were likely to be provided with more similar lunches compared to those of pupils at a different school. The 80% power calculation estimated that 800 children were needed to detect a difference of 1.5% fat intake, estimating the intraclass correlation to be 0.03. [24] In addition, subgroup analysis was carried out to determine whether there were differences in food or nutrient provision or consumption by pupil gender or school %FSME (a measure of deprivation). No other data was collected at the pupil level. For the first group of models the outcome was an individual food type or nutrient with the intercept as a fixed effect. The second group of models included the same outcomes and intercept together with gender as a dummy variable and %FSME as high or low (below or above the median of 10%). Results for %FSME were adjusted for KS2 results as a continuous variable and percentage white British pupils (%wBr) as low or high (above or below the median of 90%). Mean values with 95% confidence intervals are reported for each food type and nutrient, both provided and consumed, for raw data in the first models and to determine the effects of gender and %FSME in the second group of models.

Results

Background

Data was collected from 663 boys and 631 girls. 15 children were recorded as absent and 3 did not give consent to take part in the study. 89% of the children had a packed lunch every day. The number of children who reported that they swapped their food with another child or otherwise obtained food from another source was less than 5%. The number of schools in each fifth for KS2 results, starting with the highest was 11, 19, 13, 18 and 10. The median for %FSME was 10% (the median for England and Wales is 18%). The range was 0 to 78%. The stratified sampling scheme ensured that participating schools were broadly representative of the UK in terms of region, %FSME and KS2 results.

Food types

Common examples and frequency of each food type provided in lunch boxes are in Table 2. Food types least likely to be provided in a packed lunch were permitted savoury or sweet foods, vegetables and permitted drinks. Food types most likely to be provided in a packed lunch were sandwiches, confectionery, savoury snacks and sweetened drinks. 873 (67.5%) children had a sandwich with a protein rich filling; the remainder had a low protein filling. On average, in terms

of energy, children consumed 76% of the contents of their lunch box provided. When provided, the food type with the lowest proportion eaten was fruit, and the food type with highest proportion eaten was confectionery. 140 (11%) children had vegetables outside the sandwich and 129 (10%) children had vegetables as part of their sandwich.

14 children (1.1%) met all of the standards for school meals and 66 (5.1%) children's packed lunches met the five healthy standards: a sandwich with protein filling (or alternative starchy and protein food), some vegetables, fruit, and a dairy product (Table 3). The median number of healthy food groups in a child's lunch box was three. The proportion of children meeting each individual healthy eating standard and provided with restricted items of food or drink are summarised in Table 3. 349 (27%) children had a lunch containing confectionery, savoury snacks and sweetened drinks. 105 (8.1%) had none of these restricted items. 227 (18%) children were provided with a lunch containing no confectionery or savoury snacks. 519 (40%) children had a lunch containing both confectionery and savoury snacks.

The effects of gender and %FSME on provision and consumption of food types are shown in Table 4. Girls, on average, were provided with 6g more vegetables and consumed 4g more vegetables, were provided with 11g more fruit and consumed 12g more fruit, were provided with 13g more milk based desserts and consumed 10g more milk based desserts. Boys, on average, were provided with 3g more permitted cakes and biscuits and consumed 2g more permitted cakes and biscuits. Children attending schools with low %FSME were provided with 5g more vegetables and consumed 4g more vegetables on average and consumed 27g lower weight of sweetened drinks. The difference in the weight of sweetened drinks provided was not statistically significant.

Nutrients

A comparison of nutrients provided in packed lunches with school meals standards for England, revealed that fewer than half of children met the standards for energy, saturated fat, non-milk extrinsic sugars (NMES), non starch polysaccharides (NSP), sodium, Vitamin A, folate, iron or zinc (see Table 5). The nutrient standards most likely to be met were protein, vitamin C and total carbohydrate, all with minimum standards. The nutrient standards least likely to be met were energy, sodium and non-milk extrinsic sugars (NMES), all with maximum standards. No nutrients were significantly different for girls or children in schools with lower %FSME (Table 6).

Discussion

This is the first survey of its type to weigh packed lunch foods, and as such provides high quality information, not only on food provided but also on food consumed by children at lunchtime, which

has then been compared with the recently introduced food and nutrient based standards in England. [9]

Food types

The foods least likely to be found in packed lunches were vegetables or permitted savoury food such as pasta. Food types most commonly present in packed lunches were sandwiches, confectionery, savoury snacks and sweetened drinks. 1% of children's packed lunches met all the food based school meal standards for school meals in England, evidence that the quality of food in children's packed lunches is poor. This is partly due to the fact that packed lunches, by definition, only contain foods that can be packed for the day. Few lunches contained all five healthy food groups (starch, protein, vegetables, fruit and dairy) but most lunches contained restricted foods and drinks such as crisps or cakes.

Few children were provided with vegetables or salad in their lunch; similar to previous studies. [14] Fruit was more popular than vegetables with half of children provided with fruit in their lunch in agreement with previous surveys between 1997 and 2004 [10, 12-14] and evidence of little change in recent years. The mean portion size of vegetables and fruit provided was less than an 80g portion recommended in the UK 5-a-day campaign with boys, provided with, and consuming the least. Children attending schools with higher levels of % FSME were provided with and consumed lower weights of vegetables but not fruit. Government advice recommends five portions of fruit and vegetables per day to reduce the risk of heart disease and some cancers. This may be more difficult to achieve if intake is less than two portions at lunch time. [25] There is evidence that children taking school meals, before the school meals standards were introduced, had a higher average vegetable intake, [14] although the same study found lower fruit intakes in children having school meals. Children having a school meal are currently required to have fruit and vegetables provided every day although this is no guarantee that they will consume them. [26]

The most common drinks provided in a packed lunch were sweetened drinks such as squash or ready made fruit drinks that do not comply with the school meal standards. Children in schools with high eligibility for free school meals consumed higher levels of sweetened drinks. Evidence exists that sweetened drinks increase energy intake and are associated with increased weight gain as food intake is not reduced to compensate for the additional energy from drinks. [27-29] All children must now have access to drinking water at school, raising the issue of whether children on packed lunches need to take a drink to school. However, children provided with fruit juice may have higher intakes of vitamin C.

There is some indication that the number of children having savoury snacks and some types of confectionery such as sweets, have decreased between this survey and the FSA survey in 2004. However, overall levels of confectionery do not appear to have changed. More than three quarters of children continue to be provided with snacks restricted in school meals with boys consuming higher levels of confectionery on average. In our opinion restrictions set by schools on selected restricted snack foods may inadvertently increase other types of confectionery or savoury snacks; therefore care should be taken in school policies to introduce a holistic approach rather than concentrating on one food type.

Previous packed lunch surveys assumed that all food provided would be consumed. However, this study found that a quarter of food was left uneaten. Some parents may be over providing which could lead to over eating. Children have been found to eat more if larger portions are provided. [30] Another reason for the large left over rate is that children do not eat to satiety due to time constraints in school.

Nutrients

The mean energy of lunches provided was significantly higher than the school meal requirements for school meals, although children consumed less than provided, resulting in mean energy consumption below the recommended level for this age group (assuming 30% of total intake at lunch time). Requirements are higher for boys at this age and a higher energy intake would be expected. However this was not the case in this study. Protein levels were more likely to meet the standard than any other nutrient and remain broadly unchanged compared with the 2004 FSA survey. [13]

Around half of the children had packed lunches with total fat levels in excess of the school meal standard however considerably fewer children met the standard for saturated fat than for total fat. Total fat and saturated levels appear to have decreased since the 2004 survey [13] where levels were estimated to be 38% and 50% higher respectively. In recent years the manufacturing industry has endeavoured to reduce the total fat and saturated fat content of a number of foods including crisps, cakes and biscuits. The reduction in levels of fats is unlikely to be due to a reduction in levels of snack food provided as there is no evidence that sweet and savoury snacks in packed lunches have decreased in popularity in recent years.

Total carbohydrate provision was similar to levels recommended, however more than half the total was from sugars. Fewer children met the standard for NMES than for any other nutrient (excluding

energy). This was due to the large portions and high frequency of sweetened drinks, confectionery and milk based desserts provided in packed lunches. The packed lunches were, on average, low in starch, resulting in low fibre levels. A packed lunch high in fat and sugar may have a negative impact on the whole day's intake. Previous research undertaken before the introduction of school meal standards concluded that children who take a packed lunch have higher fat and sugar intakes on average for the whole day, not just at lunch time and lower levels of starch and NSP compared to children having school meals. [14]

Very few children met the standard for sodium. Salt levels in bread and savoury snacks have reduced in recent years and the mean sodium content was lower than in the 2004 survey. [13] The main sources of sodium are cheese and savoury snacks however other common packed lunch foods such as bread, sandwich fillings, cakes and biscuits are also important contributors. Foods such as savoury snacks that are high in salt offer little in the way of protein, vitamins or minerals and for this reason are restricted in school meals. Consumption of dairy products such as cheese is encouraged to improve calcium intake, although cheese snacks that encourage large portions (more than 20g) may be contributing too much salt and little benefit in terms of calcium if calcium intakes are already adequate. Sandwiches are useful sources of protein, vitamins and minerals and should not be restricted to reduce sodium intake.

Levels of calcium and vitamin C were more likely to meet the standard than levels of vitamin A, folate, iron and zinc. Adequate levels of iron may be hard to achieve in packed lunches as the majority of iron comes from carcass meat and fortified cereals, both of which are eaten at other meal occasions. Fruits and vegetables are good sources of vitamin A, folate and zinc and an increase in these foods could lead to an improvement in the levels of these micro-nutrients.

This study provided an accurate assessment of the food provided and consumed by children at lunchtime. However, there were two possible sources of error. Sandwiches were weighed in their entirety requiring an estimate of the individual components using average portion sizes, a common method in estimating dietary intake. [31] Secondly, some items could not be separated from their containers such as drinks in bottles and salads in containers. This may have led to a slight overestimation of food provided to children, although food consumed was accurate as container weight was taken into account.

In our opinion the results of this study are gene ralizable to all children of this age in the UK. Half the schools approached declined to take part; however participating schools were similar in terms of

% FSME and Key stage 2 results to schools that declined to participate. The participating schools broadly reflect the profile of the total UK sample in terms of region although there were fewer participating schools from Scotland than in the original sample. This may have been due to Scottish schools concentrating on increasing school meal uptake as part of 'Hungry for Success'. Data on packed lunches was collected for one day only, which varied by school, ensuring data collection was spread throughout June 2006 for the whole sample. Parents were unlikely to have changed the content of their child's lunch due to the study as they were informed of the study weeks beforehand and did not know which day data would be collected.

Conclusions

In conclusion, few packed lunches met the school meal standards. Children were provided with packed lunches low in fruit and vegetables, although most included a sandwich. The majority of packed lunches included savoury snacks, confectionery, or both. Since 2004, there may have been some improvements in the nutritional profile of packed lunches due to changes in the composition of some manufactured foods; however there has been no improvement in children's packed lunches in terms of the types of food provided.

Future research should address policy, interventions, and health promotion programs that educate parents about the nutritional content of packed lunches as well as strategies for packing a healthy lunch. Standards for school meals, introduced from 2006 to 2008 are producing drastic improvements in lunches supplied by primary schools, leading to a widening of the gap between school meals and packed lunches, unless action is taken by schools, parents, children and food manufacturers.

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Tables

Table 1: characteristics of the 89 responding and 87 non-responding schools in terms of region, % FSME and KS2 results

Characteristic	Non- responding schools		Rresponding schools	
	N	Percent	N	Percent
Region				
England	69	79.3	76	85.4
Wales	3	3.4	6	6.7
Scotland	12	13.8	4	4.5
Northern Ireland	3	3.4	3	3.4
Tertiles of % FSME				
Lowest	26	30.2	32	36.0
Middle	30	34.9	28	31.5
Highest	30	34.9	29	32.6
% FSME (median)	15	4	13	
Quintile of KS2 results				
Lowest band	11	16.2	9	12.2
2nd lowest band	17	25	18	24.3
Middle band	12	17.6	14	18.9
2nd highest band	12	17.6	21	28.4
Highest band	16	23.5	12	16.2

Table 2: Number and percentage of pupils provided with each food type including mean weight and CI of each food type provided and consumed.

Food type provided	N	%	Most common examples	Weight provided (g)	95% CI	Weight consumed (g)	95% CI	% consumed
Sandwich (Bread type)	1102	85.2	White sliced, white rolls, wholemeal	95.5	91.7 to 99.4	74. 5	70.8 to 78.1	78
Permitted savoury food	45	3.5	Pasta, pizza, chicken	7.0	4.22 to 9.77	3.8	2.2 to 5.3	54
Vegetables/salad	246	19.0	Cucumber, carrot, tomato	9.21	7.52 to 10.91	6.73	5.45 to 8.01	73
Fruit	694	53.6	Apples, grapes, banana	70.4	63.5 to 77.3	37.3	32.2 to 42.4	53
Cheese	215	16.6	Cheese string, cheese dip	7.0	5.65 to 8.37	5.25	4.2 to 6.3	75
Milk based desserts	573	44.3	Fromage frais tube, yoghurt pot	38.4	35 to 41.7	32.6	29.5 to 35.7	85
Savoury snacks	777	60.0	Potato crisps/chips, corn based snacks	16.4	15.3 to 17.4	13.2	12.2 to 14.2	81
Confectionery	809	62.5	Chocolate biscuit/cookie, chocolate sponge bar, cereal bar	23.1	21.3 to 24.9	19.9	18.4 to 21.5	86
Permitted cakes & biscuits	194	15.0	Plain biscuits with no chocolate, flapjack,	6.5	5.26 to 7.67	5.26	4.3 to 6.3	81
Permitted drinks	397	30.7	Milk (flavoured or plain), pure fruit juice, water	104	92 to 117	61.6	53.8 to 69.3	59
Sweetened drinks	787	60.8	Carbonated drinks, squashes, cordials, fruit flavoured drinks	209	195 to 223	132	123 to 141	63

Table 3: Comparison of lunch box food provided, with school meal food based standards for England

Food group standards met	School meal standards for England	N meeting standard	% meeting standard	95% CI
All food standards		14	1.1	0.6 to, 1.7
5 healthy food groups		66	5.1	3.8 to 6.9
Individual healthy food groups				
Starch	include	1123	86.8	84.6 to 88.9
Protein	include	872	67.4	64.6 to 70.9
Fruit	include	694	53.6	49.4 to 57.8
Dairy	include	685	52.9	49.8 to 56.4
Vegetables	include	246	19.0	16.0 to 21.7
Restricted items				
Confectionery	exclude	809	62.5	59.7 to 66.2
Drink	exclude	787	60.8	57.9 to 65
Savoury snack	exclude	777	60.0	56.8 to 64.2

Table 4 Mean differences in weights of food types provided and consumed by girls compared to boys, and by pupils at schools with high %FSME compared to low %FSME adjusted for school KS2 results and ethnicity

	Effect size of Gender (g)				Effect size of %FSME (g)			
Food type provided	**Food provided**	**95% CI**	**Food consumed**	**95% CI**	**Food provided**	**95% CI**	**Food consumed**	**95% CI**
Starch and protein foods								
Sandwich total	-3.8	-10.4 to 2.8	-1.1	-6.8 to 4.6	3.9	-5.9 to 13.7	3.5	-5.6 to 12.7
Permitted savoury Foods	4.2	-0.7 to 9.1	2.2	-0.7 to 5	-3.7	-10.3 to 3	-1.8	-5.8 to 2.3
Fruit and vegetables								
Vegetables/salad	5.6	2.7 to 8.5	3.9	1.7 to 6.0	-5.1	-9.1 to -1.1	-4.1	-7.1 to -1.1
Fruit	10.7	1.4 to 20	11.8	5.7 to 18	-12.2	-29.7 to 5.3	-9.6	-22.7 to 3.4
Dairy food								
Cheese	-0.6	-3.1 to 1.9	-0.4	-2.3 to 1.6	-3.0	-6.4 to 0.4	-1.4	-3.9 to 1.2
Milk based dessert	12.6	6.6 to 18.6	10.3	5 to 15.5	5.4	-3.3 to 14.2	4.4	-3.6 to 12.4
Drinks:								
Pure fruit juice, water or milk	-0.2	-21.2 to 20.7	4.6	-8.5 to 17.8	-25.8	-58.2 to 6.6	-13.7	-32.5 to 5.2
Sweetened drink	1.2	-21.8 to 24.1	-1.8	-16.9 to 13.3	19.6	-16.1 to 55.3	26.6	3.7 to 49.5
Other foods								
Savoury snacks	-0.4	-2.4 to 1.5	0.2	-1.6 to 2	0.6	-2.1 to 3.3	1.4	-1.2 to 3.9
Confectionery	-0.6	-3.6 to 2.4	-0.2	-2.8 to 2.4	-0.2	-4.9 to 4.5	-2.1	-6.0 to 1.9
Permitted cakes & biscuits	-3.3	-5.6 to -1.1	-2.0	-3.8 to -0.2	-2.5	-5.7 to 0.6	-2.8	-5.4 to -0.2

Table 5: Levels of nutrients provided and consumed and comparison of nutrients provided with school meal nutrient based standards for England

Nutrient (units)	Mean provided	95% CI	School meal standards for England		% meeting standard	95% CI	Mean consumed	95% CI
Energy (kcal)	624	607 to 641	530	30% EAR	11.8	10.0 to 13.8	475.2	459 to 491
Protein (g)	18.1	17.4 to 18.7	7.5	≥30% RNI	92.8	90.8 to 94.4	13.8	13.2 to 14.4
Total fat (g)	21.0	20.2 to 21.9	20.6	≤ 35% energy	54.7	51.4 to 58.0	16.9	16.1 to 17.7
Saturated fat (g)	8.3	7.9 to 8.6	6.5	≤11% energy	42.6	39.5 to 45.7	6.7	6.4 to 7.0
Total carbohydrate (g)	95.7	93.1 to 98.3	70.6	≥50% energy	77.0	74.2 to 79.6	70.7	68.3 to 73.0
NMES* (g)	39.6	37.9 to 41.2	15.5	≤11% energy	18.5	16.4 to 20.8	29.3	28.0 to 30.5
NSP** (g)	3.6	3.5 to 3.8	4.2	≥ 30% RNI	32.8	29.3 to 36.5	1.7	1.5 to 1.8
Sodium (mg)	742	710 to 774	499	≤ 30% SACN	19.4	16.7 to 22.4	542.9	514 to 572
Vitamin A (µg)	67.9	52.0 to 83.8	175	≥ 35% RNI	23.6	21.3 to 26.1	50.7	38.7 to 62.6
Vitamin C (mg)	33.5	29.3 to 37.7	10.5	≥ 35% RNI	84.1	81.2 to 86.5	20.7	18.1 to 23.4
Folate (µg)	47.8	45.4 to 50.2	53.0	≥ 35% RNI	41.8	38.8 to 45.0	33.9	31.7 to 36
Calcium (mg)	230	219 to 242	193	≥ 35% RNI	63.6	60.1 to 66.9	169.9	159 to 181
Iron (mg)	2..2	2.1 to 2.3	3.0	≥ 35% RNI	24.8	21.8 to 28.1	1.6	1.5 to 1.7
Zinc (mg)	1.8	1.7 to 1.9	2.5	≥ 35% RNI	27.9	25.3 to 30.6	1.3	1.2 to 1.4

NMES*=Non Milk Extrinsic Sugars
NSP**=Non Starch Polysaccharides

Table 6 Mean differences in levels of nutrients provided and consumed by girls compared to boys and by pupils at schools with high %FSME compared to low %FSME adjusted for school KS2 results and ethnicity

	Effect size of Gender (g)				Effect size of %FSME (g)			
Nutrient	**Nutrient provided**	**95% CI**	**Nutrient consumed**	**95% CI**	**Nutrient provided**	**95% CI**	**Nutrient provided**	**95% CI**
Energy (kj)	-44	-142 to 54	1.81	-87.9 to 91.6	-53	-222 to 116	-30	-206 to 146
Energy (kcal)	-9.5	-32.4 to 13.5	0.39	-18.9 to 19.7	-5.68	-44.7 to 33.3	-6.4	-44.3 to 31.5
Protein (g)	-0.8	-1.7 to 0.2	-0.27	-1 to 0.5	-0.40	-1.8 to 1	-0.2	-1.5 to 1.2
Total fat (g)	-0.9	-2.2 to 0.3	-0.30	-1.3 to 0.7	0.12	-1.9 to 2.1	-0.2	-2.1 to 1.7
Total fat as % of E	-1.0	-2.2 to 0.2	-0.71	-2 to 0.6	-0.23	-2.1 to 1.6	-0.4	-2.5 to 1.7
Saturated fat (g)	-0.5	-1.1 to 0.1	-0.15	-0.6 to 0.3	0.17	-0.7 to 1	0.0	-0.8 to 0.8
Saturated fat as % of E	-0.5	-1.1 to 0.1	-0.34	-1.1 to 0.4	-0.19	-1 to 0.6	-0.3	-1.2 to 0.7
Total carbohydrate (g)	0.5	-3.4 to 4.3	1.08	-2.1 to 4.2	-1.38	-7.9 to 5.1	-1.2	-7 to 4.7
Total sugar (g)	2.4	-0.6 to 5.4	1.67	-0.5 to 3.9	-0.18	-5.2 to 4.8	-0.3	-4.3 to 3.7
NMES (g)	0.7	-2.1 to 3.5	0.30	-1.8 to 2.4	2.56	-1.6 to 6.7	2.3	-0.8 to 5.4
NMES as % of E	1.5	0 to 2.9	0.47	-1.1 to 2	2.05	-0.2 to 4.3	2.7	0.4 to 5.1
NSP (g)	0.0	-0.2 to 0.2	0.01	-0.2 to 0.3	-0.40	-0.8 to 0	0.1	-0.3 to 0.4
Sodium (mg)	-66.8	-113 to -20.4	-33.80	-72.6 to 5	-17.50	-93.4 to 58.4	1.9	-66.6 to 70.4
Vitamin A (µg)	30.9	-1.9 to 63.7	17.86	-5.3 to 41	-12.32	-52.8 to 28.2	-0.8	-29.3 to 27.8
Vitamin C (mg)	3.5	-2.3 to 9.3	1.10	-2.8 to 5	-8.78	-19.8 to 2.2	-3.6	-10.6 to 3.4
Folate (µg)	3.0	-0.8 to 6.7	2.61	-0.3 to 5.5	-1.14	-7.3 to 5	-0.7	-5.9 to 4.5
Calcium (mg)	-3.5	-23.2 to 16.3	1.25	-15.2 to 17.7	1.96	-26 to 29.9	4.8	-21.7 to 31.3
Iron (mg)	-0.1	-0.2 to 0	-0.03	-0.1 to 0.1	-0.07	-0.3 to 0.1	-0.1	-0.3 to 0.1
Zinc (mg)	-0.1	-0.2 to 0	-0.02	-0.1 to 0.1	-0.01	-0.2 to 0.2	0.0	-0.2 to 0.2

NMES*=Non Milk Extrinsic Sugars
NSP**=Non Starch Polysaccharides

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