

The impact of the food-based and nutrient-based standards on lunchtime food and drink provision and consumption in primary schools in England

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Abstract

Objective: To assess lunchtime provision of food and drink in English primary schools and to assess both choices and consumption of food and drink by pupils having school lunches. These findings were compared with similar data collected in 2005.

Design: Cross-sectional data collected between February and April 2009. In each school, food and drink provision, including portion weights and number of portions of each item served at lunchtime, were recorded over five consecutive days. Caterers provided school lunchtime menus and recipes.

Setting: England.

Subjects: A random selection of 6696 pupils having school lunches in a nationally representative sample of 136 primary schools in England.

Results: Compared with 2005, schools in 2009 provided significantly more fruit, fruit-based desserts, vegetables and salad, water and fruit juice, and less ketchup, sauces and gravy, starchy foods cooked in fat, snacks and confectionery ($P < 0.01$). Pupils were also making healthier choices, choosing an average of 2.2 portions of fruit and vegetables from their 'five a day', but about one-third to two-fifths of these were wasted.

Conclusions: Lunchtime food provision and consumption in primary schools have improved substantially since 2005, following the introduction of new standards for school food in 2008. However, improvements still need to be made to increase the Fe and Zn content and to decrease the Na content of recipes, and in encouraging pupils to eat more of the fruits and vegetables taken at lunchtime.

Keywords

Primary schools
School meals
England

Food-based and nutrient-based
standards

The prevalence of childhood obesity in the UK has increased substantially since 1995, with 16.5% of children aged 2–15 years reported to be obese (defined as BMI > 95th percentile of the 1990 UK reference population)⁽¹⁾. School meals play an important role in children's diet; lunches typically contribute between one-quarter and one-third of children's daily intake of energy and nutrients⁽²⁾. In 2009 the take-up of school lunches in primary schools was 39.3%⁽³⁾, representing an average of 1 636 833 primary-school children having school meals every day.

Improving the quality of school meals is vital for improving children's health, especially in the effort to decrease levels of obesity and future risks of related diseases such as diabetes and hypertension. Furthermore, improvements in diet may benefit children's concentration, behaviour and academic performance^(4–6). It is essential, therefore, that school meals provide sufficient energy and nutrients to support children's nutrition, growth and development, and academic achievement, and lay the foundations for healthy eating in adulthood.

In April 2001, the Department for Education and Skills introduced food-based standards (FBS) for school meals to improve their balance and nutritional quality⁽⁷⁾. A survey in 2005 of lunchtime food provision and consumption in primary schools in England showed that the nutritional profile of school lunches was poor; over half of pupils' lunches consisted of dishes high in fat, starchy food cooked in fat or oil (e.g. chips) and drinks containing sugar, and consumption of fruit and vegetables was below recommended levels⁽⁸⁾. In response to concerns about the poor quality of school meals and increasing levels of childhood obesity, the government established the School Meal Review Panel to revise guidelines for school meals and to set standards for the nutritional content of school lunches⁽⁹⁾. The panel proposed changes that would maximize the availability of healthier items such as fruit and water, prohibit or restrict foods or drinks high in salt, sugars and fat such as confectionery, crisps and high-sugar fizzy drinks, and limit the availability of deep-fried food from being served at school.

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From September 2008, catering provision in all primary schools in England was required to be fully compliant with the new FBS and nutrient-based standards (NBS) for school lunches^(10–13). Thirteen FBS are intended to increase access to healthier foods such as fruit, vegetables and bread, and to limit the availability of less healthy foods such as confectionery, snacks and high-sugar drinks. For example, at least one portion of fruit and one portion of vegetable must be provided at lunchtime for every pupil having a school lunch, and starchy food cooked in fat should not be provided more than three times per week across the school day. Fourteen NBS complement the FBS, ensuring that provision, for example, contains appropriate amounts of energy, adequate Fe, and not too much fat, sugar or salt.

To assess the impact of the introduction of new school food standards, the School Food Trust carried out a survey of a nationally representative sample of primary schools in England to assess: (i) catering provision of food and drink at lunchtime; (ii) pupils' choices and consumption of food and drink at lunchtime (including packed lunches); (iii) the nutrient content of school lunches; and (iv) compliance of provision with the standards for school food. The findings, reported in the present paper, are compared with those from a similar survey carried out in 2005⁽⁸⁾. Findings on packed lunches will be reported separately.

Methods

Sample

In September 2008 a random sample of 290 primary schools in England with at least 100 pupils⁽¹⁴⁾, stratified by region, school stage, school type and postcode, were approached and asked to take part in the study with the aim of achieving a representative sample of primary schools across England. Data from the previous survey in primary schools in England in 2005 indicated that 150 schools were sufficient in providing the variation across all the selection criteria, as required (such as school region); hence the aim was to replicate that in this survey⁽⁸⁾. Information sheets for both the head teacher and the caterer, along with school reply forms (confirming the school's consent), were collected. Of these, 139 schools (48%) agreed to take part; 107 schools declined, six schools withdrew and thirty-eight schools did not respond. Three schools were excluded from the analyses because they served only packed lunches. The final sample included 136 schools spread across all nine government regions, with catering provision that matched patterns seen nationally⁽³⁾.

Schools included primary and middle-deemed primary schools in England. Community, Voluntary-Aided, Voluntary-Controlled and Foundation Schools were included in the sample. Schools were excluded if they contained fewer than 100 pupils, if they served only packed lunches, or if

they had taken part in the previous survey of Primary School Meals⁽⁸⁾ or the School Lunch and Behaviour Study in primary schools⁽⁴⁾.

One week before fieldwork commenced, participating schools were sent information sheets to send to all parents/guardians informing them about the survey and asking them to reply only if they did not wish their child to take part. A list of these students was made available to the fieldworkers on the first day of data collection in each school. Consent from students at the time of data collection was verbal. Fieldworkers received two days training on sampling and data collection methods, which included recording and weighing food and drink items provided at lunchtime, and recording information about what items pupils chose and ate at lunchtime.

Schools were visited at lunchtime on five consecutive days between February and April 2009. Each day, fieldworkers recorded: all items served at lunchtime; the number of portions and weights of each item provided; and the number of pupils catered for. Nine per cent of portion numbers and 3% of portion weights were missing, and these were subsequently imputed from within the data set. These most frequently related to drinks and condiments.

Each day, fieldworkers selected ten school lunch pupils and five packed lunch pupils using a random selection technique. Fieldworkers recorded pupil-level information (age, sex and school year) and described all items taken and eaten by pupils. At the end of lunch, all participating pupils returned their tray or lunch box to the fieldworkers, who weighed any leftover items individually. A total of 6696 children (3251 boys; 3341 girls; 104 sex not recorded) aged from 3 to 12 years had data on school lunch recorded. The large number of observations of school lunch food choices (over 38 160) was sufficient to demonstrate differences in the amounts of foods chosen and eaten between pupils in different subgroups (by sex, age, year, school group, etc.).

Pupils who chose to have a second helping (0.3%) were assumed to be taking half the weight of the first portion. Children who did not return their leftover items to be weighed were assumed to have consumed all their meal. Weight eaten was estimated by subtracting leftover weight from the portion weight determined for each item taken. In 0.05% of cases (spread across a variety of food groups) the value was negative; it was assumed for these items that none of that particular item was consumed.

Ethical approval was granted from Kings College London Ethical Committee.

Data preparation

The Food Standards Agency nutrient databank provided the energy and nutrient data on food composition⁽¹⁵⁾. School lunch items were categorised into one of twenty-two different food groups (see Appendix). To allow comparisons with data collected in 2005, the 2005 data were re-coded to match the 2009 food group classification.

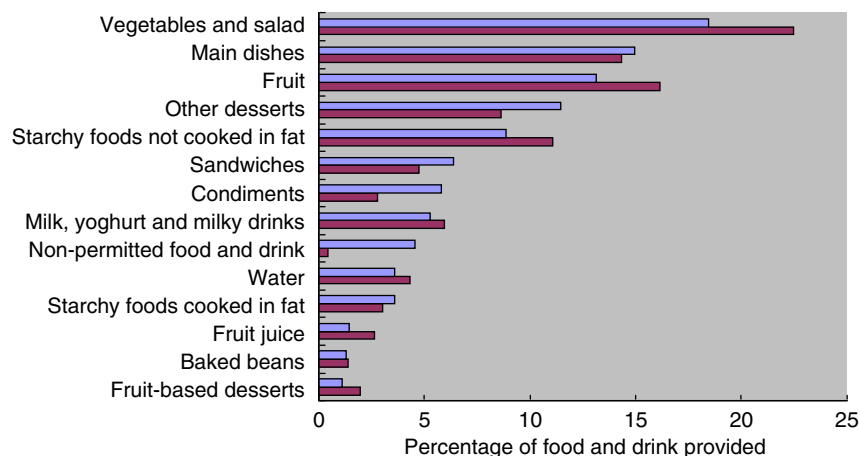


Fig. 1 Percentage of types of food and drink items provided by caterers at lunchtime, by food group, primary schools, England, 2005 (■) and 2009 (■). Each bar shows how many types of food or drink were provided in a given food group as a percentage of all items provided by the caterer at lunchtime. All differences were statistically significant at $P \leq 0.01$ except for main dishes and baked beans. Vegetables and salad included raw and cooked vegetables (but do not reflect the contribution from vegetables in main dishes). Fruit-based desserts contained an average of 40% fruit. Base (schools): 2005, n 151; 2009, n 136

Compliance with the standards was assessed against published regulations⁽¹⁰⁾. Compliance with the FBS was analysed in two ways: planned provision and actual provision. Planned provision related to provision of food at lunchtime based on data provided from full menu cycles; actual provision related to direct observations of school lunch provision in schools over the five days of fieldwork. Standards which required assessment over two or three weeks, such as those for meat products and oily fish, could not be assessed in relation to actual provision. Compliance of school meals with the NBS was based on actual provision. Separate NBS are available for infants and juniors; hence these have been reported separately.

Statistical analyses

Data were analysed using the SPSS statistical software package version 15 (SPSS Inc, Chicago, IL, USA). The χ^2 test was used to assess differences in food group availability between schools (e.g. by type of catering provider) or between years (2009 *v.* 2005). The independent-sample *t* test was used to compare differences in nutrients taken or eaten by different groups of pupils (e.g. males *v.* females, infants *v.* juniors).

Results

Food and drink provision at lunchtime

Figure 1 compares food provision at lunchtime, 2009 *v.* 2005, by food group, as a percentage of all types of food/drinks provided. Compared with 2005, schools in 2009 were providing significantly more vegetables and salad (4.0%; $P < 0.001$), fruit (3.0%; $P < 0.001$), starchy foods not cooked in fat (2.2%; $P = 0.004$), milk, yoghurt and milky drinks (0.7%; $P = 0.01$), water (0.7%; $P = 0.001$),

fruit juice (1.2%; $P < 0.001$) and fruit-based desserts (0.9%; $P < 0.001$). Conversely, schools in 2009 were providing significantly fewer desserts not containing fruit (-2.8%; $P < 0.001$), condiments (-3.0%; $P < 0.001$), starchy food cooked in fat (-0.6%; $P = 0.004$) and non-permitted items such as savoury snacks and confectionery (-4.1%; $P < 0.001$). There were no statistically significant differences in the provision of main dishes (0.6%; $P = 0.1$) or baked beans (0.1%; $P = 0.6$) between 2005 and 2009.

Food and drink choices of pupils having a school lunch

Similar trends were seen in pupils' food selection following changes in food/drinks provision (Fig. 2). In 2009, 21.8% more pupils took water, 14.7% more took vegetables and salad, 9.4% more took fruit juice, 8.4% more took fruit-based dessert, 7.2% more took starchy foods not cooked in fat, 6.5% more took fruit and 3.1% more took milk, yoghurt and milky drinks ($P < 0.001$). In contrast, 3.8% fewer pupils took other (non-fruit-based) desserts, 5.9% fewer took condiments, 7.2% fewer took starchy foods cooked in fat and 7.1% fewer pupils took items from the non-permitted group at lunchtime ($P < 0.001$).

Table 1 shows the percentage of pupils choosing food/drinks items, and the average weights taken and eaten from each of the twenty-two food groups. Approximately 80% of pupils in 2009 were taking meat, poultry, fish and main dishes providing the main source of protein in the meal. Over half (57.1%) took vegetables (not including vegetables in mixed dishes) and almost a quarter (22.9%) took salad. Just under 40% took fruit or a fruit-based dessert and 14.8% took fruit juice. Over half of pupils (51.3%) had plain water to drink. Only 10.9% of pupils took meat products (sausages, burgers, sausage rolls, etc.), and less than 4% of pupils took either drinks high

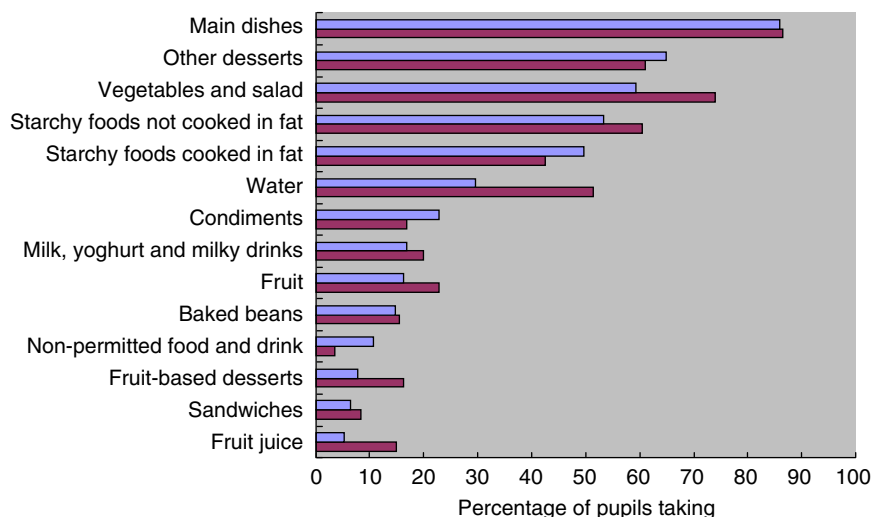


Fig. 2 Percentage of pupils having a school lunch who took specific items of food and drink, by food group, primary schools, England, 2005 (■) and 2009 (■). Each bar shows the percentage of pupils having a school lunch who took an item of food or drink from a specific food group. All differences were statistically significant at $P \leq 0.001$ except for main dishes and baked beans. Vegetables and salad included raw and cooked vegetables (but do not reflect the contribution from vegetables in main dishes). Fruit-based desserts contained an average of 40% fruit. Base (pupils): 2005, n 7166; 2009, n 6696

Table 1 Percentage of pupils taking specific food and drink items, weight as taken, weight as eaten and wastage, by food group, primary schools, England, 2009

Food group	Pupils taking %	Weight as taken		Weight as eaten		Plate wastage*		
		Mean g	SD g	Mean g	SD g	Mean g	SD g	%
Meat, poultry, fish	33.1	58.7	27.7	48.5	28.6	10.6	35.4	18.9
Meat product	10.9	79.8	38.0	69.5	35.4	10.5	27.3	11.3
Protein & carbohydrate	9.3	113.3	52.6	86.4	52.7	28.1	35.8	24.3
Protein & vegetable	9.3	107.1	35.2	77.6	46.1	30.5	39.1	31.0
Protein, carbohydrate & vegetable	21.4	113.6	62.9	85.0	59.9	29.6	35.1	25.1
Protein other	6.6	37.2	18.5	31.5	18.7	6.0	31.5	16.4
Carbohydrate & vegetable	5.4	101.8	52.5	69.6	51.8	33.7	43.9	34.6
Carbohydrate	60.4	86.0	56.3	61.5	49.6	25.7	38.1	28.3
Starchy foods cooked in oil	42.4	74.0	30.7	59.1	33.7	15.4	33.0	20.6
Vegetables	57.1	60.0	27.2	39.1	28.5	22.5	45.9	40.7
Salad	22.9	40.8	25.1	30.3	24.5	11.6	58.2	32.6
Baked beans	15.6	85.2	22.9	74.5	27.9	11.0	23.4	13.9
Sandwiches	8.4	84.9	55.2	66.3	52.7	19.2	41.0	27.3
Fruit	22.9	80.3	43.7	56.4	42.6	25.1	49.2	32.7
Fruit-based dessert	16.2	82.9	33.3	64.9	39.6	18.8	36.8	23.8
Other dessert & dessert accompaniment	61.0	85.8	52.7	74.7	52.7	11.8	29.7	14.9
Milk, yoghurt & milky drinks	20.0	134.9	52.6	110.3	56.3	24.7	27.7	17.4
Fruit juice	14.8	132.7	48.3	114.0	52.4	19.0	26.9	14.1
Water	51.3	124.0	30.5	93.6	47.6	31.8	40.6	26.1
Condiments	16.9	48.2	34.0	44.4	33.2	3.9	28.1	10.9
Non-permitted drink	3.0	145.9	29.7	123.2	47.2	22.7	27.3	15.5
Dessert containing confectionery	0.6	48.8	21.4	43.5	23.5	5.5	22.3	11.0

Base: 6696 pupils.

*The differences between 'weight as taken' and 'weight as eaten' were computed item by item within each food group, so the values are not equal to the differences between the averages as given in the table. This is likely to be a slight overestimate, as some measurements included containers (e.g. yoghurt pots) which could not readily be weighed separately from the wasted food itself during the weighing process in the dining room.

in sugar (3.0%) or snacks and confectionery (which was mainly in the form of chocolate chips in biscuits or cakes; 0.6%).

Girls chose more salad, fruit and milk, yoghurt and milky drinks than boys. Compared with infant aged pupils, those

in the junior age group chose proportionately more portions of protein- and carbohydrate-containing foods, baked beans, desserts (including fruit-based desserts) and water. Even though these reached statistical significance, the differences were very small (0.5%).

Wastage varied by type of item; lowest levels were observed for meat products, baked beans, condiments and dessert containing confectionery, and highest levels for vegetables, carbohydrate and vegetable dishes, fruit and salad. The average wastage of the food/drinks taken by pupils in 2009 was 24%, little different from 2005 (23%).

Table 2 shows that, on average, pupils were taking over two portions of fruit and vegetables per day (see footnote to Table 2 for definition of 'portion'). When all sources of fruit and vegetables were taken into account, across all pupils, an average of 2.2 portions were taken

and 1.6 portions eaten. Among 'consumers' (the 93.4% of pupils who took a fruit or vegetable item), an average of 2.3 portions were taken and 1.8 portions eaten. About 35% of pupils consumed at least 2 portions of fruit and vegetables on a given day, and over half consumed at least 1.5 portions.

Nutrient content of school lunches

Table 3 shows the mean energy and nutrient content of school meals 'as taken' and 'as eaten' by pupils in 2009, and 'as eaten' by pupils in 2005, and compares them with

Table 2 Number of portions of vegetables and fruit taken and eaten, by food group, primary schools, England, 2009

Food or drink	As served			As eaten		
	% taking	Consumers only	All pupils	% taking	Consumers only	All pupils
Vegetables, salad or dishes with vegetables	74.3	1.6	1.2	70.4	1.2	0.8
Baked beans and pulses	32.4	0.9	0.3	30.6	0.8	0.2
Fruit or fruit-based desserts	38.5	1.5	0.6	36.1	1.2	0.4
All foods containing vegetables, salad, baked beans, pulses or fruit (excluding fruit juice)	92.0	2.3	2.1	89.2	1.7	1.5
Fruit juice	14.8	0.8	0.1	14.5	0.7	0.1
All food and drink containing vegetables, baked beans, pulses or fruit (including fruit juice)	93.4	2.3	2.2	91.0	1.8	1.6

Base: 6696 pupils.

One portion of vegetable = 40 g; one portion of fruit = 40 g; one portion of fruit juice = 150 ml; one portion of beans and pulses = 40 g. Fruit juice, baked beans and pulses count as maximum of one portion per day.

Composite dishes contained an average of 28% vegetables; fruit-based desserts contained an average of 40% fruit.

Proportion of baked beans to pulses as served = 0.97.

Table 3 Mean energy and nutrient intakes from school lunches, as taken and eaten in 2009, and as eaten in 2005, infant and junior pupils, primary schools, England, compared with 2009 nutrient-based standards⁽¹³⁾

Nutrient	Nutrient-based standard	Infants			Juniors			
		2009		2005	2009		2005	
		As taken	As eaten	As eaten	As taken	As eaten	As eaten	
		Mean	Mean	Mean	Mean	Mean	Mean	
Energy (kJ)	1941–2145	2024	1547	1621	2212–2444	2077	1686	1839
Energy (kcal)	465–514	483.7	369.8	387.4	529–585	496.3	403.0	439.6
Protein (g)	5.9	18.4	14.0	13.2	8.5	18.8	15.2	14.8
Carbohydrate (g)	65.2	70.9	53.7	51.5	74.2	71.9	58.0	59.0
NMES (g)*	14.3	13.8	11.1	12.0	16.3	14.5	12.4	14.1
Fat (g)*	19.0	15.9	12.4	15.7	21.6	16.6	13.7	17.6
SFA (g)*	6.0	6.0	4.7	5.5	6.8	6.3	5.2	6.2
Fibre (g)	3.9	5.0	3.6	3.2	4.5	4.8	3.7	3.6
Na (mg)*	357	514.9	406.7	593.1	595	544.8	453.5	667.1
Vitamin A (µg)	140	348.5	244.9	185.8	175	326.7	240.8	195.6
Vitamin C (mg)	10.5	25.3	17.9	15.9	10.5	22.5	16.9	17.2
Folate (µg)	35	66.5	48.4	40.0	53	63.0	48.4	46.0
Ca (mg)	158	204	160.7	150.1	193	204.7	169.3	174.2
Fe (mg)	2.1	2.3	1.7	1.8	3.0	2.4	1.9	2.1
Zn (mg)	2.3	2.1	1.6	1.4	2.5	2.2	1.7	1.6
% of energy from								
Protein†	–	15.7	15.8	14.3	–	15.8	15.8	14.1
Carbohydrate	50	55.7	55.5	50.5	50	55	54.8	51.0
NMES*	11	10.2	10.9	11.6	11	10.4	11	12.0
Fat*	35	28.3	28.4	35.2	35	28.9	29	34.8
SFA*	11	10.6	10.8	12.4	11	10.9	11	12.3

NMES, non-milk extrinsic sugars.

Base (pupils): in 2009, 2482 infants and 4200 juniors – fourteen pupils could not be identified by age and were not included in the analysis; in 2005, 3035 infants and 4023 juniors.

*Maximum permitted value: to meet the standard, mean nutrient content should be below the value shown.

†No standard for percentage of energy to be met from protein.

the NBS (standards relate to provision rather than consumption; they provide a useful benchmark to indicate to what extent meals 'as taken' or 'as eaten' are likely to satisfy the nutritional requirements of children). In 2009, the average meal 'as taken' met the standards for both infants and juniors for protein, non-milk extrinsic sugars (NMES), fat, SFA, fibre, vitamins A and C, folate and Ca. Due to plate wastage, the nutrient content of meals 'as eaten' did not meet some of these standards. For example, the average meal 'as eaten' did not meet the NBS standard for fibre.

Infant meals 'as taken' met the standard for Fe, whereas junior meals 'as taken' did not, and the average meals 'as eaten' for both infants and juniors did not meet the standard for Fe. The Zn content of the average meals 'as taken' and 'as eaten' was below the standard for both infants and juniors. Infant meals 'as taken' and 'as eaten' exceeded the standard for Na, although junior meals 'as taken' and 'as eaten' met this standard.

Energy 'as taken' met the standards in infants but not in juniors, and the energy content of an average meal 'as eaten' was below the standard in both groups. The average meals 'as taken' and 'as eaten' by both infants and juniors met the standards for percentage of energy from carbohydrate, NMES, fat and SFA.

Differences between 2005 and 2009 show lower levels of NMES, fat, SFA and Na in 2009, and higher levels of vitamin A, folate and fibre, and (in infants) vitamin C and Ca. For example, the average infant lunch 'as eaten' had 32% more vitamin A and over 20% less fat in 2009 compared with 2005.

Compliance of provision with food-based standards and nutrient-based standards for school food

Food-based standards

Based on planned provision (i.e. over a full menu cycle), all schools met the standards for providing drinking water at all times, providing at least one portion of vegetable per day per child, and not providing snacks high in fat and salt (such as crisps). Over 80% of schools met the standards for providing healthier drinks such as fruit juice, extra bread without additional fat, at least one portion of fruit per day per child, at least one portion of oily fish in a three-week period, and restricting salt, condiments and confectionery.

In relation to planned provision, the standards least often met were for meat products (74%) and starchy foods cooked in oil (72%); about one-quarter of schools were still serving sausages, burgers and chips more often than they should. In 2005, starchy foods cooked in fat (including chips, roast potatoes, etc.) were served on average 4.4 d/week; in 2009, this had fallen to 3.4 d/week. The standard is not more than three times per week.

Only for two items, vegetables and fruit, was actual provision less likely to meet the standards than planned provision. Compliance with the fruit standard was assessed

against all fruit provided at lunchtime, including fruit as served, fruit juice and fruit in fruit-based desserts (containing an average of 40% fruit). Compliance with the vegetable standard was assessed against all vegetables provided at lunchtime, including vegetables as served (raw or cooked), portions of salad and in composite dishes including vegetables (containing an average of 28% vegetables). For vegetables, this shortfall was minimal: 58% of schools met the standard fully, a further 20% provided on average at least 90 portions of vegetables per 100 pupils, and only 7% of schools provided less than 80 portions per 100 pupils. For fruit, the shortfall was greater: 12% of schools provided a portion of fruit per pupil every day; a further 22% provided at least three-quarters of a portion; a further 34% at least half a portion; and about one-third of schools were providing less than half a portion of fruit per pupil per day.

Nutrient-based standards

The mean energy and nutrient content of an average school lunch were compared with the NBS for primary schools (Table 4). Over 80% of schools met the standards for protein, carbohydrate, dietary fibre, vitamins A and C, folate and Ca. Around one-half of schools met the standards for fat, Fe and Zn. The standards met least often were for energy, NMES and Na. The energy content of the average school meal was above the standard.

The average meal provided met ten of the fourteen NBS. Over 50% of schools met nine of the fourteen standards. One hundred and seventeen (86%) schools provided an average lunch that met between seven and ten standards, seventeen schools (13%) met more than ten, and only two schools (1%) provided meals that met fewer than seven standards.

Table 5 shows that when a school met a given standard, pupils were more likely to take and eat a meal that met that standard (all differences except for energy were statistically significant; $P < 0.004$). For example, in schools that met the standard for NMES, 74% of pupils took a meal that met the standard and 80% of meals as eaten met the standard. In schools that did not meet the standard, the values were 52% and 62%, respectively.

Discussion

The present survey is the first one to assess the impact of the new FBS and NBS on food and drink provided in primary schools in England, and to assess the changes in what pupils are taking and eating at lunchtime compared with 2005. The survey was carried out between February and April 2009, six to eight months after the standards became compulsory for primary schools in September 2008.

The results provide strong evidence that compared with 2005, lunchtime food provision and consumption in primary schools in England were healthier in 2009

Table 4 Energy and nutrient content of an average school lunch compared with nutrient-based standards, based on actual provision of food and drink, primary schools, England, 2009

Nutrient	Nutrient-based standard	Nutrient content of average meal		Schools meeting the nutrient-based standard	
		Mean	SE	n	%
Energy (kJ)	2104–2326	2620	54	24	18
Energy (kcal)	504–557	626.3	13.0	24	18
Protein (g)	7.5	23.7	0.5	136	100
Carbohydrate (g)	70.6	90.3	1.8	117	86
NMES (g)*	15.5	19.0	0.6	46	34
Fat (g)*	20.6	21.1	0.6	73	54
SFA (g)*	6.5	8.0	0.2	37	27
Fibre (g)	4.2	6.4	0.1	128	94
Na (mg)*	499	674.3	18.3	26	19
Vitamin A (µg)	175	505.7	17.7	135	99
Vitamin C (mg)	10.5	37.1	1.5	136	100
Folate (µg)	53	86.1	1.9	132	97
Ca (mg)	193	279.6	9.4	112	82
Fe (mg)	3.0	3.0	0.1	65	48
Zn (mg)	2.5	2.7	0.1	73	54
% of energy from					
Proteint	–	15.2	1.7	–	–
Carbohydrate	50	54.3	3.8	119	88
NMES*	11	11.4	2.7	73	54
Fat*	35	30.2	3.8	120	88
SFA*	11	11.4	1.8	54	40

NMES, non milk extrinsic sugars.

Base: 136 schools.

*Maximum permitted value: to meet the standard, mean nutrient content should be below the value shown.

†No standard for percentage of energy to be met from protein.

Table 5 Percentage of meals taken or eaten that met each of the nutrient-based standards according to whether the school did or did not meet the standard, primary schools, England, 2009

Nutrient	Meals taken that met standard			Meals eaten that met standard		
	School met standard (%)	School did not meet standard (%)	P	School met standard (%)	School did not meet standard (%)	P
Energy (kJ/kcal)	14	10	<0.001	7	8	0.233
Protein (g)*	98	–	–	87	–	–
Carbohydrate (g)	51	24	<0.001	29	11	<0.001
NMES (g)	74	52	<0.001	80	62	<0.001
Fat (g)	81	63	<0.001	89	75	<0.001
SFA (g)	75	55	<0.001	83	68	<0.001
Fibre (g)	57	27	<0.001	33	19	<0.001
Na (mg)	72	47	<0.001	83	61	<0.001
Vitamin A (µg)	55	34	0.004	41	20	0.002
Vitamin C (mg)*	73	–	–	56	–	–
Folate (µg)	73	42	<0.001	51	25	<0.001
Ca (mg)	54	28	<0.001	41	21	<0.001
Fe (mg)	41	30	<0.001	23	15	<0.001
Zn (mg)	41	23	<0.001	24	12	<0.001
% of energy from						
Proteint	–	–	–	–	–	–
Carbohydrate	74	55	<0.001	71	53	<0.001
NMES	52	32	<0.001	53	36	<0.001
Fat	77	54	<0.001	75	53	<0.001
SFA	68	46	<0.001	67	45	<0.001

NMES, non milk extrinsic sugars; – indicates no observations.

*All schools met the standards for protein and vitamin C.

†No standard for percentage of energy from protein.

following the introduction of the 2008 nutritional standards^(12,13). Caterers provided more vegetables and salad, starchy foods not cooked in fat, fruit, fruit juice and fruit-based desserts, and fewer desserts without fruit, starchy

foods cooked in fat and virtually no crisps and confectionery. This change in provision reflects the impact of a variety of actions undertaken by caterers and schools and their engagement with pupils and parents.

Overall, both planned and actual provision in the majority of schools met most of the FBS. Where there were lapses these were usually relatively minor, with the exception of meat products, starchy foods cooked in fat, vegetables and fruit. Based on follow-up conversations with caterers, most of the breaches of compliance relating to meat products and starchy foods cooked in fat were caused by caterers' misunderstanding about what constituted a meat product and whether foods were deep-fried in the manufacturing process. Despite the shortfall of schools meeting the standards for fruit and vegetables, pupils were taking more than 2 portions and eating 1.6 portions of fruit and vegetables at lunchtime. The wastage for these items, however, was in the range of 30–40%; similar levels of wastage were seen in 2005. Catering providers and dining room supervisors need to find more ways to encourage pupils both to finish the vegetables served and to provide fruit more often.

The NBS proved more difficult to meet, especially for energy, NMES, SFA, Na, Fe and Zn. The energy content of the average school lunch was higher than that recommended by the standard, and relatively few schools provided meals with energy levels within the limits of the standard. Because pupils did not consume all the food taken, the average meal eaten by pupils was below the standard. It is not clear whether the low energy content of meals as eaten means that some children may not have had enough to eat at lunchtime and in consequence went hungry at this meal, or if the pupils on average have energy requirements below the NBS and that school meals are making appropriate and proportional contributions to total energy intake. In light of the need to reduce levels of obesity, more needs to be done to explore whether or not the energy content of meals taken and eaten at lunchtime is consistent with the energy needs of pupils.

Although the consumption of NMES was on average lower in 2009 than 2005, the NMES content of the average meal was above the standard (i.e. not compliant). This does not reflect, however, the shift in sources of NMES from sweetened soft drinks, non-fruit-based desserts and confectionery towards fruit juice and fruit-based desserts. Similarly, the decrease between 2005 and 2009 in the levels of SFA in the average meal consumed (Table 3) reflects a shift away from meat products, starchy foods cooked in fat and savoury snacks. Increased compliance with the FBS for meat products and starchy foods cooked in fat should result in further decreases in the future and in a greater proportion of schools being compliant with the standard for both fat and SFA.

Even though only two school caterers reported using salt in cooking, the Na content of an average meal was higher than the standard. This is probably due to caterers continuing to use products high in Na (e.g. canned products in brine, stock, etc.). It is important to note, however, that although only twenty-six schools (19%) met the standard for Na, the Na content of meals taken and eaten by pupils

in 2009 was roughly one-third lower than in 2005. This reflects changes in cooking practices (i.e. caterers using recipes that have no added salt), a general reduction in the use of prepared products in school food catering as more cooking is done from scratch, and action reportedly taken by food manufacturers and wholesalers to decrease the salt content of their products. More effort is needed on all three fronts if the Na content of meals is to meet the standard.

Primary-school caterers were still finding it challenging to meet the minimum Zn and Fe content of an average school lunch. Caterers need to continue their efforts to increase the Fe and Zn content of meals by using Fe-rich and Zn-rich foods and by modifying their existing recipes to use alternative ingredients higher in Fe and Zn. As was the case for other nutrients, where catering provision met the standard, individual meals taken were also more likely to meet the standards (Table 5).

Children's eating habits develop at an early age and these dietary patterns are likely to persist into adolescence and adulthood⁽¹⁶⁾. It is not reasonable to expect children to make healthy food choices (as taught in the classroom) if at the same time they are regularly being offered less healthy choices (such as burger and chips) in the dining room. By changing the range of choice to include a higher proportion of foods associated with better health (e.g. vegetables, wholegrain cereals, starchy foods not cooked in fat), it is evident that children take and eat meals at lunchtime that are more likely to meet guidelines for healthy eating. This is further supported by restrictions on access to foods high in salt, sugar and fat (e.g. snacks, confectionery, sugary drinks, starchy foods cooked in fat). The impact of the introduction of the new standards is most evident in two of the analyses presented here. First, compared with the 2005 data (collected prior to the introduction of the new standards when, for example, items such as drinks high in sugar, confectionery and snacks were not restricted), there has been a clear and substantial shift in 2009 toward healthier food provision, selection and consumption in school at lunchtime (Figs 1 and 2, Table 3). Second, where schools have met a given standard, a significantly higher proportion of pupils are likely to take and eat meals that also meet the standard (Table 5).

The survey had a number of limitations. First, compliance with the standards in law relates to planned provision over a full menu cycle (typically three weeks). This study assessed compliance for both planned and actual provision. Ideally, planned and actual provision should be very similar, but in practice may not be. Only 113 schools were able to provide the necessary menus, portion numbers and recipes to assess planned provision fully. Conversely, 136 schools provided information on actual provision, but this was based on a one-week inventory. Two FBS require assessment over either two weeks (meat products) or three weeks (oily fish). Consequently these could not be assessed in relation to actual provision.

In addition, variations in provision over several weeks may not be reflected in a single week's inventory, so the levels of compliance with the standards could be either higher or lower than reported here. Second, it was not possible to compare the nutrient content of planned or actual provision in 2005 with 2009 because the 2005 inventory data included only a profile of the types of food and drink provided and not the total number of portions served.

Third, only 40% of recipes for main dishes were obtained and the information available on manufactured or prepared products was limited. It was necessary, therefore, to make some assumptions relating to recipe formulation and cooking methods, and this may have had an impact on the accuracy of the estimates of the nutrient content of meals provided. However, most of the information collected included detailed information on the composition of dishes, and it was therefore possible to create recipes for those that were missing or to use apparently similar recipes from other schools.

Finally, even though two typical portion weights of each item provided by schools were measured, there was, inevitably, an element of variation in portion sizes served to pupils within the same school that was not taken into account. Although this was likely to have little impact on the estimated average energy and nutrient content of meals (the nutrient content of some meals would have been overestimated if the portion size served to the pupil was smaller, or underestimated if the portion size served was larger than the portion weights measured, but this would have averaged out across all meals), it may have had a greater impact on the estimates of wastage.

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Appendix***Food group classification for school lunches***

Food group	Foods included
Meat, poultry, fish Meat products	Beef, chicken, fish, oily fish, pork, bacon, ham Corned meat, sausages, sausage rolls, burgers (that are not economy), chopped meat, kebabs, meat pies (double crust), pasties, meat puddings, meatballs, chicken/turkey nuggets, coated chicken
Protein & carbohydrate	Pasta bake
Protein & vegetable	Beef and vegetable casserole
Protein, carbohydrate & vegetable	Dishes made of a combination of meat/cheese/quorn, vegetable and rice/pasta/couscous/ potato, cheese and tomato pizza
Protein other	Cheese, eggs, quorn
Carbohydrate & vegetable	Pasta Neapolitan, pasta with vegetables, rice with vegetables
Carbohydrate	Rice, pasta, noodles, potato, bread, couscous
Starchy foods cooked in oil	Chips, roast potatoes, potato waffles, croquettes, sauté potatoes, potato wedges, garlic bread, fried bread, fried rice, Yorkshire puddings (including toad in the hole), pancakes, doughnuts
Vegetables	Cooked vegetables, e.g. carrots, broccoli, peas, sweet corn
Salad	Lettuce, cucumber, tomatoes, raw vegetables e.g. grated carrots, sweet corn
Baked beans	Baked beans
Sandwiches	School sandwiches including wraps
Fruit	Fruits (canned, dried or fresh), fruit salad
Fruit dessert	Dessert made with fruit (average of 40 % fruit), e.g. fruit crumble
Dessert & dessert accompaniment	Biscuits, pies, cakes and pastries, puddings, sponges, custard, ice cream
Milk, yoghurt and milky drinks	Milk including flavoured milk and milkshakes ($\geq 90\%$ milk, $< 5\%$ added sugar or honey), yoghurt, fromage frais
Fruit juice	Fruit juice (100 % fruit juice or diluted with water, not including blackcurrant juice)
Water	Water (still or carbonated; unsweetened, unflavoured)
Condiments	Gravy, savoury sauces and condiments, e.g. ketchup, mayonnaise
Non-permitted drink	Squash, soft drinks, blackcurrant juice, milkshakes ($< 90\%$ milk, $\geq 5\%$ added sugar or honey)
Non-permitted snack, confectionery and dessert containing confectionery	Crisps, chocolate chip desserts, cereal bars