Does nutrition education in primary schools make a difference to children's fruit and vegetable consumption?

Abstract

Objective: To explore whether initiatives to promote fruit and vegetables in primary schools are associated with changes in children's diet.

Design: Cross sectional dietary survey.

Setting: 129 English primary schools**.**

Participants: 2530 year two children (6-7 years)

Main outcome measures: Intake of fruit, vegetables and key nutrients; score for initiatives promoting fruit and vegetables in school.

Results: In schools running a gardening club children ate more vegetables; 120g (95% confidence interval, 111 to 129) compared to those that did not; 99g (95% confidence interval 90 to 109) and where parents were actively involved in school initiatives to promote fruit and vegetables, intake of vegetables was higher; 117g (95% confidence interval 107 to 128) compared to 105g (95% confidence interval 96 to 114). In schools that achieved a high total score (derived from five key types of initiatives to promote fruit and vegetables in school) children ate more vegetables; 123g (95% confidence interval, 114 to 132) compared to those that did not: 98g (95% confidence interval, 89 to 107).

Conclusion: Gardening, parental involvement and other activities promoting fruit and vegetables to children in school may be associated with increased intake of vegetables but not fruit. These effects were independent of deprivation status and ethnicity.

INTRODUCTION

As an integral part of the Five A Day campaign, the School Fruit and Vegetable Scheme (SFVS) is currently the largest national initiative to promote fruit and vegetables to children in England. Introduced into primary schools between 2002 and 2004, the scheme makes available one piece of fruit or a vegetable to children each school day for the first three years of school. The UK is not alone in introducing initiatives to promote children's intake of fruit and vegetables (1-3).

Several evaluations of the SFVS have shown an increased intake of fruit rather than vegetables while children participate in the scheme but when no longer eligible children's intake falls (4-6). In schools without the SFVS children's intake of fruit and vegetables fall as they progress from Reception (4-5 years) through to Year Two (6-7 years) (7).

To maintain and improve existing intakes of fruit and vegetables from Reception to Year Two and beyond it seems important for schools to extend initiatives to promote fruit and vegetables over and above the provision of free school fruit in Key Stage One (4-8 years).

Many English primary schools have embraced this idea and found opportunities for children to learn more about fruit and vegetables through lessons in the formal curriculum and extra curricular activities. For example, the National Curriculum enables children to learn about fruit and vegetables in Science; Design and Technology; Personal, Social, Health Education and Citizenship. Geography, English and Art also provide some educational opportunities for children to learn about fruit and vegetables (8).

Outside the formal curriculum children can learn about fruit and vegetables through growing and cooking activities. The Royal Horticultural Society, for example, has spearheaded a national campaign called Grow It, Cook It, Eat It. This campaign encourages schools to set up growing activities in school which lead to cooking and eating opportunities for those children (9). The School Food Trust is also running a £20 million 'Lets Get Cooking' campaign to help children learn relevant cooking and food preparation skills (10).

Research has shown practical activities such as cooking and gardening facilitate behaviour change in children (11;12).

Practical activities undertaken with peers and staff in school may help young children to overcome some children's natural fear of new food, known as food neophobia (13). This may occur through modelling appropriate eating behaviour, repeated exposure to foods, providing encouraging and supportive environments for eating and practical activities which help children become more familiar with foods (14-16).

New School Food Standards have been introduced to improve the nutritional quality of food served at school. Provision has been made to increase the amount of fruit and vegetables in school lunches and place restrictions on the provision of food with low nutritional value, such as chips, confectionary and soft drinks (10;17). These standards are compulsory however children are still at liberty to bring a packed lunch which does not conform to the new standards. A recent intervention to improve the food and nutritional value of children's lunch boxes has found that only 19% of children met the food based guidelines for vegetables and 54% for fruit. (18).

The content and nutritional value of what children eat outside of school is the responsibility of parents and other adult carers. There is some evidence that when children eat more fruit at school they eat less at home (19).

The National Healthy Schools Programme also addresses the promotion of fruit and vegetables as part of a healthy diet. This voluntary scheme sets targets for schools to achieve in four areas including Healthy Eating and leads to National Healthy School Status (20).

Schools are at liberty, in consultation with their governing bodies, to write and implement a policy on food in their school which many have done. Some schools include parents in their initiatives to improve school food through correspondence with them and by involving them in activities such as cooking and growing. These arrangements for educating children about fruit and vegetables and their value in a healthy diet vary across English schools. Apart from the impact of the SFVS on the diet of young children, little is known about whether these initiatives have an effect on children's intake of fruit and vegetables and the nutritional composition of their diets.

The aim of this research is to explore whether children's intake of fruit and vegetables is related to school initiatives to promote fruit and vegetables.

METHODS

Sampling methods

The sample was drawn from maintained schools containing pupils in Years Two to Four with a minimum year group size of 15 pupils. Independent schools, special schools, schools without all three years, and small schools with less than 15 pupils per year group were excluded. The National Foundation for Educational Research (NFER) was responsible for recruiting schools and collecting data. Schools that had or were participating in other NFER projects were excluded.

A random national sample was stratified by ethnicity, deprivation, educational achievement, and region of England:

Power calculations suggest 2200 children would give approximately 90% power to detect a difference of 0.33 portions of fruit per day based on a comparison of mean fruit intake in schools with a high proportion of children eligible for FSM to those with a low eligible proportion.

Results from our initial evaluation of the SFVS found a 68% response from pupils completing the CADET food diary (4). To allow for this loss to follow up 130 schools will be recruited with an estimated total of 3 250 children available.

129 schools were accepted to take part in the study. A letter was sent to parents or guardians of children in year two, two weeks in advance of the data collection, giving information about the study and providing the opportunity for children to be withdrawn from the study. Ethical approval was granted by the University of Leeds Research Ethics Committee.

Dietary assessment

The Child and Diet Evaluation Tool (CADET) was used to estimate mean intake of the groups. The CADET was designed as a simple dietary assessment tool and records a child's dietary intake over 24 hours. The validation study compared the CADET with a 24 hour semi weighed food diary obtained from the same children for the same day and shows a close association with usual diet (21). CADETs were completed by NFER trained administrators during the school day and sent home to be completed by parents and returned the following morning with the child

Children with a total energy intake of less than 500kcal or more than 3500kcal were excluded from the study, as were those for whom the parental part of the CADET was left blank. This resulted in a final sample size of 2,530 children.

Initiatives to promote fruit and vegetables

A questionnaire was developed by researchers at the University of Leeds to measure the initiatives schools use to promote fruit and vegetables to pupils in Year Two and across the school.

The questionnaire investigated what is taught about fruit and vegetables in the formal curriculum; the amount of time spent learning about fruit and vegetables; school activities and resources for growing and cooking food; school catering and the involvement of parents in promoting fruit and vegetables to children. The questionnaire was administered to all Year Two teachers to complete.

A scoring system was developed to rate the extent to which schools engaged in the activities outlined above. A maximum score of seven was awarded for each of five sections depending on the extent to which activities were undertaken. A maximum score of 35 could be awarded. The median of the scores was considered to be the cut-off point for schools falling into 'high' and 'low' scores.

Statistical analysis

A multivariable regression analysis using multilevel modelling techniques (MLM) was conducted using MLwiN v2.10 to investigate the effect of initiatives to promote fruit and vegetable consumption on children's intake of these foods (22). A two level hierarchical random intercepts model was used to allow for the dependency inherent in pupil observations nested within the same school to be taken into account.

Analyses were adjusted for ethnicity & deprivation. The interaction between ethnicity & deprivation was assessed by likelihood ratio test and included in the model for foods where this was statistically significant ($p<0.05$).

RESULTS

Basic Characteristics

We recruited 2,709 children from 129 schools, a response rate of 72% to CADET. After 179 exclusions for misreporting on the CADET of 179, a final sample size of 2,530 children was achieved. The mean age of children was 7 years (1290 girls and 1240 boys). English was spoken as an additional language by 10% of the sample. 17% of children received free school meals and 54% ate a packed lunch. 35% of children had a member of the family educated to degree level or higher. Of the 130 participating schools, 100 returned the school questionnaire.

[Insert table 1 here]

Table 1 shows the mean intake of foods and nutrients arranged by gender. The amount of vegetables eaten by boys exceeds that eaten by girls by 14g however girls eat 38g more fruit than boys. The combined daily intake of fruit and vegetables for all children is 309g, equivalent to almost four, 80g portions a day but less than the Five A Day recommendation. Boys and girls consume similar amounts of pulses, beans and seeds; 20g daily, and boys eat, on average, 8g more dried fruit per day than girls. Children ate almost the same weight of chocolate, confectionary (sweets, toffees and mints etc) and savoury snacks each day (77g) as they did vegetables (90g).

Milk consumption is low for this age group. Only 233g per day (just over a quarter of a pint) as other drinks such as fruit juice, carbonated drinks and squashes feature highly in the diet. In both boys and girls the consumption of carbonated drinks and squash exceeds that of milk however these children are obtaining enough calcium from their diet to meet the reference nutrient intake of 550mg per day.

Reported energy intake for boys is 300kcal below the EAR for this age group and for girls is 180kcal below the EAR. Vitamin A intake is about half of the RNI of 500µ per day. Vitamin C intake is more than twice the RNI for this age group and intake of folate is also well above the RNI for this age group of 150µ per day. Iron intake is adequate and protein intake (55g) is almost twice the RNI of 28g per day. Percentage energy derived from fat is low and consequently the percentage of energy derived from carbohydrate is slightly higher than guidelines recommend. There are no dietary guidelines for fibre intake in children however, an intake of 12g per day appears low. Sodium intake is high at double the recommended intake for children of this age.

[Insert table 2 here]

Table 2 explores differences in food intake and initiatives to promote cooking, gardening and improve catering at school. There are no significant differences between children's intake of foods and schools that have either a high or low score for cooking activities, although there were higher intakes of fruit (excluding dried fruit) in schools which had a high score.

In schools that achieved a high score for gardening, children ate significantly more vegetables, but there were no other significant differences between children's food intakes for a high score compared to a low score.

Where schools achieved a high score for improving catering, intake of pulses, beans and seeds was significantly higher; 24g (95% CI: 20 to 29) compared to low scoring schools; 17g (95% CI: 12 to 22). A borderline non-significant but lower intake of sweets, toffees and mints was found in high scoring schools compared to low scoring schools.

[Insert table 3 here]

Table 3 shows further effects associated with school initiatives to promote fruit and vegetables to children. Schools with a high score for lessons teaching children about fruit and vegetables were not associated with children's food intake apart from a slightly reduced intake of savoury snacks. This was borderline non significant.

In schools where parents have been informed about its guidance on food and involved them in meetings to promote fruit and vegetables (high scoring schools), children ate significantly more vegetables (not pulses, beans or seeds), compared to schools with a low score.

A high total score for promoting fruit and vegetables was associated with a significant daily increase with children eating 25g more vegetables a day. Children in these high scoring schools also ate more pulses, nuts and seeds and less chocolate products, although the differences were borderline non-significant.

[Insert table 4 here]

Table 4 confirms the independent effect associated with total score on children's intake of food by taking into account the effect of ethnicity and social deprivation. Results for this table also show schools with a high total score eat 25g more vegetables a day than schools with a low score. These children also eat significantly more pulses, beans and seeds.

Discussion

These results provide an overview of food and nutrient intake of a large sample of English children at the end of their third year of school (School Year 2).

Intake of fruit and vegetables in this group is almost four portions per day which appears as an improvement on the findings of earlier studies. It is however lower than the five portions a day recommended for current and future health. This finding is similar to the baseline intakes of children in an earlier evaluation of the School Fruit and Vegetable Scheme (4).

It is evident that foods, other than fruit and vegetables have a prominent position in the diet of children. Sweets, confectionary and savoury snacks are eaten in almost the same amounts as vegetables, and more fizzy drink and squash is consumed than milk.

From a nutritional point of view, however, calcium levels meet recommended intakes and iron levels are adequate. Sodium levels are high as has been shown in many dietary surveys of children (4;23). Large regular intakes of savoury snacks contribute to these high intakes of sodium. Vitamin A levels are low and may result from a poor intake of vegetables in some children. It is interesting to note that intake of folate is adequate and intake of vitamin C is high. Good sources of these vitamins in children's diets are likely to be fortified breakfast cereals and fruit juice respectively.

With regard to macronutrient intake; energy intake is low. This may be due to under reporting foods consumed as a result of items being missed or assumed portion sizes which are too small for this age of a child; however protein intake is more than adequate. Fibre intakes appear low and the figures obtained are in line with a diet which is low in fruit and vegetables. The fibre intake of children in this survey is on a par with the adult population. However it should be noted there are currently no absolute recommendations for intake of fibre for this age group of children.

Schools across England vary in the number and type of initiatives they undertake to educate, and promote fruit and vegetables to children. This study has provided some evidence to show in schools where gardening activities take place children consume significantly more vegetables and pulses than schools where gardening and growing activities are limited. This may provide some evidence to support the importance of practical activities in encouraging children to consume vegetables and has been shown elsewhere (24). However further work is required to confirm this.

Likewise in schools where there was a high degree of parent involvement in promoting fruit and vegetables to children more vegetables were eaten. Because of the nature of this cross sectional analysis it is not possible to deduce a causal relationship but these results suggest there may be some association that needs to be tested further. Parents are vitally important to the acceptance by children of new fruit and vegetables in their diet. This is because of the importance of adults modelling appropriate eating behaviour and creating a positive environment to support and encourage children's intake of these foods (13;25-27).

The number of lessons spent on promoting fruit and vegetables was not associated with consumption of fruit and vegetables. Perhaps lessons do not include the best behaviour changing techniques such as modelling, repeated exposure, practical experience with fruit and vegetables (17;28). Lessons may not include such an approach and may explain why efforts in this area are not associated with a higher intake of fruit and vegetables. It is therefore important to augment knowledge about fruit and vegetables with other approaches to encourage consumption of these foods.

Combining the five individual scores to produce a global score to reflect initiatives schools made to educate children about fruit and vegetables produced one notable finding regarding higher intakes of vegetables in schools with a high score. One might ask why this did not hold true for fruit. Perhaps because all schools now participate in the School Fruit and Vegetable Scheme, which largely supplies fruit to children, intake of fruit cannot be improved upon. It has reached its upper threshold leaving more scope for increasing vegetable intake. Certainly, the children were eating on average about 88g more fruit that vegetables per day, equivalent to a portion of fruit.

Do the results differ in more deprived schools? The results reported in table 4 provide some encouragement that efforts to promote fruit and vegetables to children have an effect regardless of the deprivation status of the area and the ethnic mix of the school.

This is a large national cross sectional study of children's diet however there are limitations to the study. Cross sectional studies can only suggest associations between variable and do not provide robust evidence of causality. Little work has been undertaken to evaluate the impact of educational interventions on children's intake of fruit and vegetables. Measuring exactly how and what is being taught in different parts of the formal curriculum relies on teacher recall and is therefore subject to error. Promotion of fruit and vegetables in the informal curriculum through activities such as cooking and gardening is also limited by reliance on teachers to record this involvement. However we believe the questionnaire used to do this provided a reasonable record of the activities schools engaged in to promote fruit and vegetables to pupils.

CADET has been used in several large studies to estimate children's intake of food and nutrients. It has the limitations of a 24 hour record of food intake however the sample size for this study is large and should compensate for this.

This is, we believe, the first time an attempt has been made to explore the relationship between initiatives schools themselves are taking to promote fruit and vegetables to children and there association with diet. The results of this study show some encouraging results for schools who involve parents and promote fruit and vegetables through extra curricular activities such as gardening, however further works needs to confirm these findings.

Table 1 Mean intake of foods and nutrients in girls and boys

	Girls		Boys		All children	
	Estimate (MLM)*	95% CI	Estimate (MLM)*	95% CI	Estimate (MLM)*	95% CI
Vegetables (non pulse, bean or seed) g	83.1	(76.5 , 89.8)	96	(89.3 , 103)	89.5	(83.6 , 95.4)
Total vegetables g	104	(97 , 111)	118	(111 , 125)	111	(105 , 117)
Pulses, beans, seeds	20.7	(17.4 , 24)	22	(18.7 , 25.3)	21.3	(18.5 , 24.1)
Total fruit g	217	(206 , 228)	179	(169 , 191)	198	(189 , 208)
Fruit (non-dried) g	216	(205 , 227)	177	(166 , 188)	196	(187 , 206)
Dried fruit g	16.1	(14.5 , 17.6)	23.7	(22.3 , 25.1)	20.2	(19.1 , 21.3)
Sweets, toffees, mints g	26.3	(25.4 , 27.2)	25.4	(24.4 , 26.3)	25.9	(25.2 , 26.6)
Chocolate bars, Mars etc. g	23.7	(22.8 , 24.6)	24.4	(23.5 , 25.2)	24.1	(23.4 , 24.7)
Crisps, savoury snacks g	26.3	(25.6 , 26.9)	24.9	(24.2 , 25.5)	25.6	(25.1 , 26.1)
Nuts g	26.9	(25.5 , 28.2)	26.2	(24.4 , 28.1)	26.6	(25.5 , 27.7)
Milk or milky drink g	230	(221 , 239)	237	(228, 246)	233	(227 , 240)
Fizzy pop, squash, fruit drink g	353	(336 , 370)	372	(355 , 389)	362	(349 , 376)
Fruit juice (pure) g	216	(206 , 226)	219	(209 , 229)	217	(210 , 225)
Energy kcal	1561	(1532 , 1590)	1666	(1637 , 1695)	1613	(1588 , 1638)
Energy MJ	6574	(6452 , 6696)	7014	(6892 , 7136)	6793	(6689 , 6897)
Protein g	53.1	(52 , 54.3)	56.6	(55.4 , 57.7)	54.8	(53.9 , 55.8)
CHO g	224	(220 , 228)	239	(235 , 243)	231	(228 , 235)
Fibre g	11.7	(11.4 , 12)	12.3	(12 , 12.5)	12	(11.7 , 12.2)
Fat g	56.6	(55.2 , 58)	60.5	(59.1 , 61.8)	58.5	(57.4 , 59.7)
% energy derived from fat	32.4	(32 , 32.7)	32.4	(32 , 32.7)	32.4	(32.1 , 32.7)
Total sugars g	122	(119 , 125)	126	(123, 129)	124	(121 , 126)
Iron mg**	8.5	(8.3 , 8.7)	9.2	(9 , 9.4)	8.8	(8.7 , 9)
Calcium mg **	651	(634 , 668)	716	(698, 734)	682	(669 , 696)
Potassium mg**	2167	(2116 , 2218)	2237	(2185 , 2291)	2202	(2159 , 2245)
Sodium mg **	1905	(1864, 1946)	2080	(2031 , 2129)	1990	(1952 , 2030)
Folateμg **	178	(174 , 183)	189	(184 , 194)	184	(180 , 187)
Carotene μg**	1447	(1309 , 1599)	1594	(1442, 1762)	1518	(1384 , 1664)
Vitamin A μg (retinol equiv)**	216	(208, 225)	236	(227 , 246)	226	(219 , 234)
Vitamin C mg**	84.4	(80.4 , 88.7)	78.6	(74.8 , 82.5)	81.5	(78 , 85)

*Multi level Model (MLM)

Table 2. The effect of cooking, gardening and school catering on food intake in children

	COOKING SCORE					GARDENING SCORE					CATERING SCORE				
	High Score		Low Score			High Score		Low Score			High Score		Low Score		
	Estimate (MLM)	95% CI	Estimate (MLM)	95% CI	P-value	Estimate (MLM)	95% CI	Estimate (MLM)	95% CI	P-value	Estimate (MLM)	95% CI	Estimate (MLM)	95% CI	P-value
Vegetables (non pulse, or seed) g	89.0	(78.8 , 99.3)	88.0	(79.4 , 96.6)	0.876	97.0	(88 , 106)	79.5	(70.4 , 88.6)	0.007	86.8	(78.3 , 95.3)	90.9	(80.4 ,101)	0.554
Total vegetables g	113	(102, 123)	108	(99 , 117)	0.524	120	(111 , 129)	99.3	(89.9 , 109)	0.002	111	(103 , 120)	108	(96.7 , 119)	0.604
Pulses, seeds g	23.3	(18.2 , 28.3)	20.1	(15.8 , 24.4)	0.347	22.9	(18.3 , 27.5)	19.8	(15.1 , 24.4)	0.344	24.4	(20.2 , 28.5)	16.8	(11.8 , 21.9)	0.024
Total fruit g	205	(188 , 222)	193	(179 , 208)	0.312	200	(184 , 216)	196	(180 , 212)	0.738	197	(183 , 212)	199	(182 , 217)	0.844
Fruit (non-dried) g	203	(186 , 220)	191	(177 , 206)	0.31	198	(182 , 214)	194	(178 , 210)	0.735	195	(181 , 210)	197	(180 , 215)	0.868
Dried fruit g	19.4	(17.4 , 21.4)	21.3	(19.4 , 23.1)	0.174	21.5	(19.5 , 23.4)	19.3	(17.4 , 21.2)	0.119	19.5	(17.8 , 21.3)	21.6	(19.5 , 23.6)	0.141
Sweets, toffees etc g	25.4	(24.4 , 26.5)	25.8	(24.9 , 26.7)	0.598	26.1	(25.2 , 27.1)	25.2	(24.2 , 26.1)	0.164	25.1	(24.2 , 26)	26.4	(25.4 , 27.5)	0.056
Chocolate bars, Mars, Galaxy etc.g	23.7	(22.6 , 24.7)	24.4	(23.5 , 25.3)	0.305	24.1	(23.1 , 25)	24.1	(23.1 , 25.1)	0.968	23.9	(23 , 24.8)	24.3	(23.3 , 25.4)	0.568
Savoury snacks g	25.1	(24.3 , 26)	25.5	(24.8 , 26.2)	0.459	25.0	(24.3 , 25.8)	25.7	(25 , 26.5)	0.192	25.5	(24.8 , 26.3)	25.1	(24.3 , 25.9)	0.443
Nuts g	26	(23.9 , 28.1)	27.3	(25.6 , 29.1)	0.332	27.2	(25.4 , 29)	26.3	(24.3 , 28.3)	0.492	26.2	(24.2 , 28.1)	27.4	(25.6 , 29.2)	0.365
Milk or milky drink g	228	(218 , 239)	234	(225 , 243)	0.412	238	(228 , 247)	225	(215 , 235)	0.066	229	(220 , 237)	236	(225,247)	0.29
Fizzy pop, squash, fruit drink g	363	(340 , 387)	356	(336 , 376)	0.645	367	(346 , 388)	35	(330 , 373)	0.319	362.134	(343 , 382)	355	(331 , 378)	0.631
Fruit juice (pure) g	216	(204 , 228)	211	(201 , 222)	0.563	213	(202 , 224)	213	(202 , 225)	0.977	212.905	(203 , 223)	213	(201 , 226)	0.947

Table 3 The effect of lessons, parents and combined initiatives to promote fruit and vegetables in school, on food intake in children

	LESSON SCORE					PARENTAL INVOLVEMENT					TOTAL SCORE				
	High score		Low score			High score		Low score			High score		Low score		
	Estimate (MLM)	95% CI	Estimate (MLM)	95% CI	P-value	Estimate (MLM)	95% CI	Estimate (MLM)	95% CI	P-value	Estimate (MLM)	95% CI	Estimate (MLM)	95% CI	P-value
Vegetables (non pulse, or seed) g	88.2	(78.2, 98)	88.6	(79.8, 97.5)	0.941	98.1	(88, 108)	82.0	(73.7, 90.2)	0.015	98.5	(89.3, 108)	79.1	(70.3, 87.8)	0.003
Total vegetables g	112	(101, 122)	108	(99.1, 118)	0.626	117	(107, 128)	105	(96.2, 114)	0.078	123	(114, 132)	97.7	(88.7, 107)	0.000
Pulses, seeds g	23.5	(18.6, 28.4)	19.7	(15.3, 24.1)	0.255	19.2	(14 , 24.4)	22.8	(18.6, 27.1)	0.285	24.4	(19.7, 29)	18.6	(14.1, 23.1)	0.082
Total fruit g	196	(180, 213)	200	(185, 215)	0.771	209	(191, 226)	191	(177, 205)	0.129	198	(181, 214)	198.8	(183, 214)	0.908
Fruit (non-dried) g	194	(177, 211)	198	(183, 213)	0.743	206	(189, 224)	189	(175, 204)	0.143	196	(180, 212)	196.7	(181, 212)	0.915
Dried fruit	20.9	(18.9, 22.9)	20.0	(18.1, 21.8)	0.489	21.8	(19.8, 23.8)	19.3	(17.5, 21.1)	0.070	20.6	(18.6, 22.5)	20.2	(18.3, 22.1)	0.814
Sweets, mints etc g	26.0	(25, 27)	25.4	(24.5, 26.3)	0.369	25.9	(24.8, 27)	25.5	(24.6, 26.4)	0.592	25.8	(24.8, 26.8)	25.5	(24.6, 26.5)	0.708
Chocolate bars, mars, galaxy etc. g	23.8	(22.7, 24.8)	24.3	(23.4, 25.3)	0.432	24.2	(23.2, 25.3)	24.0	(23.1, 24.9)	0.758	23.5	(22.5, 24.4)	24.7	(23.8, 25.7)	0.069
Savoury snacks g	25.9	(25.1, 26.7)	24.9	(24.2, 25.6)	0.053	25.5	(24.6, 26.3)	25.3	(24.6, 26)	0.799	25.0	(24.2, 25.8)	25.6	(24.9, 26.4)	0.283
Nuts g	27.9	(25.8, 29.9)	26.1	(24.3, 27.8)	0.178	27.7	(25.7, 29.6)	26.1	(24.4, 27.9)	0.269	27.4	(25.5, 29.3)	26.3	(24.4, 28.2)	0.417
Milk or milky drink g	225	(214, 235)	236	(228, 245)	0.091	233	(222, 244)	231	(222, 240)	0.728	230	(220, 240)	233.2	(224 , 243)	0.595
Fizzy pop, squash, fruit drink g	351	(328, 374)	365	(345, 385)	0.374	349	(325, 373)	366	(346, 385)	0.297	358	(336, 380)	360	(339, 381)	0.932
Fruit juice (pure) g	215	(203, 228)	212	(201, 222)	0.630	213	(201, 225)	213	(203, 224)	0.991	214	(202, 225)	213	(202, 224)	0.889

Table 4 Independent* effect of initiatives to promote fruit and vegetables in schools controlling for social class and ethnicity.

	Difference between schools	95% CI	p-value for significance of parameter on food group
Reference category - Good total score			
Vegetables (non pulse, bean or seed)g	-18.0	(-30.1 , -5.9)	0.004
Total vegetables g	-25.1	(-37.9 , -12.3)	0.000
Pulses, beans, seeds g	-6.7	(-12.8 , -0.7)	0.029
Total fruit g	3.0	(-19.3 , 25.4)	0.791
Fruit (non-dried) g	3.0	(-19.3 , 25.3)	0.789
Dried fruit * g	0.1	(-2.7 , 2.8)	0.956
Sweets, toffees, mints g	-0.5	(-1.9 , 0.9)	0.490
Chocolate bars, Mars, Galaxy etc. g	0.9	(-0.5 , 2.3)	0.224
Crisps, savoury snacks g	0.6	(-0.5 , 1.7)	0.291
Nuts g	-1.7	(-4.6 , 1.3)	0.267
Milk or milky drink g	6.0	(-8.9 , 21)	0.429
Fizzy pop, squash, fruit drink g	-3.2	(-35.2 , 28.9)	0.846
Fruit juice (pure) g	-1.0	(-17.3 , 15.3)	0.904

* Linear regression of the total score on the foods listed was adjusted for ethnicity and deprivation. The interaction between ethnicity & deprivation was assessed by likelihood ratio test and included in the model for foods where this was statistically significant ($p<0.05$)

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