An evaluation of nutrient intake from school meals of children in secondary schools in Knowsley MBC before and after a programme of intervention.

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SECTION 1
GLOSSARY & ABBREVIATIONS USED

Balance of Good Health:
A model of a healthy diet promoted by the FSA based on the idealised relative contribution from cereals and starchy foods, fruits and vegetables, meat and alternative protein sources, diary products and fatty and sugary foods as represented pictorially.

Carotene:
A certain amount can be transformed into vitamin A by the body. It is only found in plant foods and so is an indicator of vegetable consumption (and to a lesser extent fruit).

Caroline Walker Trust:
Named after a nutritionist who was most concerned about public health nutrition and especially the diet of children. The Trust has taken a lead in making recommendations for nutritional standards for school meals.

Coding:
The process of deciding which food was consumed in comparison to a data base of foods for which an estimate of its chemical composition exists.

DH:
Department of Health. Responsible for health and health care and, jointly with the FSA, for nutritional and dietary recommendations.

DfES:
Department for Education and Skills. Responsible for school meals and the national curriculum.

EAR:

Estimated average requirement. An amount of a nutrient sufficient to meet the needs of half the population. This was set by the Committee on Medical Aspects of Food Policy, DH 1991.

Free School Meals:

Meals which must be provided by local authorities free of charge to children from the most deprived backgrounds.

FSA:

Food Standards Agency is responsible for protecting the public health by promoting a safer food supply and ensuring consumers have the information they need to be able to choose a safe and healthy diet. The FSA also provides dietary advice and monitors dietary intake and nutritional health jointly with DH.

JMU

Liverpool John Moores University

MJ:

Mega joule. A unit of energy. A typical diet might contain 10MJ (approximately 2,390 kcals). 1,000kcal = 4.18MJ; 1 kcal = 4.18kJ.

MUFA:

Mono unsaturated fatty acids a component of the total fat intake. It is generally considered that intake should be increased.

NDNS:

National Diet and Nutritional Survey. An on-going rolling programme of national dietary and nutritional surveys of different sub-groups of the population. Any one group is surveyed about once every 10 years.

NMES:
Non milk extrinsic sugars. All sugars not from milk (lactose) which when consumed are not contained within a cell wall (that is they have been added to food by the manufacturer, cook or consumer).

NSP:
Non starch polysaccharide. A form of carbohydrate which the human body cannot digest and absorb (except for a very minor amount). It is a major component of the fibre content of the diet.

Ofsted:
Office for Standards in Education. Ofsted is a non-ministerial government department established to take responsibility for the inspection of all schools in England, whether state or independent. It also inspects local authorities, teacher training establishments, youth work, all 16–19 education and early years childcare.

P:S:
The ratio between the amount of PUFA and SFA consumed. It is generally considered that a higher ratio is desirable.

PUFA:
Polyunsaturated fatty acids a component of the total fat intake. It is generally considered that intake should be increased.

Retinol:
A form of vitamin A which is only found in foods of animal origin. It is therefore a useful marker of intake of foods of animal origin.

SFA:
Saturated fatty acids a component of the total fat intake. It is generally considered that intake should be decreased.

S. Fibre:

Southgate fibre. An estimation of fibre intake which includes some non polysaccharides. It is currently less used than in the past.

Sugars:

All sugars consumed whether, mono or di-saccharides (including lactose) or naturally occurring in foodstuffs or added by manufacturer, cook or consumer.

ug:

Micro gram. One millionth of a gram.

Quality of Diet:

Some people eat more food than others and generally people eat to satisfy their need for energy. The volume of food consumed is usually evaluated in terms of its energy value instead of its weight. Thus when assessing the intake of nutrients differences in energy intake need to be allowed for. For nutrients which contribute to energy intake (protein, fat, carbohydrate and alcohol) this is usually done by calculating the proportion of energy supplied by the nutrient (%) which is why, for example, weight of fat (g) and energy from fat (%) are both given. This is the way preferred by nutritionists for comparing intake of these nutrients and their components (fat – SFA, MUFA & PUFA and carbohydrate – starch, sugars and NMES). For other nutrients energy intake can be allowed for by calculating nutrient intake per unit of energy (nutrient density). For example calcium intake is given as an absolute amount (mg) and in relation to energy (mg/MJ). It might be argued that a more nutrient dense diet is a more desirable one.

SECTION 2

SUMMARY

This is a report of a longitudinal controlled intervention study of the dietary and nutritional intake of 80 secondary school children who consumed school meals in Knowsley.

Key findings:

- Interpretation of the results requires caution due to poor pupil response rate and reliability of the data.
- Knowledge of intake at school meals is of very limited value since most nutrients are consumed elsewhere.
- The choices made by the children appears to be the main factor in determining intake.
- The meals chosen did not conform to the Balance of Good Health model: fruit was not consumed and very few vegetables.
- A very small repertoire of foods was consumed (mostly processed convenience foods).
- Intakes of SFA and salt were too high and calcium, iron and NSP too low (the consequences of this are unclear).
- Intervention had a negligible effect in the short term.

Recommendations:

- Food provided in schools must reflect best practice and educational messages.
- Strategies should aim to increase take up of meals in school.
- The Balance of Good Health (food based) model must be promoted.
- Snacks or ‘fast food’ (which can be perfectly acceptable) are likely to be attractive to consumers.
- Dietary recommendations should focus on foods provided and their nutritional characteristics (quality) rather than the nutritional value of the meal (since this will depend upon the needs of individuals).
- Encouraging a varied intake may be the single most important way to promote healthy eating.

SECTION 3

INTRODUCTION

Ill health as a consequence of poor diet costs the NHS at least £4B per annum (DH, 2005). For example obesity is a rapidly escalating problem which has severe consequences which include: the development of coronary heart disease, hypertension, type 2 diabetes and a variety of cancers. There is evidence that poor eating habits occur in childhood which gives rise to a variety of paediatric problems such as anaemia and indeed the early signs of several of these conditions of maturity. The British Medical Association has expressed concern about the eating habits and nutritional status of adolescents in the UK (BMA, 2003) and the diet of British children has been described as being amongst the worst in Europe (Vereecken & Maes, 2000). For example the National Diet and Nutrition Survey of children (Gregory & Lowe, 2000) showed high intakes of saturated fatty acids (SFA), non-milk extrinsic sugars (NMES) and salt but low intakes of iron, calcium and non-starch polysaccharide (NSP). One study found that only about 75% of primary school children ate fruit and 39% vegetables and 31% both, and 23% neither, on the survey day (Hackett et al, 2002). These problems are far worse in the least affluent communities (DH, 2005).

Clear priorities have been set by the Department of Health to reduce intake of fat, SFA, salt, sugar but to increase intake of fruits and vegetables and tackle obesity (DH, 2005). The main mechanisms to achieve this are to provide better information, choice and access to healthier food (DH, 2005).

SECTION 4
SCHOOL MEALS – VALUE AND CONCERNS

The provision of meals at school has a long history of over 100 years. The service began with the recognition that hungry children could not take advantage of the schooling provided. The abandonment of nutritional standards for school meals in 1980 and the introduction of a cash-cafeteria system generated much criticism but, there has been a slow but steady move towards re-establishing comprehensive nutritional standards which are fully integrated with nutritional and dietary advice for the general population (Sharp, 1992; DfES, 1997; Caroline Walker Trust 2005). Legally enforceable minimum standards were reintroduced in 2001, but relate mainly to intakes of particular food groups, and are likely to be updated shortly to include a nutritional specification. In addition to concern over school meals the FSA / DH / DfES are committed to improving the provision of all food in schools and many initiatives have begun, for example the fruit in school programme. The value of school meals is to receive particular attention but the school meal must be considered alongside all foods available in schools, for example from 'tuck shops', vending machines and breakfast or after school clubs and as rewards. This highlights that the school meal is only one meal per day for 5 days per week for up to 40 weeks per year.

Some limited information is available on the consumption of school meals from the National Diet and Nutrition Survey (NDNS: Gregory et al, 2000). The results of the NDNS survey highlighted the importance of school meals to those receiving free meals since they obtained a higher proportion of their daily nutrient intake from meals than other children. It also revealed the relatively high amounts of chips and 'buns, cakes and pastries' consumed. The 11-18 year olds' school meals supplied about 40% of the energy as fat and over 13% energy as saturated fatty acids (SFA) but very little fibre (about 3g), calcium (about under 200mg) or iron (about 2mg). Thus there was considerable room for improvement from which the children from the least affluent families might benefit most.

A more comprehensive study was conducted by Nelson et al, (2004) on behalf of the Food Standards Agency (FSA) which studied a nationally representative

sample of 79 secondary schools and 5695 children aged 11-18 years. It was found that 41% of energy was provided by fat and 14% from SFA and that the guidelines for intakes of iron, calcium and proportion of energy from starchy foods were not likely to be met. Intake of cakes, soft drinks, chips and potatoes cooked in oil, high fat main dishes such as chicken nuggets were highlighted. It is stated in the report that '…there appears to have been no improvement in the profile of nutrient intake from school meals following the introduction of the national nutritional standards…' (specifically when compared with the NDNS results). There was, however, evidence of some schools offering a wide variety of foods and many schools followed at least some healthier eating practices and sometimes a pricing policy was operated to encourage healthier choices. Nelson et al's conclusions included: nutritional standards must be compulsory, lunches should reflect the 'Balance of Good Health' model for healthy eating (FSA, 2001), choice should be restricted and schools must monitor school meals.

SECTION 5

KNOWSLEY MBC - PROFILE

Knowsley is one of the five metropolitan districts in Merseyside, covering 33 square miles, neighbouring a number of other local authorities: Liverpool, Sefton, Lancashire, Halton and St Helens. In 2003 approximately 150,200 people were living in Knowsley within the suburban townships of Huyton, Kirkby, Prescot, Whiston, Halewood, Stockbridge Village, and Cronton. Knowsley is predominantly green belt but also includes an industrialised outer city area. Knowsley's population is relatively young, with almost 23% under 16, compared to a national average of around 20%, and with only 5.7% aged 75 or over, compared with 7.6% nationally. Other characteristics of the population emerging from the latest (2001) census include:

- A male: female ratio of around 47:53 (49:51 nationally)
- Almost 42% of households with no car or van (less than 27% nationally)
- 29% single person households (30% nationally)
- Only 1.6% of population are of black, minority ethnic background (about 9% nationally)
- Over 12% are permanently sick or disabled (5.5% nationally)
- Less than 10% have a degree or higher level qualifications (almost 20% nationally)
- Almost 62% of owner-occupied houses (about 69% nationally)

Knowsley has high levels of deprivation, and has been highlighted as the third most deprived borough in England. The borough is ranked 38 out of 354 for income deprivation and 30 out of 354 for employment deprivation. Of Knowsley's 22 wards, 18 are among the most deprived 10% of all wards in England. In 1991 44% of Knowsley children lived in households where there was no adult in employment, compared with only 19% nationally and 11.8% of the Borough's children lived in lone parent households in 2001 compared with 6.5% nationally. In 1999 nearly half of Knowsley's residents were receiving Council Tax Benefit, and a third more were also in receipt of Housing Benefit. However, the local economy has grown by 1.8% between 1996 and 2001, twice the north west

regional average, and unemployment has reduced in the borough from 19.3% in 1992 to 4.0% by April 2005.

Although Knowsley has endured high levels of ill health there is evidence of improvement taking place. For example life expectancy for both men and women is below those for England & Wales but has been improving (Knowsley Primary Care trust, 2005). There was also a 34% reduction in mortality from coronary heart disease in under 75 year olds in Knowsley between 1995-97 and 2001-03. (Williamson and Langton 2005) However, lung cancer death rates remain very high (SMR 187). Death rates from several conditions with a dietary component to the aetiology have also increased, and it is estimated that some 21,500 people in Knowsley are obese (Knowsley PHT, 2004) who include;

Children aged 4 and 5 (Reception Year 2003/04): 8.6% obese; 12.2% overweight.

Children aged 10 and 11 (Year 6 2002/03): 20.3% obese; 14.1% overweight.

Adults (2001 Adult Lifestyle Survey): 14.1% obese (11.8% males, 16.3% females); 50.1% overweight (62% males, 46.8% females)

Adults (2005 GP registered population): 28.6% obese.

SECTION 6

THE KNOWSLEY SCHOOL MEALS SERVICE

There are 78 schools in Knowsley accommodating 23,875 pupils of which 8,768 (36.72%) are entitled to free school meals. School kitchens are reasonably well equipped, but in some cases lack adequate work space. A combination of short available service time and limited dining room seating capacity, particularly in secondary schools, also have a negative impact on the appeal of the service in the eyes of pupils. These issues will be addressed within the secondary school sector as part of Knowsley's design planning for its impending 'Building Schools for the Future' programme which will see the replacement of its existing eleven secondary schools with eight new learning centres.

Staff are generally very committed to the schools where they work which tend to be within the community where they live and where often both they and their children have been educated. However, staff absence can often affect the efficiency of the service, and the management and control of this absorbs significant amounts of management time which could otherwise be spent on improving service quality.

Knowsley has always embraced the traditional values of the school meals service and recognised its importance within the community. Following the demise of compulsory competitive tendering and the delegation of school meals budgets to schools, the Council introduced a school meals policy that would enable members to continue to exercise a guiding influence with regards to quality and price. This was later amended in 2004 to include a school meals charter which set out the aspirations of the service in the context of promoting of healthy living and healthy lifestyles amongst young people. (see Appendix A)**.**

SECTION 7
THE RESEARCH PROJECT

7.1 Background

DfES together with the Food Standards Agency commissioned a survey of how caterers were meeting the school meal nutritional standards in secondary schools. A report from this work was later published July 2004.

It was evident from this work that while many caterers meet the standards at the beginning of service, there are still some that do not. This number increases at the end of service provision. Even in schools where caterers meet the standards pupils choose options that do not reflect a balanced diet. When compared to the Caroline Walker Trust guidelines for school meals it is clear that more needs to be achieved to ensure pupils are able to choose options that meet Government recommendations for their daily intake. In particular, from a stepwise regression analysis of the data, it is clear that key areas for consideration relate, among others, to folate, fat, protein and vitamin C intake.

DfES have therefore established a panel to consider how to revise the secondary school meals standards. In order to assist this work, DfES and the FSA agreed to undertake short pilot projects to assess which aspects of the standards can be modified and to what extent. It is anticipated that the pilots will:

- involve the caterer(s) along with other key stakeholders (including more than one school),
- involve discussion with pupils either through school councils or school nutrition action groups,
- involve baseline and post intervention monitoring using a tool that can be assessed for wider roll out (the tool should assess pupil consumption rather than just service provision),
- involve modification both to menus (e.g. number of time main meals/potato products fried in oil are served) and recipes (e.g. ways of incorporating fruit and vegetables into recipes), and

- that enable greater uptake of school meals rather than a decline in such numbers.

The aim of this study was to assist the panel by carrying out a review of school meal provision in secondary schools in Knowsley. This involved calculating the nutritional value of the current menus, estimating the nutrient intake from school meals, comparing the intake to accepted dietary standards, implementing a variety of changes to the provision and evaluating the impact of these changes. The study had three objectives:

- To establish average school meal's nutrient intake for a cross-section of 11-12 year old and 15-16 year old boys and girls.
- To modify school meals provision so that the food pupils eat is more in line with the 2001 national nutritional standards for secondary schools.
- To evaluate whether changes in nutrient intake have occurred in the short term as a result of the modifications made.

7.2 Methods

The overall study design was a longitudinal controlled intervention. Children at three schools had their nutrient intake at base-line assessed from one school meal. The school meal provision was then modified in two schools and one month later a further estimate of the intake of the same children was made using identical methods. The base-line data was collected between late February and early April 2005 and the follow-up data (after intervention) between late May and June 2005. It was hoped that 150 matched pairs of children (50 control and 100 intervention) would complete the study, and to achieve this it was proposed to survey 200 children at base-line (based on recruiting about 250 children and inviting about 500 to take part). The children were both boys and girls from two age groups (year 7 aged 11-12 years and years 10 & 11 aged 14-16 years). A record of whether the child was receiving a free school meal was kept on the consent form which was completed by all children and their carers. The study was approved by Liverpool John Moores University Ethics Committee.

Since the brief required the estimation of nutrient intake, and changes in nutrient consumption as a result of successful intervention were anticipated to be small, a very accurate method of measuring intake and a large sample size was required. For logistical reasons reliability could not be improved by increasing the number of days studied. It was therefore decided to use the weighed inventory method, with the weighing being carried out by trained workers. To this end EKS electronic scales were purchased and a proforma for recording results designed (Appendix B). Local community cooks and were trained to record intake and a 'dummy run' was carried out (which helped establish weights and composition of some common items such as sandwiches).

7.3 Recruitment of Pupils

Subjects were recruited at three schools by their teachers who distributed an information sheet and a consent form which had to be signed by both the child and a parent / carer. The consent forms were held by the Operations Manger. The schools were chosen to give a fair geographical representation of pupils across the borough and also were those known to have sufficient space in the dining area to accommodate the weighing procedure. On each day of the survey teachers helped to channel volunteers towards the Community Cooks who weighed each child's intake. This also involved completing a few simple questions (subject's name, sex, year group) and then noting the weight of every item purchased using the taring facility of the scales. The children were instructed to return any left-over food, together with the plates, utensils and any wrapping or containers. The weights of any left-over items were also entered onto the form. The forms were then returned to JMU for processing.

7.4 Dietary Data

Diet data was analysed using Microdiet^{TM} (Downlee Systems, 2005) based on the sixth edition of McCance and Widdowson's The Composition of Foods and all supplements (FSA, 2002). Whenever possible foods in the data base were matched to manufacturer's information and in many cases additional foods were inserted into the data base using manufacturer's information (perhaps supported by similar information already in the data base, for example if the

manufacturer's data did not include a figure for calcium, data for this nutrient would be added from a comparable item in the data base). Estimates of non-milk extrinsic sugars content of foods was made by calculation (but the data are very incomplete). In addition copies of all recipes used by the school meals service were analysed using Microdiet and entered into the data base as new foods. All the coding was carried out by one experienced nutritionist and coding decisions were recorded to ensure consistency.

In addition to the analysis of nutrient intake the number of portions of foods consumed falling into categories based on the Balance of Good Health food groups (5 groups: fruit & vegetables, starchy foods, meat, fish and alternatives, milk & dairy foods and sugary and fatty foods), which relate to the standards for school meals set by DfES (2001), was counted for each child.

Each child's record of his or her intake was analysed separately and later combined for analysis using Statistical Package for the Social Sciences^{TM}. Several children recorded their intake more than once in error – in these cases only the first record was used. Nutrient intakes were compared to dietary reference values (DH, 1991) and standards published by the Caroline Walker Trust (Crawley, 2005) as summarised in table 1. The 'quality' of the diet was assessed by computing either the contribution of nutrients to energy intake or by calculating the weight of nutrient consumed per MJ of energy. Salt intake was estimated from sodium but no allowance was made for the non-salt sodium.

Table 1.

Caroline Walker Trust (Crawley 2005) recommendations for nutrient intake at school meals.

	Protein	**Fat**	**CHO**	**Energy**	**SFA**	**NMES**	**NSP**
	g	**g**	**g**	**kcals**	**g**	**g**	**g**
CW Trust 2005: Boys 11-18y	13.8	27.8	95.2	714	8.7	20.9	5.7
CW Trust 2005: Girls 11-18y	12.7	22.5	77.0	578	7.1	16.9	4.6
	Minimum	Maximum	Minimum	----------	Maximum	Maximum	Minimum
	Sodium	**Salt**	**Calcium**	**Iron**	**Vitamin C**	**Vitamin A**	**Folate**
	mg	**mg**	**mg**	**mg**	**mg**	**ug**	**ug**

CW Trust 2005: Boys 11-18y	710.0	1806	400.0	4.5	14.6	250.0	80.0
CW Trust 2005 Girls 11-18y	710.0	1806	320.0	5.9	14.6	250.0	80.0
	Maximum	Maximum	Minimum	Minimum	Minimum	Minimum	Minimum

The main outcome variables were the changes in nutrient intake from baseline to follow-up but these changes need to be evaluated taking into account a variety of variables: sex of the child, age of the child, whether the child received a free school meal and whether the school was intervention or control.

The sources of a variety of nutrients at baseline (energy, saturated fatty acids, sugars, sodium, calcium, iron and vitamin C) were investigated in relation to consumption of foods in specific groups (table 2):

Table 2.

List of food groupings used to estimate contribution of foods to nutrient intake .

Food Group:	**Pizza etc**	**Soft Drinks**	**Cakes & Biscuits**	**Breads**	**Meat**	**Fruit & Vegetables**	**Potatoes**
Foods:	Pizza	Fruit juice	Muffins	Slices	Chicken Nuggets	Fresh fruit	Chips
	Sausage Roll	Fruit drinks + sugars	Doughnuts	Baguettes	Chicken - in sandwiches	Peas	Mashed
	Chips	Fruit drinks - no added sugars	Cornflake Cakes	Wraps	Lamb Curry	Salad	Wedges
	Potato Wedges	Milk	Iced Cakes	Bread Rolls	Pork Casserole	Baked Beans	Baked
	Chicken Nuggets	Flavoured Water	Chocolate biscuits		Ham	Ketchup	
			Savoury Biscuits		Sausage Roll		

7.5 Intervention

The intervention was planned in conjunction with the baseline data collection and was to some extent informed by the baseline results as they accumulated. Therefore the nature of the intervention is described in the results section.

7.6 Statistical Procedures

The sex of the volunteers, whether or not they received free school meals, the school attended (which reflects whether the child was part of the intervention or control group) and which year group they were in were used as grouping variables (since they were thought might influence intake). Whether these variables were associated was evaluated using Chi-square or Fisher's Exact test as appropriate.

All variables were checked for normality using one-sample Kolmogorov-Smirov test and the results summarised in the appendix (Tables C.1 & C.2). Since a number of the variables were not normally distributed both non-parametric tests and parametric tests were to evaluate differences. To evaluate base-line data the independent samples t-test was used to investigate differences in intake between individuals according to the grouping variables if the data were normally distributed and Mann-Whitney U test if not. One-way analysis of variance was used to evaluate differences between the three schools with a post-hoc Tukey test if homogeneity of variance was confirmed, if not, the Kruskall-Wallis test was applied.

To evaluate whether change in intake occurred the one-sample t-test was applied to the difference data to all variables since it is tolerant of lack of normal distribution. The Mann-Whitney U test was used to evaluate differences between sexes, school attended (which represents intervention or control group), receipt free school meal and year group since the variable being tested was the difference between two distributions which may, or may not, be normally distributed. In all cases a p value of <0.05 was taken to indicate a significant result (95% confidence intervals were also calculated but are not presented here), that is, that an association or difference existed or a change had occurred which was unlikely to be due to chance. This is presented in the tables as 'significance p' when the actual p value is given.

SECTION 8
RESULTS

8.1 Base-line

One school of the three approached declined to take part and so a further school was invited to take part. Two associations were found between grouping variables; firstly, school attended and receipt of a free school meal (p=0.029) - fewer pupils in receipt of free school meal than expected took part at school B (intervention) and, secondly, between school attended and year group (p=0.005) - there were more year 7 children at school C (control).

Base-line data were collected between the end of February and April, 2005, 159 records were returned and 152 completed dietary records were analysed but these were from only 121 individuals (68 boys and 46 girls with 7 of unknown sex and 59, 43 and 19 returns from the three schools); 78 children from year 7 and 43 from year 10/11).

8.2 Recipes

The nutrient composition was estimated for 28 recipes prepared by the school meals service. These are shown, per portion, in appendix table C.4 The energy value per portion is low compared with CWT recommendations (only two foods exceeded these figures). These recipes contributed a large proportion of the estimated protein requirement and tended to be very high in the proportion of energy supplied by both fat and saturated fatty acids (they did, however, generally meet the CWT recommendations for weight of fat). In addition they tended to contain large amounts of sodium (salt) but most of them supplied very little calcium (unless based on dairy products), very little iron (even in the meat dishes) and typically, very little vitamin C.

8.3 Nutrient Intake

The nutrient intake at baseline is summarised in table 3 for the 80 subjects who completed all aspects of the study.

Table 3.

Intake at baseline before intervention for all subjects and boys and girls.

	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
	All n = 80		Boys n = 38		Girls n = 37	
Water (g)	311	132.9	296	154.5	322	112.0
Energy (kcal)	489	210.4	470	206.5	513	210.5
Energy (MJ)	2.04	.880	2.0	.864	2.15	.881
Protein (g)	15.9	7.91	17.1	8.69	15.5	6.98
Fat (g)	16.8	8.97	17.5	9.55	16.4	8.71
CHO (g)	72.3	35.05	65.0	31.61	79.5	35.56
Starch (g)	44.8	22.40	44.9	20.57	44.5	23.84
Sugars (g)	26.8	18.69	19.2	17.30	34.6	16.62
NMES (g)	12.0	15.14	6.6	11.15	17.1	16.26
SFA (g)	7.2	4.54	7.0	4.47	7.6	4.84
MUFA (g)	5.3	3.38	5.4	3.75	5.3	2.99
PUFA (g)	2.4	1.94	2.6	2.08	2.4	1.87
P:S	0.46	.503	0.51	.596	0.44	.423
Cholesterol (mg)	28.0	27.84	34.1	33.16	24.8	21.24
S. fibre (g)	2.5	2.89	2.5	2.88	2.4	2.91
NSP (g)	3.1	2.13	2.8	1.82	3.3	2.41
Sodium (mg)	570	376.5	596	412.7	576	351.1
Salt (mg)	1449	957.7	1516	1049.8	1464	892.9
Calcium (mg)	170	129.6	155	117.0	189	142.6
Iron (mg)	2.3	1.35	2.1	1.13	2.5	1.52
Vit C (mg)	47.8	36.26	40.3	38.63	58.6	31.26
Vitamin A (ug)	39	45.5	32	36.6	49	53.4
Retinol (ug)	29	38.0	24	30.0	36	45.7
Carotene (ug)	61	83.8	46	46.1	82	110.3
Folate (ug)	55	41.3	50	34.2	63	48.8
Protein (%)	14.2	8.58	15.3	6.58	13.7	10.42
Fat (%)	30.5	9.69	32.9	9.58	28.0	9.33
Carbohydrate (%)	54.7	11.86	51.7	9.88	57.2	12.81
Starch (%)	35.1	12.44	37.8	12.20	31.8	11.51
Sugars (%)	19.0	11.63	13.2	9.79	25.1	10.54
NMES (%)	8.7	11.35	4.3	7.28	13.3	13.13
SFA (%)	12.9	5.11	13.2	5.21	12.5	5.22
MUFA (%)	9.6	3.69	10.2	4.14	9.0	2.95
PUFA (%)	4.6	3.46	5.1	3.85	4.3	3.15
NSP (g/MJ)	1.6	1.02	1.6	1.08	1.5	.94
Calcium (mg/MJ)	84.3	63.84	85.9	69.01	82.0	51.43
Iron (mg/MJ)	1.1	.49	1.1	.45	1.1	.52
Retinol (ug/MJ)	19.2	21.76	17.6	22.37	22.2	22.02
Vit C (mg/MJ)	24.4	18.91	20.2	19.41	30.3	17.44

The energy intake does not seem to be excessive (and was well below the Caroline Walker (2005) targets), nor the intake of fat and conversely, the intake of carbohydrate is acceptable as is that of sugars (total and NMES). The vitamin C intake and P:S ratio of the meals were also high. However, the proportion of energy from SFAs and sodium intake were very high and intakes of calcium, iron, folate, vitamin A and NSP were low. The variation in intake was enormous, for example energy consumed ranged from 68 - 1,502 kcals at the lunch time meal.

The differences found in intake according to the grouping variables are summarised below but for brevity data are given by year group or receipt of free school meal in appendix C.

The following variables showed significant differences in mean intakes between the values of the grouping variable 'SEX' (using the Independent Samples t-test)

Tables 4a,b.
Baseline Data: Comparison of mean nutrient intake by 'SEX' (data shown in table 3).

Variable	Significance p
Sugars (g)	0.000
Fat (%)	0.026
CHO (%)	0.039
Starch (%)	0.031
Sugars (%)	0.000
Vit C (mg/MJ)	0.021

The following variables showed significant difference in distribution between the values of the grouping variable 'SEX' (using the Mann-Whitney-U test)

Variable	Significance p
NMES (g)	0.002
Protein (%)	0.049
NMES (%)	0.001
PUFA (%)	0.038

Note that the variable carotene (ug) was also very close to significance (0.071). Tables 4a,b show that the girls consumed more carbohydrate, sugars (total and NMES - g and %) and vitamin C. The boys consumed more fat (%), starch (%), protein (%) and PUFA (%).

The following variables showed significant differences in means between the values of the grouping variable 'FREEMEAL' (using the Independent Samples t-test).

Tables 5a,b.

Baseline Data: Comparison of mean nutrient intake by 'FREEMEAL' (data shown in appendix table C6).

Variable	Significance p
Protein (g)	0.006
SFA (%)	0.023

Note that the results for variables water (g) and starch (%) were also very close to being significant.

The following variables showed significant differences in distribution between the values of the grouping variable 'FREEMEAL' (using the Mann-Whitney-U test)

Variable	Significance p
Cholesterol (mg)	0.037
Protein (%)	0.000
P:S	0.027

Note that the result for variables S. fibre (g) (0.055), retinol (ug/MJ) (0.075), and PUFA (%) (0.075) were also very close to being significant. Tables 5a,b show that those children receiving a free school meal consumed less protein (14 vs 20g and 11 vs 18%) and cholesterol (19 vs 36 mg), and their meals had a lower P:S ratio (0.3 vs 0.5) but more SFA (14 vs 11%).

There were no variables showing significant differences in means between the values of the grouping variable 'YEARGROUP' (using the Independent

Samples t-test). However, the results for variables calcium (mg) (0.052) and protein (g) (0.048 if the variances are unequal, which Levene's test suggested they were not) are also very close to being significant.

The following variables showed significant differences in distribution between the values of the grouping variable 'YEARGROUP' (using the Mann-Whitney-U test).

Table 6.
Baseline data. Comparison of mean nutrient intake by 'YEARGROUP' (data shown in appendix table C7).

Variable	Significance p
Protein (%)	0.021

Note that the results for variables S. Fibre (g) (0.051) and P:S (0.096) were also very close to being significant. This result suggests that the protein intake (%) of the older children was higher than that of the year 7 children.

The following variables showed significant differences between the schools. School C was the control school and the other two the intervention schools (data shown in Appendix C table C8).

Table 7.

Baseline Data: Comparison of mean nutrient intake by 'school attended'.

Variable	Significant Differences Between Schools	Significance p
Energy (MJ)	School A v School B	0.001
	School A v School C	0.023
Energy (kcal)	School A v School B	0.001
	School A v School C	0.023
Fat (g)	School A v School B	0.015
	School A v School C	0.003
CHO (g)	School A v School B	0.000
Sugars (g)	School A v School B	0.004
Starch (g)	School A v School B	0.005
	School A v School C	0.035
SFA (g)	School A v School B	0.019
	School A v School C	0.041
MUFA (g)	School A v School B	0.005
Calcium (mg)	School A v School B	0.042
Iron (mg)	School A v School B	0.035
Vitamin C (mg)	School B v School C	0.049
Vitamin C (mg/MJ)	School B v School C	0.004
Protein (%)	School A v School B	0.021
	School A v School C	0.006
Fat (%)	School B v School C	0.016
	School A v School C	0.045
Sugars (%)	School B v School C	0.005

School C was the control.

The mean energy intake at school A was lower than the other schools (314 kcal vs 529 kcal & 504 kcal for school B and School C respectively). As a result the intake of fat (g), carbohydrate (g) sugars (g), SFA (g), MUFA (g), calcium (mg), iron (mg) were all lowest at school A as was the proportion of energy from carbohydrate but that from fat was higher. The mean vitamin C intake at school C was lower than that at school B as was the percentage of energy from sugars. Thus intakes at the schools were not identical at baseline but the differences are generally small.

8.4 Food Choice

The foods chosen by the children were of very limited variety and intake was dominated by: pizza, chips, sausage roll, soft drinks and cakes and biscuits. This is evident from tables 8 and 9.

Table 8 shows the number of portions consumed of different key food groups (based on the Balance of Good Health), as a percentage of children n=121.

Table 8.

Frequency of intake (% children) of portions foods categorised according to the Balance of Good Health.

Number of Portions:	**0**	**1**	**2**	**3**
Starchy food cooked with oil	39.7	52.9	7.4	
Starchy food not cooked with oil	33.9	61.2	4.1	0.8
Vegetables	67.8	32.2		
Fruit	100			
Milk	99.2	0.8		
Cheese	68.6	31.4		
Red meat	88.4	11.6		
Other meat	69.4	29.8	0.8	
Fish coated	98.3	1.7		
Oily fish	100			
Tinned fish (tuna)	90.9	8.3	0.8	
Legumes	94.2	5.8		
Water	85.1	14.9		
Soft drinks - added sugars	45.5	53.7	0.8	
Soft drinks - no added sugars	88.4	11.6		
Cakes & biscuits	57.0	41.3	1.7	

Starchy foods were consumed by almost all children (3 children did not consume a starchy food). Fruit was not consumed by any child and vegetables and fish, in any form, by very few children (32.2% and 1.7%). Drinks were consumed by all but 22 children.

Table 9 shows the proportion of a variety of key nutrients contributed by intake of foods. It can be seen that intake is dominated by a very small number of

foods (food groups). The very substantial contribution of pizzas etc to a variety of nutrients, of cakes and biscuits to sugars and iron, and of soft drinks to sugars and vitamin C and the very minor contribution of meat to iron intake and fruit and vegetables to intake of vitamin C is noteworthy.

Table 9.

Proportion of nutrients (%) supplied by the most frequently consumed foods.

Food group	Energy	Saturated Fat	Sugars	Sodium	Calcium	Iron	Vitamin C
Pizza etc	47.8	56		41.1	59	47.3	
Cakes & Biscuits	20.8	26.6	36.6	16.2	16.6	23.7	
Soft drinks	11.1		50.9				76.3
Bread				15.3	10.5	11.1	
Meat						7.0	
Fruit & Vegetables							2.3
Potatoes							21.4
Total:	**79.7**	**82.6**	**87.5**	**72.6**	**86.1**	**89.1**	**100**

An empty cell indicates a very minor contribution to the intake of that nutrient.

The columns do not always add up to 100% because there are many minor sources of the nutrients which are excluded from the table.

8.5 Follow up and Intervention

As a result of the findings of the first stage assessments of pupils school lunchtime eating habits the following interventions were introduced prior to the second stage assessments taking place:

- Increased vegetable content in daily specials recipes
- Salad accompaniment available free with all main courses and served in individual bowls
- Milk carton size increased from one third pint to one half pint and offered at the same price.
- An additional daily special was introduced which included a pizza slice, salad, fruit pot, and a sugarless drink.

- All meat to be ‘dry sealed’ as part of the cooking process to reduce fat consumption.
- The range of cold drinks to be reduced to the following to help speed up service; - milk, water, three flavours of fresh carton fruit juice, Ribena Really Light™, and Five Alive™.
- Milk and fruit based hot puddings with custard introduced.
- New range of black melamine cutlery and crockery purchased and used.
- Sausage rolls removed from the menu.
- Doughnuts removed from the menu.

Additionally, the following interventions are ongoing:

- Discussions with bread supplier and suppliers of sauces and gravies to reduce salt content or to source product with reduced salt content.
- Locating suitable noodle pot and cutlery for use in a noodle bar.

The effect of modifying the recipes on nutritional composition can be seen by comparing appendix tables C.4a,b,c (the baseline composition) with appendix tables C.5a,b,c (composition at follow up). A few recipes were withdrawn before follow-up but no new recipes were added except fruit salad. A comparison is made in table 10 showing the number of recipes which met the Caroline Walker Trust (2005) recommendations (using only the higher requirement - for boys). This comparison is crude since it does not allow for other items consumed but it does indicate some potential areas for recipe development and the effect of the changes made to the recipes as part of the intervention.

Table 10.

Number of recipes which meet the Caroline Walker Trust (2005) recommendations for a range of nutrients.

Nutrient:	Protein (gm)	Fat (gm)	Carbohydrate (gm)	Energy	SFA (gm)	Fat (%)*	Carbohydrate (%)**	NSP (gm)	NMES (gm)
Survey:									
Baseline n=28	27	22	0	2	20	6	1	1	28
Follow up n = 26	24	20	0	0	20	13	3	2	26

* Target <=35% ** Target >=50% (DH, 1991).

Nutrient:	Sodium (mg)	Calcium (mg)	Iron (mg)	Vitamin C (mg)	Vitamin A (ug)	Folate (ug)
Survey:						
Baseline n=28	20	4	4	4	12	2
Follow up n = 26	19	4	0	4	12	3

Very few recipes met the recommendations for fat and carbohydrate, NSP and micronutrients (except sodium). As a result of the intervention the only substantial difference was the number of recipes which meet the recommendation for proportion of energy supplied by fat which was much lower at follow-up. The number of recipes supplying the recommended amount of iron fell.

The follow up study resulted in 80 usable dietary records being collected; 38 boys, 37 girls, 5 unknown; 33 entitled to free school meals and 23 not, 24 unknown; 62 in year 7 and 18 in years 10 or 11 and 26 at school C (control) and 42 at school B and 12 at school A (the intervention schools). The level of detail reported in the dietary records was poor on many of these. Hence for a number of individuals there was some doubt about exactly what food had been consumed and the amounts of some components. Assumptions were made based on the information collected in the base-line survey and these are likely to minimise differences between the two surveys. A summary of the nutritional changes is shown in tables 11 & 12 (a positive figure is equal to a lower intake at follow-up).

Table 11.

Mean change in nutrient intake (calculated as base-line intake - intake at follow up) all subjects, boys and girls.

	All n = 80		Boys n = 38		Girls n = 37	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Water (g)	8.2	219.33	-5.5	262.15	8.8	154.0
Energy (kcal)	32	230.3	49	220.8	19	250.3
Protein (g)	0.9	11.40	.05	13.41	1.3	9.74
CHO (g)	3.3	35.63	6.6	31.80	0.2	40.73
Fat (g)	1.9	10.49	2.8	11.40	1.4	9.78
Starch (g)	3.1	25.83	7.1	23.17	-2.2	27.76
Sugars (g)	-0.3	20.24	-1.3	19.67	2.1	21.67
NMES (g)	-2.3	21.98	-3.6	19.09	0.1	25.33
SFA (g)	1.2	4.75	1.4	5.28	1.1	4.37
MUFA (g)	0.6	3.81	0.8	4.08	0.4	3.58
PUFA (g)	-0.3	3.11	-0.7	3.62	0.1	2.66
P:S	-0.2	.73	-0.3	.93	-0.1	.54
Cholesterol (mg)	4	31.0	1	36.6	7	26.7
S. fibre (g)	-0.7	4.73	0.7	3.24	-2.3	5.73
NSP (g)	-0.1	2.83	.4	1.94	-0.8	3.48
Sodium (mg)	21	474.9	131	415.5	-81	534.8
Calcium (mg)	47	141.9	68	115.5	24	169.6
Iron (mg)	0.3	1.47	0.6	1.23	0.04	1.69
Vitamin C (mg)	25.4	44.37	17.7	43.15	39.2	34.69
Vitamin A (ug)	10.5	44.47	8.1	34.37	13.8	52.72
Carotene (ug)	-5.4	163.77	-1.7	69.46	-8.1	231.61
Folate (ug)	11.8	45.93	16.6	41.70	8.1	51.69
Protein (%)	0.9	10.90	-0.1	10.47	1.8	12.03
Fat (%)	2.1	10.58	2.5	11.78	1.9	9.24
CHO (%)	-2.7	15.70	-1.7	16.81	-3.6	15.02
Starch (%)	-1.2	16.47	1.9	16.85	-5.0	15.82
Sugars (%)	-1.8	15.85	-4.2	16.44	1.2	15.40
SFA (%)	1.2	5.44	1.3	6.44	1.3	4.56
MUFA (%)	0.5	4.49	0.5	5.29	0.4	3.11
PUFA (%)	-0.7	4.90	-1.4	5.77	-0.1	4.09
NSP (g/MJ)	-0.2	1.44	0.01	1.34	-0.5	1.56
Calcium (mg/MJ)	18.8	75.21	33.1	70.74	1.1	79.51
Iron (mg/MJ)	0.1	.70	0.2	.63	-0.01	.78
Retinol (ug/MJ)	8.8	26.83	7.0	25.42	11.7	28.95
Vitamin C (mg/MJ)	12.2	25.96	6.5	25.99	20.8	22.04

A negative number indicates a rise in intake and a positive number a fall.

Table 12.

Comparison of changes in intake between schools C (control) and schools A and B (Intervention).

	School C n = 42		School B n = 42		School A n = 12	
	Control		Intervention			
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Water (g)	-27	265.2	15	201.7	63	166.0
Energy (kcal)	36	257.3	36	231.8	9	171.6
Protein (g)	-2.0	15.02	2.9	9.18	0.3	8.46
Fat (g)	0.7	12.56	3.3	9.86	-0.1	7.44
Carbohydrate (g)	9.8	36.01	-0.5	36.38	2.4	32.88
Starch (g)	12.0	27.24	-2.5	25.02	3.2	21.44
Sugars (g)	-2.3	20.89	1.2	20.49	-1.0	19.17
NMES (g)	-3.9	19.59	-1.3	25.39	-2.0	13.57
SFA (g)	0.3	5.74	1.9	4.41	0.8	3.27
MUFA (g)	1.0	4.82	0.5	3.39	0.2	2.79
PUFA (g)	-0.5	3.16	0.0	3.21	-0.9	2.68
P:S	0.0	.56	-0.2	.84	-0.3	.64
Cholesterol (mg)	-5	37.99	11	25.05	0.5	29.36
S. fibre (g)	1.8	3.10	-2.7	5.13	1.2	2.53
NSP (g)	1.2	2.10	-1.2	3.06	0.8	1.76
Sodium (mg)	0.4	417.91	36	538.55	13	373.54
Calcium (mg)	61	120.24	37	161.35	49	117.93
Iron (mg)	0.9	1.18	-0.2	1.58	0.8	1.13
Vitamin C (mg)	7.8	56.62	35.4	32.68	28.8	41.81
Vitamin A (ug)	11	48.6	9	44.6	16	37.4
Carotene (ug)	11	50.7	-23	220.8	21	49.1
Folate (ug)	18	40.3	4	52.8	25	24.1
Protein (%)	-1.4	8.65	1.6	6.28	3.4	22.65
Fat (%)	1.6	12.72	3.3	7.99	-0.5	13.57
Carbohydrate (%)	-0.0	16.82	-4.4	9.79	-2.5	27.24
Starch (%)	5.3	15.44	-5.2	15.38	-1.2	19.08
Sugars (%)	-5.3	15.04	0.3	14.37	-1.5	21.76
SFA (%)	-0.0	6.75	1.9	4.85	1.7	3.95
MUFA (%)	0.8	6.44	0.3	2.78	0.4	4.64
PUFA (%)	-0.5	4.27	-0.4	4.66	-2.2	6.87
NSP (g/MJ)	0.4	1.15	-0.8	1.52	0.5	.83
Calcium (mg/MJ)	19.0	68.02	15.4	79.02	30.2	81.55
Iron (mg/MJ)	0.3	.49	-0.2	.67	0.6	.82
Retinol (ug/MJ)	3.1	26.76	9.6	25.17	18.5	31.59
Vitamin C (mg/MJ)	-0.0	31.05	15.7	16.85	26.0	31.41

A negative number indicates a rise in intake and a positive number a fall.

It is apparent that there were only very minor differences, overall, between the baseline intake and that at follow-up. The only differences to achieve statistical significance are shown in tables 13 (for all subjects), table 14 for differences associated with the sex of the subjects and tables 15a,b for differences associated with the school attended (hence intervention group).

The following variables showed a significant difference between 'Baseline' and 'Follow up' values (as calculated using the 'Difference' variables):

Table 13.
Comparison of mean difference in intake between 'baseline' and 'follow up' data for all subjects.

Variable	Significance p	Average Difference
SFA (g)	0.028	1.1929
SFA (%)	0.045	1.2382
P:S	0.041	-0.1702
Calcium (mg)	0.004	46.5012
Vitamin C (mg)	0.000	25.4382
Vitamin A (ug)	0.039	10.4561
Folate (ug)	0.024	11.8073
Calcium (mg/MJ)	0.028	18.8175
Retinol (ug/MJ)	0.004	8.8243
Vitamin C (mg/MJ)	0.000	12.1588

One-Sample t-test was performed on all 'Difference' variables, with the null hypothesis: **Ho: m=0**.
Note: The One-Sample t-test is robust to lack of normalcy. It is equivalent to using the paired values t-test. The small fall in SFA (g or %) and rise in P:S, if real, would be welcome but all the other changes are undesirable.

The following variables show significant differences in the change in intake between boys and girls, indicating that the 'take-up' of the intervention differed between the sexes:

Table 14.

Comparison of mean difference in intake by ‘SEX’.

Variable	Significance p
Vitamin C (mg)	0.013
Vitamin C (mg/MJ)	0.003

The mean vitamin C intake of all children fell but that of the girls fell more than the intake of the boys.

The following variables show significant differences between schools, indicating that the ‘take-up’ of the intervention differed between these two groups:

Tables 15a,b.

Comparison of mean difference in intake by ‘SCHOOL’.

Variable	Significant Differences Between Schools	Significance p
Vitamin C (mg/MJ)	School B v School C	0.007
	School C v School A	0.041

Mean change in intake of Vitamin C (mg/MJ) across schools.

School	Mean	N	Std. Deviation
School B	15.70	42	16.847
School C	0.03	26	31.048
School A	26.02	12	31.418
Total	12.16	80	25.963

Interventions were carried out at school A and school B hence there is evidence that a fall in the intake of vitamin C in relation to energy intake did occur as a result of the intervention.

Table 16 summarises the intake at follow-up in relation to the Balance of Good Health model and according to whether the schools belonged to the control (n=26) or intervention (n=54).

Table 16. Frequency of intake (% children) of portions foods consumed at follow-up categorised according to the Balance of Good Health and intervention.

Number of Portions:	**0**		**1**		**2**		**3**	
	C	**I**	**C**	**I**	**C**	**I**	**C**	**I**
Starchy food cooked with oil	38.5	41.8	61.5	49.1		9.1		
Starchy food not cooked with oil	53.8	36.4	46.2	58.2		5.5		
Vegetables	61.5	47.3	38.5	49.1		1.8		1.8
Fruit	100	100						
Milk	100	96.4		3.6				
Cheese	80.8	65.5	19.2	34.5				
Red meat	80.8	87.3	19.2	12.7				
Other meat	65.4	81.8	34.6	18.2				
Fish coated	100	100						
Oily fish	100	100						
Tinned fish (tuna)	96.1	89.1	3.8	10.9				
Legumes *	100	80.0		20.0				
Water	65.4	87.3	26.9	12.7	7.7			
Soft drinks - added sugars	100	100						
Soft drinks - no added sugars *	73.1	28.4	23.1	58.2	3.8			
Cakes & biscuits	53.8	58.2	46.2	41.8				

C = control school. I = Intervention schools.
* significant difference between control / intervention.

Comparing tables 8 and 16 it would appear that the pattern of food consumption was overall very similar between the two surveys; at follow-up meals remained dominated by pizza and chips with a complete absence of fruit and 51% of children ate no vegetables (baked beans and small amounts of salad were the main vegetables consumed) despite the availability of a wide range of food types including freshly prepared main courses, fresh vegetables, salads and fresh fruit. Dairy products hardly featured in either survey. However, at follow-up there were, perhaps, more tortilla wraps consumed (although there was no difference in the proportion of children eating starchy foods). At follow-up there were only two significant differences between the control and intervention children: intervention children were more likely to have eaten legumes - exclusively baked beans ($p=0.01$) and more likely to have

consumed a soft drink with no added sugar (p=0.02). No drinks containing added sugars were consumed at follow up.

SECTION 9
DISCUSSION

9.1 Positives and Negatives

The measurement of dietary intake is very problematic especially for nutrients and micronutrients. This is in part due to large errors in the available methods (including the use of food tables to convert estimates of food consumed into nutrient intakes) and partly due to the huge variation in intake both between people and within people. Weighing food is a very laborious process and required a team of helpers and despite training this led to some problems. For example some descriptions of foods were not adequate to enable them to be identified with precision and some data were missing (eg sex of the child). Weighing food intake is also likely to distort intake thus compromising the validity of the estimates. No estimate of validity was made in this study because it was based on a single meal and so the use of biomarkers would not be appropriate. Nevertheless weighing was used to try to minimise error in estimating weights and to try to ensure a higher response rate.

The reliability of estimates of individual's intake from school meals is poor as it is based on records of single meals. Thus the ability to detect differences in intake was limited both by poor reliability and sample size; the number of volunteers (schools and individuals), completed records and subsequent matched pairs of records was very disappointing. It is feared that this may reflect the priority given to healthy eating by both schools, children and their parents. Perhaps the importance of healthy eating (especially in adolescence) is still not well appreciated? In addition the quality of the data collected deteriorated for the second survey. Furthermore the study design was limited by the very tight timetable allowed and so baseline measurements were all conducted in February to April and the follow-up in May and June. There may, therefore, be a seasonal effect in the data which cannot be allowed for. These factors have limited the ability to detect change and to generalise from the results.

Interpretation of nutrient intake from school meals only, is confounded by not being able to put the intake at school meals into the context of the whole day's intake. Although clearly school meals should conform to nutritional standards the implications of consuming the school meals will depend on intake at other times of the day and indeed over a much longer time period. These results therefore should be regarded as indicative of patterns of consumption and therefore suggestive of the action needed to improve school meals but are not necessarily indicative of potential dietary / nutritional problems in adolescents. A child who took advantage of the range of foods on offer, could over a period of days, consume a varied and acceptable diet. The impression of most people involved in the project was that children tend to eat almost the same foods each day. The mean intakes at the meals were evaluated by comparison with three standards: the Balance of Good Health (FSA, 2001), the Dietary Reference values (DH, 1991) and the Caroline Walker Trust recommendations (CWT, 2005). Evaluation was complicated by the greatly varying energy intakes of the individual children hence the 'quality of the meals' was calculated by estimating the proportion of energy supplied by protein, fat and carbohydrate and by estimating the intake of other nutrients per unit of energy (MJ) consumed. Since obesity is becoming such a major problem the evaluation of mean energy intake is particularly unreliable without estimates of mean whole day's intake and preferably, in addition, energy expenditure. Thus the low energy intakes observed are not necessarily unwelcome but a low energy intake requires a better quality diet (weight nutrients per MJ) to be consumed in order to meet recommendations for other nutrients, for example iron and calcium. Overall, recommendations which are not expressed in relation to energy intake are of very limited value especially when the intake of a meal, not an average day's intake, is being evaluated. This will be returned to below.

Despite the choices on offer, the children who completed the baseline study showed an extremely limited repertoire of foods (subjectively this was the most impressive finding). The choices made by the children were therefore the major factor which determined their nutritional intake. In particular very few meals were based on the recipes prepared by the school meals service which,

as a consequence, had virtually no impact on mean nutrient intakes. Conversely the influence of manufactured foods (notably pizzas and soft drinks) was very evident. This highlights the vital role to be played by the manufacturers of foods and the suppliers of foods for catering service (since contractual arrangements will often require all foods to be purchased only from a very limited number of suppliers). Until more choice is available from manufacturers specifically to include good quality healthier options (for example low salt varieties of pizza and bread), limited progress can be made. It was of particular concern that no fruit was recorded to have been consumed and very minimal amounts of vegetables. Limiting choice to 'healthier' options may be one way to improve intake, but only if the foods on offer are attractive to the children. Providing foods which the children do not wish to eat is likely to lead to a fall in take-up of school meals which could be nutritionally bad for those who depend most upon school meals. In addition it was apparent that there were implications for the local area if school meal take-up fell as a result of children leaving the school premises at lunchtime to purchase foods outside.. Thus, ways of improving the take-up of school meals might have nutritional and other community related benefits.

Interpretations of analyses of nutrient intake based on mean results are potentially very misleading since such a huge range in intakes was observed. This further emphasises that intake is primarily determined by the choices made by individuals. In particular this is no guarantee that those who ate most had the highest nutrient requirements. Indeed the lack of difference in energy intake in relation to sex or age suggests that 'physiology' was not driving intake at school meals. Without information on the rest of the day's intake and on the nutritional status of the subjects it is not possible to make firm conclusions with regard to the adequacy of the intake. The intake observed therefore, can only be evaluated in the general context of healthy eating, nevertheless school meals must set an example for both children and adults.

9.2 Baseline

This phase of the survey highlighted several key issues. None of the meals weighed in this study conformed to the 'Balance of Good Health' model for

healthy eating and even the overall profile fell far short. There was a heavy reliance by pupils on processed foods and complete lack in consumption of fruit and minimal intake of vegetables. Starchy foods were popular but were often ‘fatty’ and / or ‘sugary’, for example cakes and biscuits, chips and potato wedges. Sandwiches and wraps were consumed by many and possibly provide scope for improvement if designed to provide more ‘bread’ and less fatty spread / filling. There were concerns about the high salt content of bread and no sources of lower sodium bread were readily available to the school meals service. A drink was consumed by most children and fruit drinks (most without added sugars) were the most popular hence the high vitamin C intake. Although sugars consumed in this form is normally great cause for concern since these drinks (and sugar from other sources) was consumed as part of a meal there is little risk to teeth (Moynihan, 1995) but consumption of sugared drinks may contribute to over consumption (Seidell & Visscher, 2004). Dairy products, with the exception of cheese, made a very limited contribution (eggs were not consumed) as did meat (except for chicken nuggets) and fish (only tinned tuna made an appreciable but very small contribution). These findings are reflected in the nutritional results - high intakes of SFAs and sodium and low intakes of calcium and iron. There were therefore some very positive findings, for example the overall balance of fat and carbohydrate in the diet, but there is certainly room for improvement and more creative planning with regards to service design and delivery to ensure that a limited range of foods supply all nutrients.

Clearly school meals can only contribute to good nutrition if they are eaten. There are additional incentives to teachers to persuade children to take school meals since those who do not are more likely to leave the school premises. Although not investigated in this study it is likely that the environment and conditions under which school meals have to be consumed is a major disincentive for children. Better dining halls and furniture, more space and time, and better presentation of food are all likely to help encourage more children to take school meals, and all future new school designs including those emerging from the ‘Building Schools for the Future’ programme must acknowledge the importance of this fact. Where children share control of such

conditions there is also likely to be better compliance. A School Nutrition Action Group (Passmore, 1996; Health Education Trust web site) can be used to encourage and enable children to play a role in promoting consumption of (healthier) food in school.

9.3 Intervention

Only one significant change in nutrient intake occurred, apparently as a result of the intervention programme - a decline in vitamin C intake per MJ of energy consumed suggesting a deterioration in quality. It is suspected that this relates to a change in the soft drinks on offer in one school. The differences between the baseline intake and that at follow up were very minor. It is possible that had the sample size been larger, and hence the statistical tests more powerful, that more differences in intake would have been significant. However, such small differences are likely to be of little practical importance. These findings not only highlight the problematic nature of achieving dietary change at school meals but also suggest the very limited impact that changes in school meals are likely to have on average daily intake of these young people. That is, most of these subjects were clearly obtaining most of their nutrients outside of the school (average energy intake was 489 kcals but the EAR for a 11-14 year old boys is 2220 and girls 1845 kcals; higher intakes were recorded in Nelson et al's 2004, survey). The Caroline Walker Trust, however, recommends intake of 714 kcals for 11-18 year old boys and 578 kcals for girls. Hence expecting school meals to have a substantial impact on overall intake and then later on health outcomes appears to be extremely implausible. This is not say that changes to school meals are not required and should not be attempted. There is a moral obligation to provide food which is seen to be healthy and to promote health education to ensure consistency in messages reaching the children (and adults). Furthermore it is quite possible that there are some children who rely far more heavily on the nutrients obtained from school meals than others. Previous studies have suggested that children in receipt of free school meals depend more on school meals (Gregory et al, 2000) but this cannot be confirmed from these data.. It is suggested that too much emphasis is being placed on providing a 'meal' (a substantial contribution to the day's intake) when most children clearly only

wanted to eat ‘snacks’ (a relatively minor contribution). Given that many schools have decreased the amount of time to consume lunch it would seem sensible to consider catering for both these demands by offering a varied and predominantly healthy snack service at lunch time

SECTION 10
CONCLUSION AND THE WAY FORWARD

It is axiomatic, for both moral and educational reasons, that food supplied in schools should reflect the best dietary advice. It should also be possible for this to be monitored at the school level (without the need for a high level of nutritional expertise and significant additional expense and manpower) and Ofsted are now beginning to expect this. It is suggested that the 'Balance of Good Health' provides a practical basis for doing this but that perhaps the most important criterion should be the variety of choices made. A very marked feature of this survey was the restricted repertoire of foods consumed. Encouraging variety is likely to be acceptable to all the various vested interests involved since no food (group) is excluded but an overall 'Balance of Good Health' is promoted. This would need to involve a re-evaluation of portion sizes on offer. If more but smaller portions of a more varied group of foods were offered and consumed it is more likely that nutritional standards would be met (variety of intake is used as a major component of dietary advice / quality in Japan: Okuda & Hackett, 1995). For example chips could feature on menus but the portion served would be greatly reduced which may encourage co-consumption of other foods. Each child would then build his or her lunch from maybe 5 or 6 small portions of different foods. A 'mix n' match' service might achieve this (where a fairly wide choice of small portions are on offer). The amount consumed will be determined by each individual's appetite (and the number of foods selected) as well as by intake at other times and places. The important thing is that children do not go hungry and that they eat a varied, predominantly healthy diet. Such an approach can also help address issues of inclusivity and cross-cultural education since, for example vegetarian foods and foods from varied cultures can be provided. It is suggested that the model of school catering which prevails is now outdated and that focussing on variety would change the model to a twenty first century 'snack bar' model but one consciously designed to encourage the consumption of a healthy balanced diet. Appendix D gives an example of a mix n' match menu.

Meals eaten at school are just one facet of a child's dietary intake and their contribution to the nutritional health of children should be neither under- nor over-stated. Whilst the intake at any one meal is clearly of virtually no significance in terms of consequences, the patterns observed in this study are cause for concern.

The food provided at school should be an example of the standards expected generally - it should be safe, nutritious and attractive. It is particularly important that the food provided reflect what is taught in the classroom otherwise the credibility of the National Curriculum is jeopardised.

Following the sharing of the findings of this report it has also been acknowledged at a political level that the Council will provide the necessary direction and leadership to ensure that the report recommendations are implemented and that lasting improvements in the nutritional intake of pupils are achieved.

SECTION 11
RECOMMENDATIONS

- Food provided in schools must reflect best practice and educational messages.
- Strategies should aim to increase take up of meals in school.
- The Balance of Good Health (food based) model must be promoted.
- Snacks or ‘fast food’ (which can be perfectly acceptable) are likely to be attractive to consumers.
- Dietary recommendations should focus on foods provided and their nutritional characteristics (quality) rather than the nutritional value of the meal (since this will depend upon the needs of individuals).
- Encouraging a varied intake may be the single most important way to promote healthy eating.

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Appendix A

School Meals Policy Management and Administration Statement, July 2004

1. INTRODUCTION

Knowsley attaches importance to the provision of School Meals to pupils in the Borough as an integral aspect of the key aims of the Authority.

This policy seeks to incorporate the objectives of all stakeholders in the School Meals Service and to provide a foundation upon which the future direction and development of the service can be based. Policy guidelines have added relevance following the legislative effects of Best Value, Fair Funding and the National Nutritional Standards.

The objectives identified within the School Meals Charter derive from consultation with stakeholders, and represent a commitment to work together to achieve agreed outcomes for the benefit of all.

2. SCHOOL MEALS CHARTER

The Pledge

- To support and promote the healthy eating objectives of the Knowsley Health Partnership, including the reporting of agreed measurable outcomes.
- To provide a good quality, nutritious school lunch which is primarily prepared on a daily basis, where appropriate, with fresh vegetables, fruit and meat and provides students with choice.
- To provide, where appropriate, a breakfast service, mid morning break, and lunchtime service to ensure all pupils have access to healthy and nutritious food and refreshments.
- To ensure the School Meals Service is branded to each age group and to regularly consult all stakeholders in the review of school menus.
- To ensure additional food and beverage services provided through vending machines, tuck shops and mobile outlets are compatible with the promotion of healthy eating.
- To maximise the impact healthy eating has upon effective pupil behaviour and attainment.
- To constantly review and utilise new technology to improve the queuing system and lunchtime experience of young people.
- To maintain and constantly strive to improve the Hospitality Assured School Meals Service quality assessment rating.

The Environment

- To work collaboratively with Head teachers and Governors to ensure that dining areas and the duration of the lunchtime period afford all pupils the opportunity to enjoy their lunch in relaxing and pleasant surroundings.
- To ensure the dining room environment is conducive to the enjoyment of food and provides facilities which encourage young people to appreciate the social role food consumption plays in society.

The Menu

- To make available and promote healthy breakfast and morning break menus at affordable prices.
- To provide a varied choice of midday meals, including a minimum of two main course and two dessert choices in all primary and special schools, and to inform and keep informed parents and guardians of the menus on offer.
- To provide a good quality, nutritious two course midday meal and drink for every pupil wishing to have one such that the quality and nutritional value of the meal will serve as the pupil's main meal of the day.
- To provide menus which are attractive to young people in order for them to make informed healthy choices.
- To consult with all stakeholders in the menu planning process and to keep them informed of the outcome.
- To cater for all special medical and ethnic dietary needs on request.
- To continuously seek opportunities to encourage an increased take up of School Meals, both of free and paid meals, to facilitate development of the service

The Staff

- To ensure all staff undergo certificated basic food hygiene and basic health and safety training.
- To identify and provide employee development opportunities for all staff through annual job chats.
- To ensure all staff are customer focused and sensitive to the needs of young people.
- To ensure all staff feel valued, and through this are enthusiastic, motivated and committed to the School Meals Service.
- To ensure all staff play a full and active part in promoting the educational and social ethos of the school through their manner and behaviour, working closely and productively with the school.

3. Legislation

3.1 It is acknowledged that there are a number of statutory instruments that govern the supply of catering to schools. These are listed in Appendix 1 of this policy and the arrangements for catering service provision must embody the requirement to comply with the legislative requirements.

4. Service Provision and Choice

The organisation of the School Meals Service is based on the following systems:

4.1 Multi Choice Options

Based on a nutritionally balanced specification, pupils will be offered two or three main course and dessert choices. The aim will be to establish 'healthy lifestyle' patterns to encourage increased take up of key nutritional food groups.

4.2 Cash Cafeteria

Pupils bring money to school on a daily basis and choose from a range of food items. This service offers more flexibility to parents and pupils, whilst at the same time preparing young people in the handling of money and making choices.

4.3 Cashless Systems

Pupils are issued with a Smart Card which they can credit with cash through a revaluation centre. Pupils entitled to free meals will also receive a daily credit allowance equivalent to the value of a free meal.

5. Healthy eating and nutritional requirements

5.1 Knowsley recognises the importance of a good diet for young people and the contribution of dietary care in providing a sound foundation for good health in later life. This is acknowledged in the Council's key objectives and the principles embodied in the Knowsley Healthy School's programme shown in 8.1.5 of this policy statement. The aim is therefore to provide a well-balanced nutritional lunch that can be reinforced through teaching about nutrition and health in the classroom.

5.2 Knowsley recognises the importance of the School Meals Service in developing an effective obesity strategy, and supports initiatives that positively contribute towards its success.

5.3 Knowsley supports and promotes a holistic approach to a healthy eating agenda and participation in the application of the National Nutritional Standards.

5.4 It is the Council's current policy not to use any products that are known to contain genetically modified ingredients.

6. Resources

6.1 The arrangements for the provision of School Meals will incorporate due diligence by the service provider to include aspects such as purchasing policy,

food delivery and storage, preparation and handling of food, health and safety, cleaning and equipment maintenance.

6.2 To this effect staff must be appropriately trained in the handling, production and service of food to promote best practice with a view to achieving optimum service delivery.

7. Menus Pricing

7.1 Tariffs will be set by the Department of Education and Lifelong Learning (DELL) at reasonable levels which are benchmarked against other Local Authorities in the North West region. Governing bodies have the power to determine tariff prices and menu content, but are required to have regard to the pricing levels set or proposed by DELL.

8. Guiding Responsibilities

8.1 Responsibilities of Schools

8.1.1 Premises

- Governing Body's will allow the free use of the necessary premises by the service provider for the supply of catering services as well as providing opportunities for pupils to bring packed lunches.
- Governing Body's will allow reasonable free use of all forms of energy and services required to provide the services.
- Governing Body's are responsible for day to day maintenance and repairs in respect of to all elements of kitchen building and kitchen equipment and other items for which delegated maintenance budgets apply.

8.1.2 Meal Numbers

- schools will be responsible for notifying the School Cook before 10.30am, of the number of pupils requiring lunch to aid service delivery, better utilising resources and minimising waste.

8.1.3 Cash Collection and Banking

- schools without a cash cafeteria service will be responsible for collecting meal income from pupils and preparing it for banking.
- schools will be responsible for banking all income using approved local authority processes and procedures.
- schools will collect all School Meals income and implement the approved Bad Debts procedure where appropriate.

8.1.4 Supervision

- Schools will provide adequate midday supervision to ensure appropriate student behaviour is maintained in accordance with school policy.

8.1.5 Healthy Eating Policy

Governing bodies are requested to acknowledge the principles outlined below:

- the school has an agreed Healthy Eating policy which:
  - has established mechanisms for involving the whole school community in its development and implementation.
  - makes links to national curriculum, the Primary Schools Health Education (PHSE) Framework, and National Nutritional Standards.
  - is based on stated whole school aims and values.
  - includes guidance on the dining environment, nutritional standards, sensitivity to cultural, ethical, social and economic issues about food, food provided for school social events, vending, the provision of water and the use of promotional schemes from food manufacturers.

- School Provision
  - The school environment promotes Healthy Eating through the provision of information and interesting displays which are regularly updated and changed, and through the provision of a dining room environment which fosters social eating.
  - The school provides, promotes and monitors healthier food at lunch and break times and in any breakfast clubs where they are provided.
  - External agencies are consulted to provide information on Healthy Eating provision, and invited to support Healthy Eating activities.

- Curriculum
  - Different forms of curriculum provision are provided to address Healthy Eating issues including teaching through a variety of subject areas and other activities and school events which deliver consistent messages.
  - Schemes of work are clearly developed with clear aims and learning outcomes in relation to Healthy Eating.
  - Planning in Healthy Eating work incorporates the development of (basic) skills including practical food skills to enable Healthy Eating such as budgeting, shopping, cooking and food hygiene skills and basic food safety practices.
  - The curriculum supports a balanced attitude towards Healthy Eating and promotes Dental Health.

8.2 Responsibilities of the Service Provider

8.2.1 Statutory Requirements

- The provider will comply with all current relevant legislation and any changes or new legislation. (see Appendix A)

8.2.2 Staffing

- the provider will be responsible for the whole recruitment process.
- the provider will be responsible for all trade union negotiations.
- the provider will be responsible for all payroll processing.
- the provider will be responsible for arranging absence cover, any referrals of staff to the occupational health unit, and dealing with any Department for Work and Pensions (DWP) benefit inquiries, and requests for references.
- the provider will be responsible for all training.

8.2.3 Menus and Nutrition

- the provider will offer a menu choice which meets the National Nutritional Standards.
- the provider will administer and provide for any special dietary requirements.

8.2.4 Equipment

- the provider will be responsible for the repair and replacement of light equipment, and of heavy equipment as agreed with schools.
- the provider will be responsible for the electrical testing of portable electrical equipment and gas safety testing of heavy equipment.
- the provider will be responsible for remedying any pest infestation arising in the kitchen area.

8.2.5 Marketing

- the provider will undertake continual development of the catering service and the implementation of an effective marketing plan.

8.2.6 Insurance

- the provider will arrange all required staff and liability insurance using appropriate insurance policies.

8.2.7 Security

- the provider will be responsible for the security of the area under its control including goods and equipment used in the provision of the service.

8.2.8 Income Reconciliation

- the provider will be responsible for collecting, counting and preparing for banking cash income received in cash cafeteria kitchens with the exception of schools with cashless pay systems.

- the provider will be responsible for operating income reconciliation for all cash cafeteria schools in order to ensure that the due income is received.

8.3 Responsibilities of the Department of Education and Lifelong Learning (DELL)

8.3.1 Free and Paid Meals

- DELL will be responsible for determining the entitlement to free pupil meals.

9. Best Value

9.1 The School Meals Service provider will be required to demonstrate compliance with the legislative requirements of best value.

9.2 The best value duty does not apply to individual schools, given that the process of deciding on the spending of a delegated budget is in itself a mechanism for cost effectiveness. However, governing bodies who elect to self manage the School Meals Service within their school will be required to show within their budget plans, how they are adhering to the principles of best value.

Applicable Legislation

- Food Safety (General Food Hygiene) Regulations 1995
- Health and Safety at Work Act Etc. 1974
- Food Labelling Regulations 1984 and 1996
- All current Health and Safety Legislation covering the following:
  - Control of Substances Hazardous to Health Regulations (COSHH)
  - Manual Handling Regulations
  - Provision and Use of Workplace Equipment Regulations
  - Electricity at Work Regulations
  - Gas Safety Regulations
  - Management at Work Regulations
  - Reporting of Diseases, Dangerous Occurrences and Injuries Regulations (RIDDOR)
  - First Aid Regulations
  - Fire Safety Regulations
- Food Safety Act 1990
- National Nutritional Standards

Appendix B.

Proforma for weighing intake.

Evaluation of school meals provision in Knowsley.

Baseline / Follow-up

School: _____

Day: _____ **Date:** _____

Subject code: _____

Boy or girl?: _____

Date of birth: _____

Field worker: _____

Office use: **Free School meal?** _____ (Code from consent form at end of study only).

MW6 Code Office use	Description food item	Weight (g) Served	Weight (g) Leftovers	Weight (g) Eaten

Continue on reverse (cross out if not used).

Subject's name in full: _____

APPENDIX C.
STATISTICAL TABLES.

Table C.1 Baseline data - summary tests of normal distribution.

There is **insufficient** evidence to reject Ho: Normalcy for these variables:	There is **sufficient** evidence to reject Ho: Normalcy for these variables:
Sugars (g)	PUFA (g)
Water (g)	Cholesterol (mg)
Protein (g)	S. Fibre (g)
Fat (g)	Sodium (mg)
Carbohydrate (g)	Vitamin C (mg)
Energy (Kcal)	Retinol (ug)
SFA (g)	Vitamin A (ug)
MUFA (g)	Carotene (ug)
NSP (g)	NMES (g)
Starch (g)	PRT (%)
Calcium(mg)	NMES (%)r
Iron (mg)	Vitamion A (ug /MJ)
Folate (ug)	P:S
Energy (MJ)	Salt (mg)
FAT (%)	PUFA (%)
CHO (%)	
Starch (%)	
Sugars (%)	
NSP (g/MJ)	
Calcium (mg/MJ)	
Iron (mg/MJ)	
Vitamin C (mg/MJ)	
SFA (%)	
MUFA (%)	
Parametric tests were applied to these variables	**Non-parametric** tests were applied to these variables

Table C.2 Difference data - summary tests of normal distribution.

There is **insufficient** evidence to reject Ho: Normalcy for these variables:	There is **sufficient** evidence to reject Ho: Normalcy for these variables:	
Water (g)	PUFA (g)	(0.042)
Protein (g)	S. Fibre (g)	(0.005)
Carbohydrate (g)	Vitamin A (ug)	(0.007)
Fat (g)	Carotene (ug)	(0.000)
Energy (kcal)	NMES (g)	(0.029)
Sugars	Calcium (mg/MJ)	(0.062)
SFA (g)	Retinol (ug/MJ)	(0.005)
MUFA (g)	P:S	(0.000)
Cholesterol (mg)	PUFA (%)	(0.037)
NSP (g)		
Starch (g)		
Sodium (mg)		
Calcium (mg)		
Iron (mg)		
Vitamin C (mg)		
Folate (ug)		
Protein (%)		
Fat (%)		
Carbohydrate (%)		
Starch (%)		
Sugars (%)		
NSP (g/MJ)		
Iron (mg/MJ)		
Vitamin C (mg/MJ)		
SFA (%)		
MUFA (%)		
PARAMETRIC TESTS will be applied, where appropriate	**NON-PARAMETRIC TESTS** will be applied, where appropriate	

Table C4a. Nutrient composition of baseline recipes per portion (no allowance made for cooking losses).

BL Recipe	Water	Protein	Fat	CHO	Energy	Sugars	SFA	MUFA	PUFA	Cholesterol
	g	g	g	g	kcal	g	g	g	g	mg
Baked fish	68.4	17.1	0.7	9.3	109.0	0.2	0.1	0.1	0.2	30.2
Barbeque chicken	86.6	28.3	6.7	23.1	259.5	8.5	2.3	3.0	1.1	81.0
Battered fish	138.2	24.2	16.1	24.0	331.2	0.5	1.2	9.0	4.8	40.3
Beef potato pie	135.5	34.8	39.9	42.8	657.8	2.4	12.8	18.5	5.8	106.7
Beef vegetable curry	137.1	31.2	24.6	6.7	371.5	4.0	5.5	10.6	3.8	90.0
Braised beef & onions	196.2	31.3	21.7	11.7	363.0	1.9	5.5	10.7	3.8	90.0
Cheese flan	138.6	23.4	37.7	32.4	554.3	5.0	17.8	13.7	3.4	227.5
Cheese pasta bake	281.4	24.6	29.9	45.6	537.9	8.0	15.3	9.9	2.6	89.9
Chicken vegetable curry	225.6	24.3	16.4	37.9	386.7	4.0	1.6	7.2	3.9	81.0
Chicken pie	233.5	27.0	32.2	53.9	599.6	2.9	7.9	16.2	6.7	147.3
Chilli beef	174.2	22.2	26.1	40.0	474.3	5.7	7.2	12.5	4.0	54.0
Corned beef hash	208.5	31.5	24.6	28.7	454.5	3.5	7.8	11.8	3.8	100.7
Cottage pie	354.3	25.2	25.3	65.6	573.1	5.7	7.0	12.2	3.8	54.0
Irish stew	397.4	32.5	25.5	60.5	584.8	9.9	7.3	11.8	4.4	86.4
Italian chicken	277.5	28.9	22.6	33.9	445.1	8.2	4.8	11.6	5.1	118.5
Lamb korma	189.4	25.8	32.4	37.4	535.8	3.6	9.2	13.2	4.6	82.8
Lasagne	326.6	36.5	38.0	41.9	644.0	12.3	17.6	14.4	2.7	126.4
Quiche Lorraine	158.7	32.0	46.1	31.0	659.9	3.6	19.9	17.8	5.0	280.3
Sausage bacon wrap	19.2	17.3	31.8	15.7	414.5	0.2	11.8	2.1	0.7	15.9
Sausage casserole	246.1	20.5	56.4	35.2	721.2	6.3	15.9	6.4	4.2	0.0
Scouse	396.0	36.3	22.1	60.5	569.9	9.9	5.5	10.7	4.2	90.0
Spaghetti Bolognaise	164.9	25.9	25.7	48.6	517.3	5.8	7.0	12.3	3.9	54.0
Spicy chicken	94.0	35.8	27.3	50.5	578.0	3.1	4.5	7.0	13.8	96.3
Steak mushroom pie	219.2	36.6	41.7	53.8	721.9	2.9	12.1	20.1	7.1	156.3
Sweet sour pork	237.5	32.7	17.4	42.9	449.1	8.0	2.8	8.3	5.0	89.1
Turkey casserole	231.1	22.7	12.0	13.4	249.1	2.8	1.2	6.5	3.5	63.0
Turkey meatballs curry	130.5	16.5	14.1	52.6	390.1	2.8	0.3	0.3	0.5	0.0
Turkey meatballs tomato	133.1	16.2	9.5	34.3	279.0	2.8	0.1	0.0	0.2	0.0
CW Trust 2005: Boys 11-18y		13.8	27.8	95.2	714.0		8.7			
CW Trust 2005: Girls 11-18y		12.7	22.5	77.0	578.0		7.1			
		Minimum	Maximum	Minimum	----------		Maximum			

Table C4b. Nutrient composition of baseline recipes per portion (no allowance made for cooking losses).

	S. fibre	NSP	Starch	Sodium	Calcium	Iron	Vitamin C	Retinol	Vitamin A	Carotene	Folate	NMES
	g	g	g	mg	mg	mg	mg	ug	ug	ug	ug	g
Baked fish	0.0	0.4	9.1	56.6	28.6	0.3	0.0	0.0	0.0	0.0	10.2	0.0
Barbeque chicken	0.0	0.9	14.5	738.6	13.9	0.7	1.0	0.0	28.6	171.7	7.1	0.6
Battered fish	0.0	0.9	23.5	484.9	78.1	0.7	0.0	0.0	0.0	0.0	16.7	0.0
Beef potato pie	0.4	2.4	39.8	418.1	68.1	3.5	5.8	0.0	1.5	8.7	73.2	0.0
Beef vegetable curry	0.5	1.0	2.4	674.4	37.9	3.2	6.8	0.0	277.4	1664.4	55.5	0.0
Braised beef & onions	0.5	0.8	9.1	411.9	32.0	2.7	1.5	0.0	1.6	9.3	54.5	0.0
Cheese flan	0.0	1.1	27.4	911.9	539.3	1.6	0.9	313.0	330.9	107.7	49.4	0.0
Cheese pasta bake	0.4	2.7	37.0	759.8	584.7	1.5	11.7	287.2	358.8	429.7	46.4	0.0
Chicken vegetable curry	0.5	1.1	33.6	690.7	54.3	1.7	6.8	9.9	286.3	1658.1	32.9	0.0
Chicken pie	0.4	2.4	50.4	465.6	114.8	2.2	1.3	188.8	207.0	109.2	36.3	0.0
Chilli beef	2.2	1.5	33.8	359.6	48.6	2.0	1.6	0.0	13.8	83.0	30.3	0.0
Corned beef hash	0.4	2.2	24.6	1180.2	43.4	3.3	10.3	22.4	25.0	15.8	38.3	0.0
Cottage pie	0.9	4.9	58.5	452.0	55.5	2.9	21.2	0.0	1.0	6.0	83.0	0.0
Irish stew	0.9	5.9	49.1	444.0	63.9	3.5	24.6	0.0	1248.7	7492.4	98.7	0.0
Italian chicken	0.2	2.2	25.0	440.5	189.2	1.6	4.0	100.5	370.5	1619.8	42.3	0.0
Lamb korma	0.4	0.4	33.3	634.7	71.9	2.5	1.2	0.0	0.4	2.4	13.0	0.0
Lasagne	1.4	2.7	27.4	704.0	488.4	2.9	6.4	221.7	262.2	243.0	58.7	0.0
Quiche Lorraine	0.0	1.1	27.4	1538.0	421.8	2.0	1.3	282.3	297.4	90.8	48.7	0.0
Sausage bacon wrap	0.5	0.0	15.5	1313.2	1.5	0.1	0.3	0.0	0.0	0.0	0.9	0.2
Sausage casserole	1.5	1.8	28.2	2071.4	26.6	0.6	11.5	0.0	664.5	3987.1	22.1	0.3
Scouse	0.9	5.9	49.1	448.5	52.7	3.9	24.6	0.0	1249.3	7495.5	121.2	0.0
Spaghetti Bolognaise	0.4	2.7	42.2	309.1	45.6	2.9	9.7	0.0	55.7	334.1	44.7	0.0
Spicy chicken	0.0	2.5	47.1	590.9	142.5	3.0	0.0	25.8	31.1	31.5	28.2	0.0
Steak mushroom pie	0.5	2.5	50.3	431.4	116.1	3.9	1.3	178.9	198.1	115.5	68.7	0.0
Sweet sour pork	0.7	1.6	34.0	311.4	50.2	1.8	19.0	0.0	302.3	1813.9	27.0	0.0
Turkey casserole	0.4	1.6	9.8	452.4	35.9	1.2	3.4	0.0	261.3	1567.6	29.1	0.0
Turkey meatballs curry	0.0	0.1	39.3	935.6	41.6	1.1	0.0	0.0	0.0	0.0	7.1	0.0
Turkey meatballs tomato	0.0	1.4	21.0	238.6	15.8	0.8	8.5	0.0	55.3	331.7	17.0	0.0
CW Trust 2005: Boys 11-18y		5.7		710.0	400.0	4.5	14.6		250.0		80.0	20.9
CW Trust 2005 Girls 11-18y		4.6		710.0	320.0	5.9	14.6		250.0		80.0	16.9
		Minimum		Maximum	Minimum	Minimum	Minimum		Minimum		Minimum	Maximum

Table C4c. Nutrient composition of baseline recipes per portion (no allowance made for cooking losses).

	PROTEIN	FAT	CHO	SUGARS	SFA	MUFA	PUFA	Starch / CHO	Salt
	%	%	%	%	%	%	%	%	mg
Baked fish	62.7	5.5	32.1	0.6	0.9	0.8	2.0	1.9	144.1
Barbeque chicken	43.6	23.1	33.3	12.3	7.9	10.4	3.8	36.9	1878.6
Battered fish	29.2	43.6	27.2	0.5	3.2	24.6	13.0	1.9	1233.4
Beef potato pie	21.2	54.6	24.4	1.4	17.5	25.3	7.9	5.7	1063.5
Beef vegetable curry	33.6	59.6	6.7	4.0	13.3	25.8	9.1	59.8	1715.2
Braised beef & onions	34.5	53.9	12.1	1.9	13.6	26.4	9.3	15.9	1047.7
Cheese flan	16.9	61.3	21.9	3.4	29.0	22.2	5.5	15.4	2319.4
Cheese pasta bake	18.3	50.0	31.8	5.6	25.7	16.5	4.3	17.5	1932.5
Chicken Vegetable curry	25.1	38.1	36.7	3.9	3.6	16.6	9.1	10.5	1756.7
Chicken pie	18.0	48.3	33.7	1.8	11.8	24.4	10.0	5.4	1184.2
Chilli beef	18.7	49.5	31.7	4.5	13.7	23.7	7.6	14.3	914.7
Corned beef hash	27.7	48.7	23.7	2.9	15.3	23.4	7.5	12.3	3001.8
Cottage pie	17.6	39.7	42.9	3.7	10.9	19.2	6.0	8.6	1149.7
Irish stew	22.2	39.2	38.8	6.3	11.2	18.1	6.7	16.4	1129.2
Italian chicken	26.0	45.7	28.5	6.9	9.6	23.4	10.3	24.3	1120.4
Lamb korma	19.2	54.5	26.2	2.5	15.5	22.1	7.8	9.5	1614.4
Lasagne	22.6	53.0	24.4	7.1	24.6	20.1	3.7	29.3	1790.7
Quiche Lorraine	19.4	62.9	17.6	2.0	27.1	24.3	6.8	11.6	3911.8
Sausage bacon wrap	16.7	69.1	14.2	0.2	25.7	4.5	1.4	1.4	3340.1
Sausage casserole	11.4	70.3	18.3	3.3	19.8	8.0	5.2	17.9	5268.6
Scouse	25.5	34.9	39.8	6.5	8.7	16.8	6.6	16.4	1140.6
Spaghetti Bolognaise	20.0	44.8	35.2	4.2	12.2	21.4	6.7	11.9	786.2
Spicy chicken	24.8	42.4	32.8	2.0	7.0	10.9	21.5	6.1	1502.8
Steak mushroom pie	20.3	52.0	27.9	1.5	15.1	25.0	8.8	5.4	1097.4
Sweet sour pork.	29.1	34.9	35.8	6.7	5.6	16.6	10.0	18.6	792.0
Turkey casserole	36.5	43.2	20.2	4.2	4.2	23.5	12.5	20.5	1150.6
Turkey meatballs curry	16.9	32.6	50.5	2.7	0.7	0.7	1.2	5.3	2379.8
Turkey meatballs tomato	23.2	30.8	46.1	3.8	0.3	0.0	0.6	8.2	606.8
CW Trust 2005: Boys 11-18y									1806
CW Trust 2005 Girls 11-18y									1806
									Maximum

Table C5a. Nutrient composition of modified recipes at follow up per portion (no allowance made for cooking losses).

Recipes	Water	Protein	Fat	CHO	Energy	Sugars	SFA	MUFA	PUFA	Cholesterol
	g	g	g	g	kcal	g	g	g	g	mg
FU Baked fish	68.4	17.1	0.7	9.3	109.0	0.2	0.1	0.1	0.2	30.2
FU Barbeque chicken.	86.6	28.3	6.7	23.1	259.5	8.5	2.3	3.0	1.1	81.0
BL Battered fish	138.2	24.2	16.1	24.0	331.2	0.5	1.2	9.0	4.8	40.3
FU Beef potato pie	135.5	34.8	29.9	42.8	567.9	2.4	12.1	12.6	2.9	106.7
FU Beef vegetable curry	172.3	31.8	14.8	8.6	292.9	5.4	4.9	4.7	0.9	90.0
FU Braised beef & onions	196.2	31.3	11.8	11.7	273.1	1.9	4.8	4.7	0.8	90.0
FU Cheese flan	138.6	23.4	37.7	32.4	554.3	5.0	17.8	13.7	3.4	227.5
FU Cheese pasta bake	290.8	25.3	30.0	46.7	546.2	8.3	15.4	9.9	2.6	89.9
FU Chicken vegetable curry	260.7	24.9	6.6	39.8	308.0	5.4	0.9	1.2	1.1	81.0
FU Chicken pie	233.5	27.0	22.2	53.9	509.7	2.9	7.2	10.3	3.8	147.3
FU Corned beef hash.	208.5	31.5	14.6	28.7	364.6	3.5	7.1	5.9	0.9	100.7
FU Cottage pie	462.0	25.9	15.6	75.1	525.2	14.5	6.4	6.3	1.1	54.0
FU Irish stew	424.3	32.6	15.6	62.9	505.4	12.1	6.7	5.8	1.5	86.4
FU Italian chicken	297.7	29.7	12.7	36.0	367.7	9.5	4.1	5.7	2.3	118.5
FU Lasagne	326.6	36.5	38.0	41.9	644.0	12.3	17.6	14.4	2.7	126.4
FU Quiche Lorraine	158.7	32.0	46.1	31.0	659.9	3.6	19.9	17.8	5.0	280.3
FU Sausage bacon wrap	19.2	17.3	31.8	15.7	414.5	0.2	11.8	2.1	0.7	15.9
FU Scouse	423.0	36.5	12.2	62.9	490.5	12.1	4.9	4.7	1.3	90.0
FU Spaghetti Bolognaise	164.9	25.9	15.7	48.6	427.4	5.8	6.4	6.4	0.9	54.0
FU Spicy chicken	94.0	35.8	27.3	50.5	578.0	3.1	4.5	7.0	13.8	96.3
FU Sweet sour pork	274.3	33.7	7.6	45.6	375.3	9.7	2.2	2.4	2.2	89.1
FU Turkey casserole	240.4	23.4	12.1	14.6	257.3	3.1	1.2	6.5	3.5	63.0
FU Turkey meatballs	130.5	16.5	14.1	52.6	390.1	2.8	0.3	0.3	0.5	0.0
FU Turkey meatballs	133.1	16.2	9.5	34.3	279.0	2.8	0.1	0.0	0.2	0.0
BL salad	88.8	0.7	0.2	3.2	17.2	2.8	0.1	0.1	0.2	0.0
Fruit salad	68.8	0.5	0.1	8.3	34.0	8.1	0.0	0.0	0.0	0.0
CW Trust 2005: Boys 11-18y		13.8	27.8	95.2	714.0		8.7			
CW Trust 2005 Girls 11-18y		12.7	22.5	77.0	578.0		7.1			
		Minimum	Maximum	Minimum	----------		Maximum			

The prefix, FU, indicates a recipe which ahs been modified as a result of the intervention.
The prefix, BL, indicates a recipe unchanged by the intervention.
No prefix indicates a new recipe introduced for the intervention.

Table C5b. Nutrient composition of modified recipes at follow up per portion (no allowance made for cooking losses).

FU Recipes	S. Fibre	NSP	Starch	Sodium	Calcium	Iron	Vitamin C	Retinol	Vitamin A	Carotene	Folate	NMES
	g	g	g	mg	mg	mg	mg	ug	ug	ug	ug	g
FU Baked fish	0.0	0.4	9.1	56.6	28.6	0.3	0.0	0.0	0.0	0.0	10.2	0.0
FU Barbeque chicken	0.0	0.9	14.5	738.6	13.9	0.7	1.0	0.0	28.6	171.7	7.1	0.6
BL Battered fish	0.0	0.9	23.5	484.9	78.1	0.7	0.0	0.0	0.0	0.0	16.7	0.0
FU Beef potato pie	0.4	2.4	39.8	418.1	68.1	3.5	5.8	0.0	1.5	8.7	73.2	0.0
FU Beef vegetable curry	1.0	1.8	2.7	706.6	49.1	3.4	13.2	0.0	553.7	3321.9	63.2	0.0
FU Braised beef & onions	0.5	0.8	9.1	411.9	32.0	2.7	1.5	0.0	1.6	9.3	54.5	0.0
FU Cheese flan	0.0	1.1	27.4	911.9	539.3	1.6	0.9	313.0	330.9	107.7	49.4	0.0
FU Cheese pasta bake	0.4	3.3	37.6	771.1	588.9	1.7	13.2	287.2	370.2	498.2	52.0	0.0
FU Chicken vegetable curry	1.0	1.9	33.9	722.9	65.5	1.9	13.2	9.9	562.5	3315.6	40.6	0.0
FU Chicken pie	0.4	2.4	50.4	465.6	114.8	2.2	1.3	188.8	207.0	109.2	36.3	0.0
FU Corned beef hash.	0.4	2.2	24.6	1180.2	43.4	3.3	10.3	22.4	25.0	15.8	38.3	0.0
FU Cottage pie	0.9	7.7	58.9	482.0	85.5	3.3	28.4	0.0	2495.4	14972.4	97.4	0.0
FU Irish stew	0.9	6.6	49.2	451.5	71.4	3.6	26.4	0.0	1872.3	11234.0	102.3	0.0
FU Italian chicken	0.2	3.1	25.6	454.8	196.4	1.9	6.1	100.5	631.3	3184.9	49.4	0.0
FU Lasagne	1.4	2.7	27.4	704.0	488.4	2.9	6.4	221.7	262.2	243.0	58.7	0.0
FU Quiche Lorraine	0.0	1.1	27.4	1538.0	421.8	2.0	1.3	282.3	297.4	90.8	48.7	0.0
FU Sausage bacon wrap	0.5	0.0	15.5	1313.2	1.5	0.1	0.3	0.0	0.0	0.0	0.9	0.2
FU Scouse	0.9	6.6	49.2	456.0	60.2	4.0	26.4	0.0	1872.9	11237.1	124.8	0.0
FU Spaghetti Bolognaise	0.4	2.7	42.2	309.1	45.6	2.9	9.7	0.0	55.7	334.1	44.7	0.0
FU Spicy chicken	0.0	2.5	47.1	590.9	142.5	3.0	0.0	25.8	31.1	31.5	28.2	0.0
FU Sweet sour pork	1.1	2.8	34.7	326.5	58.7	2.1	36.8	0.0	604.2	3625.3	40.1	0.0
FU Turkey casserole	0.4	2.2	10.4	463.6	40.1	1.3	4.8	0.0	272.7	1636.1	34.7	0.0
FU Turkey meatballs	0.0	0.1	39.3	935.6	41.6	1.1	0.0	0.0	0.0	0.0	7.1	0.0
FU Turkey meatballs	0.0	1.4	21.0	238.6	15.8	0.8	8.5	0.0	55.3	331.7	17.0	0.0
BL salad	0.6	0.9	0.0	5.4	13.4	0.4	9.3	0.0	45.7	274.3	24.4	0.0
Fruit salad	0.9	0.9	0.2	7.8	12.1	0.2	19.2	0.0	3.7	22.3	8.2	0.0
CW Trust 2005: Boys 11-18y	5.7		710.0	400.0	4.5	14.6			250.0		80.0	20.9
CW Trust 2005: Girls 11-18y	4.6		710.0	320.0	5.9	14.6			250.0		80.0	16.9
	Minimum		Maximum	Minimum	Minimum	Minimum	Minimum		Minimum		Minimum	Maximum

The prefix, FU, indicates a recipe which ahs been modified as a result of the intervention.
The prefix, BL, indicates a recipe unchanged by the intervention.
No prefix indicates a new recipe introduced for the intervention.

Table C5c. Nutrient composition of modified recipes at follow up per portion (no allowance made for cooking losses).

J Recipes	Protein	FAT	CHO	Sugars	SFA	MUFA	PUFA	Starch / CHO	Salt
	%	%	%	%	%	%	%	%	mg
J Baked fish	62.7	5.5	32.1	0.6	0.9	0.8	2.0	98.1	144.1
J Barbeque chicken.	43.6	23.1	33.3	12.3	7.9	10.4	3.8	62.8	1878.6
L Battered fish	29.2	43.6	27.2	0.5	3.2	24.6	13.0	98.1	1233.4
J Beef potato pie	24.5	47.4	28.3	1.6	19.2	19.9	4.5	93.1	1063.5
J Beef vegetable curry	43.4	45.4	11.0	6.9	14.9	14.5	2.8	31.5	1797.1
J Braised beef & onions	45.8	38.7	16.1	2.6	15.9	15.6	2.8	78.2	1047.7
J Cheese flan	16.9	61.3	21.9	3.4	29.0	22.2	5.5	84.6	2319.4
J Cheese pasta bake	18.6	49.5	32.1	5.7	25.3	16.3	4.3	80.4	1961.2
J Chicken vegetable curry	32.3	19.1	48.5	6.6	2.7	3.6	3.1	85.2	1838.6
J Chicken pie	21.2	39.2	39.6	2.2	12.7	18.2	6.6	93.5	1184.2
J Corned beef hash.	34.6	36.0	29.5	3.6	17.5	14.6	2.2	85.7	3001.8
J Cottage pie	19.8	26.8	53.6	10.4	11.0	10.8	1.9	78.5	1226.0
J Irish stew	25.8	27.7	46.6	9.0	11.8	10.4	2.7	78.2	1148.3
J Italian chicken	32.3	31.2	36.7	9.6	10.1	13.9	5.6	71.3	1156.7
J Lasagne	22.6	53.0	24.4	7.1	24.6	20.1	3.7	65.3	1790.7
J Quiche Lorraine	19.4	62.9	17.6	2.0	27.1	24.3	6.8	88.4	3911.8
J Sausage bacon wrap	16.7	69.1	14.2	0.2	25.7	4.5	1.4	98.6	3340.1
J Scouse	29.7	22.4	48.1	9.3	9.0	8.7	2.3	78.2	1159.7
J Spaghetti Bolognaise	24.2	33.1	42.6	5.1	13.4	13.4	1.9	87.0	786.2
J Spicy chicken	24.8	42.4	32.8	2.0	7.0	10.9	21.5	93.3	1502.8
J Sweet sour pork	36.0	18.3	45.5	9.7	5.2	5.7	5.3	76.1	830.3
J Turkey casserole.	36.4	42.2	21.3	4.5	4.2	22.8	12.3	71.2	1179.3
J Turkey meatballs	16.9	32.6	50.5	2.7	0.7	0.7	1.2	74.7	2379.8
J Turkey meatballs	23.2	30.8	46.1	3.8	0.3	0.0	0.6	61.1	606.8
L salad	17.3	12.6	69.8	61.9	2.6	2.6	7.9	0.6	13.6
·uit salad	6.2	2.4	91.0	88.8	0.3	0.0	0.5	2.5	19.7
W Trust 2005: Boys 11-18y									1806
W Trust 2005: Girls 11-18y									1806
									Maximum

The prefix, FU, indicates a recipe which ahs been modified as a result of the intervention.
The prefix, BL, indicates a recipe unchanged by the intervention.
No prefix indicates a new recipe introduced for the intervention.

Table C6.
Baseline intake according to school meal status.

	Status not known n= 24		Does not receive free meal n = 23		Receives free meal n= 33	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Water (g)	304	151.4	350	116.6	287	126.7
Energy (MJ)	1.8	1.05	2.0	.76	2.1	.8
Energy (Kcal)	444	252.6	501	181.9	511	195.95
Protein (g)	15.3	8.90	19.5	8.23	13.7	6.03
Fat (g)	17.1	10.85	15.5	6.83	17.3	8.96
CHO (g)	59.9	38.96	75.3	32.18	79.1	32.56
Starch (g)	39.3	26.65	44.1	19.10	49.3	20.81
Sugars (g)	20.2	18.66	29.6	17.29	29.4	18.99
NMES (g)	9.4	15.77	15.6	13.78	11.3	15.54
SFA (g)	6.2	5.09	6.6	3.33	8.3	4.73
MUFA (g)	4.9	4.65	5.3	2.44	5.5	2.88
PUFA (g)	2.5	2.13	2.9	2.57	1.9	1.02
P:S	.6	.77	.5	.40	.2	.16
Cholesterol (mg)	32.4	32.17	35.9	31.52	19.3	18.69
S. fibre (g)	2.0	2.57	2.1	3.21	3.1	2.84
NSP (g)	2.5	2.15	2.9	2.15	3.5	2.05
Sodium (mg)	551	424.7	646	409.9	529	314.04
Salt (mg)	1401	1080.6	1644	1042.56	1346	798.77
Calcium (mg)	126.8	145.2	200.0	102.68	179.4	129.92
Iron (mg)	1.8	1.38	2.4	1.27	2.5	1.31
Vitamin C (mg)	41.8	42.88	50.1	32.60	50.4	33.99
Vitamin A (ug)	36.1	47.55	45.6	38.94	37.2	49.07
Carotene (ug)	44.4	53.84	74.6	53.72	63.2	113.65
Retinol (ug)	28.6	39.43	33.1	32.69	26.6	41.25
Folate (ug)	41.1	30.94	54.3	44.08	66.0	43.80
Protein (%)	14.4	6.07	18.2	12.10	11.2	5.79
Fat (%)	34.5	10.48	27.6	6.11	29.5	10.38
Carbohydrate (%)	50.2	10.88	53.8	13.13	58.3	10.67
Starch (%)	35.0	14.65	32.2	10.73	37.2	11.75
Sugars (%)	14.9	10.95	20.6	9.88	20.9	12.72
NMES (%)	6.0	10.54	10.9	9.08	9.1	13.13
SFA (%)	12.8	6.31	11.4	2.90	13.9	5.21
MUFA (%)	9.7	5.33	9.4	2.15	9.5	3.14
PUFA (%)	5.6	4.95	5.0	3.35	3.5	1.40
NSP (g/MJ)	1.5	1.02	1.3	.97	1.7	1.04
Calcium (mg/MJ)	71.0	79.03	102.3	55.22	81.3	55.68
Iron (mg/MJ)	.9	.47	1.2	.53	1.1	.44
Retinol (ug/MJ)	19.0	23.24	24.0	22.64	15.7	19.97
Vitamin C (mg/MJ)	23.4	23.27	23.8	13.98	25.4	18.88

Table C7
Baseline intake according to year group.

	Year group 7 n= 62		Year group 10/ 11 n = 18	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**
Water (g)	302	124.0	341	160.05863
Energy (MJ)	2.0	.8	1.8	.8
Energy (Kcal)	500	210.9	446	208.5
Protein (g)	14.9	6.82	19.1	10.46
Fat (g)	17.3	8.86	14.7	9.31
CHO (g)	74.8	36.09	63.4	30.48
Starch (g)	46.4	22.90	39.2	20.19
Sugars (g)	27.8	19.41	22.9	15.85
NMES (g)	12.3	15.64	10.6	13.54
SFA (g)	7.6	4.58	5.9	4.27
MUFA (g)	5.4	3.54	4.7	2.76
PUFA (g)	2.2	1.72	2.9	2.50
P:S	.4	.47	.6	.57
Cholesterol (mg)	24.7	25.27	39.5	33.62
S. fibre (g)	2.8	3.07	1.3	1.71
NSP (g)	3.2	2.20	2.3	1.74
Sodium (mg)	553	349.04	624	466.46
Salt (mg)	1408	887.78	1588	1186.45
Calcium (mg)	183	132.95	122	107.16
Iron (mg)	2.4	1.33	1.8	1.29
Vitamin C (mg)	48.8	37.46	44.2	32.51
Vitamin A (ug)	41.0	47.74	33.1	37.46
Carotene (ug)	62.4	91.57	55.4	49.86
Retinol (ug)	30.6	39.96	23.9	30.91
Folate (ug)	58.7	43.46	42.8	30.77
Protein (%)	13.2	8.61	17.4	7.85
Fat (%)	31.1	10.08	28.2	8.03
Carbohydrate (%)	54.7	12.78	54.4	8.16
Starch (%)	35.0	11.76	35.3	14.92
Sugars (%)	19.3	11.61	18.0	11.93
NMES (%)	8.4	10.93	9.5	13.01
SFA (%)	13.3	5.22	11.3	4.47
MUFA (%)	9.6	4.06	9.2	1.92
PUFA (%)	4.2	3.29	5.7	3.83
NSP (g/MJ)	1.5	1.00	1.4	1.07
Calcium (mg/MJ)	89.7	64.86	65.4	57.95
Iron (mg/MJ)	1.1	.42	1.0	.67
Retinol (ug/MJ)	19.6	22.03	17.4	21.31
Vitamin C (mg/MJ)	23.9	18.46	26.0	20.84

Table c8. Intake at baseline according to school (School C = control).

	School B n=42		School C n = 26		School A n = 12	
	Mean	**Std. Dev**	**Mean**	**Std. Dev**	**Mean**	**Std. Dev**
Water (g)	340	118.2	280	157.4	275	108
Energy (kcal)	528	167.9	503	257	314	150.6
Energy (MJ)	2.2	.70	2.1	1.07	1.3	.63
Protein (g)	17.5	7.71	14.0	8.80	14.2	5.58
Fat (g)	17.3	7.99	19.3	10.08	9.3	5.55
CHO (g)	80.1	26.73	71.8	44.50	45.4	25.15
Starch (g)	47.3	18.50	47.9	27.36	29.2	17.68
Sugars (g)	31.7	15.61	23.7	21	15.7	16.19
NMES (g)	14.0	14.73	10.3	16.80	8.5	12.62
SFA (g)	7.9	4.24	7.7	5.02	3.8	2.99
MUFA (g)	5.6	2.48	5.6	4.69	3.3	1.98
PUFA (g)	2.6	2.03	2.3	1.95	1.9	1.55
P:S	0.3	.33	0.4	.67	0.6	.56
Cholesterol (mg)	29.7	28.17	24	31.93	29.2	15.91
S. fibre (g)	2.4	2.82	3.2	3.29	1.5	1.86
NSP (g)	3.1	2.14	3.2	2.36	2.3	1.45
Sodium (mg)	613	388.3	554	407.7	449	234.5
Salt (mg)	1558	98	1411	1037	1144	596
Calcium (mg)	204	115.1	144	144.6	101	111.39
Iron (mg)	2.5	1.22	2.3	1.53	1.4	1.01
Vitamin C (mg)	57.6	31.12	36.1	40.64	38.4	35.89
Vitamin A (ug)	44	46.9	33	48.10	33	34.59
Retinol (ug)	31	39.5	26	39.15	24	31.89
Carotene (ug)	75	103.3	41	56.13	51	40.34
Folate (ug)	63	44.5	50	39.91	36	23.58
Protein (%)	13.5	5.64	11.5	4.77	22.3	16.31
Fat (%)	28.6	7.70	35.6	11.42	25.8	7.60
Carbohydrate (%)	57.3	8.30	52.1	13.45	50.7	16.77
Starch (%)	34.2	10.43	37.4	13.55	33.0	16.38
Sugars (%)	22.3	9.98	14.5	10.46	17.2	16.05
NMES (%)	10.5	11.14	5.2	8.60	9.7	15.87
SFA (%)	12.8	4	14.2	6.08	10.4	4.82
MUFA (%)	9.4	2.35	9.8	5.46	9.3	2.98
PUFA (%)	4.3	2.74	4.5	4.33	5.5	3.70
NSP (g/MJ)	1.4	1.01	1.6	1.10	1.7	.84
Calcium (mg/MJ)	95.6	54.65	69.8	71.42	75.9	74.04
Iron (mg/MJ)	1.1	.45	1.0	.45	1.1	.68
Retinol (ug/MJ)	19.0	20.18	14.9	19.80	28.5	29.21
Vitamin C (mg/MJ)	27.0	15.37	16.7	17.91	31.8	27.01

Appendix D.

Illustrative menu.

An example, to illustrate the principle of a ‘Balance of Good Health’ orientated mix n’ match snack bar menu.

NB Price can be used to support healthier choices eg fruit and vegetables - relatively cheap, chips - relatively expensive.

Balance Good Health Category:
Starchy foods

Bread	Variety sandwiches - based on 1 ‘slice’ / small bun bread ie 35g. Variety ‘on toast’ snacks eg cheese, baked beans, sardines etc Individual portions low fat / PUFA spread available at cost. May purchase more than one portion. May purchase more than one portion.
Wraps / pitta bread / sandwiches	The standard portion is one small wrap / pitta bread eg 28g. Salad can be included ‘free’.
Baked / boiled / mashed potatoes	60g portion. May purchase more than one portion.
Rice	60g portion savoury (include vegetables) or plain. May purchase more than one portion.
Noodles	60g portion. May purchase more than one portion.
Soup and bread.	Soup portion 150g to be relatively low in sodium. Bread, unlimited ‘free’ varied choice featuring wholegrain.
Chips / wedges	Low fat with high P:S, portion size 60g. May purchase maximum two portions.
Pizza or Sausage roll	1 slice approx 100g portion. 50g portion size.

Fruit & Vegetables

Vegetables	choice several all small portions (perhaps 40g). Cooked variety ways eg roasted, raw plus ‘dip’. May purchase more than one portion.

Variety sauces	include small amounts vegetable eg curry (varied), Bolognaise, tomato, Thai, Mexican, chilli, mushroom, barbeque etc
Salad	small portions eg 2 slices tomato = mix n' match. Mayonnaise available in sachets and high cost. May purchase more than one portion.
Fruit	small portions eg raw, stewed or fruit salad 80g. May purchase more than one portion.

Meat, Fish and alternatives

Tuna	portion 50g. May purchase more than one portion.
Fish cakes / fingers	Grilled / Baked - 60g portion.
Curries / stew etc	always include some vegetable material - portion 60g Use as fillings / sauce. May purchase more than one portion.
Pies 100g	eg cottage pie, meat and potato individual small portions -
Sliced / roast meats	30g portion. May purchase more than one portion.
Humous / dips	Low fat preferred.
Legumes: Bean / chick peas etc	Salads, curries, pies.
Baked beans	100g portion.
Macaroni cheese	

Milk & Dairy foods

Cheese	20g portion - usually lower fat varieties.
Yoghurts	small low fat pots. Plain low fat yoghurt to accompany fruit / puddings / curry.
Milk drink	Plain semi skimmed, coffee (latte) 150ml. Sugar available at cost in individual sachets. Sweetener sachets available.

Drinks (not a Balance of Good Health category)

Fruit juice	No added sugars. Small portion eg 150ml.
Water	Unlimited

Fatty & sugary foods

Biscuits	single or two - 25g.
Cakes / pies	portion size 60g.
Custard / set milk based dessert	100g portion.

Typical meal:

Soup & bread
1 Wrap includes salad and chicken
Chilli sauce
Chips
2 vegetables (baked beans and mixed)
Stewed apple with yoghurt
Milky coffee & sugar

A crude analysis suggests that such an intake might supply about:
825kcal: 19.5% protein, 19.0% fat, 61% carbohydrate from
40g protein, 17g fat, 135g CHO
SFA 8.9%, MUFA 5.1%, PUFA 2.4%, P:S 0.3, Sugars 18.2%
NSP 10.6g, Calcium 483mg, Iron 7.3mg, vitamin A 877ug, vitamin C 38mg

Although perhaps high in energy value (and protein) it does demonstrate the principle that promoting variety can lead to an adequate energy intake from a low fat choice of foods and that vitamin and mineral intake is far superior to that observed.

Such a scheme should be negotiated with schools and would need to be piloted and evaluated before extensive use.