ORIGINAL ARTICLE

Dietary habits of young people attending secondary schools serving a multiethnic, inner-city community in the UK

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Background: Childhood obesity is an escalating health concern with important implications, including increased risk of type 2 diabetes and cardiovascular disease. Although South Asians in the UK have an increased risk of developing these conditions, detailed studies on their lifestyles including the dietary habits of young people are scarce.

Methods: As part of an action research project, a food intake questionnaire was used to survey the dietary habits of 11–15-year olds attending five inner-city schools serving a predominantly South Asian population. Food choices were considered in the overall sample and in South Asians compared with white Europeans.

Results: 3418 (72% of registered pupils) responses were obtained. A subset of 3018 pupils could be categorised as either South Asian (86%) or white European (14%). Around one fifth of pupils started the school day without eating anything. Responses indicated high consumption of "negative" foods such as sweets, including Asian sweets (63%), but lower rates for "positive" foods such as vegetables (34%). In the full sample, 26% said they had consumed more than one can of sugar-sweetened fizzy drink and 17% reported eating more than one packet of full-fat crisps on the previous day. Poor dietary habits were indicated in both South Asian and white European pupils.

Conclusions: Our large-scale survey confirmed poor dietary habits in secondary school pupils from a multiethnic community. Urgent efforts are needed to find ways of encouraging healthy lifestyles, particularly in populations with a high risk of developing cardiovascular disease and type 2 diabetes.

The escalation in rates of overweight and obesity, particularly among children and young people, is a widely cited current concern both in the medical literature and more generally in the media. The problem is often described in terms of a trend towards epidemic proportions. In the USA, the prevalence of overweight in children and adolescents, defined by the 85th centile of weight-for-height, increased twofold between 1973 and 1994,¹ and the urgent need for prevention strategies has been emphasised in a statement from the American Academy of Pediatrics.² The importance of dealing with the growing problem of obesity in adults and children has been emphasised also in the UK.^{3–6} Survey results for this country for the period 2001–2 suggest that the prevalence of obesity (on the basis of UK national body mass index centile classification) ranged from 15.4% at age 14 years to 22.0% at age 11 years in boys, and from 15.6% at age 15 years to 19.8% at age 13 years in girls. In addition, a trend towards increasing levels of overweight and obesity among younger children has been identified from the same source between 1995 and 2003.⁷ Of particular note is the recent increase in central overweight and obesity in young people, as indicated by changes in waist circumference measurement.⁸

Overweight and obesity in childhood are risk factors for morbidity and mortality in adulthood.^{9–10} Furthermore, the rise in childhood obesity is likely to be linked to the increased incidence of type 2 diabetes in young people.^{11–13} These concerns may be of particular importance in relation to people of South Asian origin living in Western countries, whose ethnic origin also seems to increase their risk of developing type 2 diabetes and coronary heart disease,^{14–15} including an increased tendency towards insulin resistance in childhood.¹⁶ Analysis of data from the 1999 Health Survey for England showed ethnic group differences in the proportion of overweight and obese children and young people living in England, with increased rates in

Afro-Caribbean and Pakistani girls and in Indian and Pakistani boys.¹⁷ A 5-year cohort study of children living in London has indicated ethnic and socioeconomic differences in the prevalence of overweight and obesity.¹⁸ In addition, in adults, a person of South Asian origin with a body mass index (BMI; weight (kg)/height (m)²) of ≥ 27.5 seems to have a risk of morbidity comparable to that of a white person with a BMI of ≥ 30 .¹⁹

The rise in levels of obesity among young people is likely to be linked to levels of physical activity and dietary habits, including increased consumption of convenience foods and sugar-sweetened drinks. A study on school children in the US showed that for each additional serving of sugar-sweetened drinks, both BMI and frequency of obesity increased.²⁰ The need for improved eating habits in young people has been confirmed,²¹ but much of the publicity surrounding poor diet in this age group is based on anecdotal evidence. Detailed studies on the diets of secondary school children in the UK, including dietary habits in multiethnic populations, are sparse. We conducted a baseline survey including a food intake questionnaire as part of an action research project (Schools Acting in Leicester Against Diabetes and heart disease). The survey was carried out in five inner-city secondary schools in Leicester, UK. This city had a population of just below 280 000 at the time of the 2001 census, and was ranked 31 of 354 local authorities in the 2004 Indices of Deprivation, where 1 was the most deprived area and 354 the least deprived (<http://neighbourhood.statistics.gov.uk>). Leicester has an ethnically diverse population (<http://www.leicester.gov.uk>), with a high concentration of some ethnic groups in particular areas. South Asian people of Indian origin represent the largest ethnic minority population in the

Abbreviations: BMI, body mass index

city, and this group was strongly predominant in the five participating schools.

METHODS

Ethical review and data collection

Although formal ethical approval was not required for this community project, the action research proposal was informally reviewed by the local research ethics committee, who expressed the opinion that they saw no objection to the project, including the survey.

For the survey of dietary habits, we used a minimally modified version of a self-report food intake questionnaire based on recall of food and drink consumption on the previous day.²¹ This was selected in preference to an instrument designed to measure food frequency, as it was simple to complete, requiring only yes or no responses for most questions. The instrument used has been validated in terms of face validity by comparison with evidence of dietetic practice derived from a survey of dietitians.²² In addition, reliability and criterion validity were investigated using repeated administrations and comparison with food diary responses.²³ It was also previously adapted for use in children from the ethnically diverse population in Leicester.²⁴ Food items listed in our version of the questionnaire included, for example, Indian sweets (typically very high in sugar and fat) and ethnic savoury snacks. The food intake questionnaire identifies the consumption of any amount of specified foods and drinks on the previous day and 96 items or types of food or drink were included in our version. Analysis of results obtained using this instrument includes calculating the number of items consumed in various food and drink groups such as positive and negative markers which dietitians would generally recommend or discourage (fig 1). Although the food intake questionnaire does not generally quantify consumption, respondents are asked to provide this information for a few items such as the number of packets of crisps eaten and the number of cans of fizzy drink consumed on the previous day. There are also some more general questions—for example, relating to whether breakfast had been eaten on the previous day, entitlement to free school meals and type of lunch eaten. Our survey also included some questions relating to family history of diabetes and cardiovascular disease.

Pupils in school years 7–10 (ages 11–15) from the five participating schools were included in the baseline survey, which was conducted in 2003. Schools were actively involved in the planning and administration of the survey, and questionnaires were completed during lesson or tutor time in four schools and at home in the fifth school. Schools were asked not to complete the questionnaire on Mondays so that the previous day would be a school day. Before administration of the survey, information about the research was presented to pupils either by a member of the research team during an assembly, or by teaching staff during lesson or tutor time.

Data analysis including treatment of missing data

Data were analysed using SAS V.8.2 and STATA V.9 statistical software. We considered the consumption of individual food items in the overall multiethnic sample of pupils who responded to the questionnaire. We sought advice from local dietitians in selecting key foods to be considered in this analysis. In addition, we compared responders who could be categorised as either South Asian or white European in terms of the number of items consumed in various food groups: positive, negative, sugary, fatty, fibrous, salty, snacks, altered fat and altered sugar (fig 1). For this comparison, possible confounding effects of age, sex, family history of cardiovascular disease, entitlement to free school meals, school attended and eating a

school lunch were considered. To further consider the results obtained using this multivariate analysis, we also compared the consumption of individual food items included in the food groups (univariate, complete case analysis using χ^2 tests) between South Asian and white European pupils.

The original dataset contained a high proportion of missing data entries, where pupils had failed to tick either the yes or no box for individual items. Where data contained in individual variables were considered, complete case analysis using listwise deletion of cases with missing data was adopted. However, limiting the analysis to cases with complete data would have resulted in considerable loss of power for composite variables, such as the number of negative items consumed, where a single missing data entry for any of the 21 items would have resulted in exclusion of this case. To investigate the effect of missing entries in the dataset, data relating to consumption of items in two food groups (negative and positive markers) were compared for pupils with complete data and those without. A possible approach would have been to code missing entries in the same way as negative responses, on the basis of the assumption that pupils who failed to tick either the yes or no box had probably not consumed that item. Further comparison of datasets was carried out to investigate the effect of this approach. On the basis of the results obtained in our investigations relating to missing data, a decision was taken to impute values to replace missing data for analysis of composite variables. Five datasets were generated using SAS V.9.1 software, and multiple imputation²⁵ was subsequently carried out using STATA command lists.

RESULTS

Response rate and characteristics of responders

We obtained 3418 (72%) valid responses to the food intake questionnaire from 4763 eligible pupils on the registers of the five participating schools. Responders comprised 1744 (51%) boys and 1674 (49%) girls, and were mostly aged 11–15 (median age 13) years. From pupils' self-report data relating to ethnicity, we were able to categorise a subset of 3018 pupils as either South Asian (2594; 86% of subset) or white European (424; 14%). The remaining 400 pupils could not be categorised in either of these groups as they were of other ethnic origin, mixed race or had failed to respond to the question about ethnicity.

Missing data

We identified 9.8% missing data entries in the questionnaires. However, comparison of complete and incomplete cases for data relating to positive and negative markers identified no significant differences in terms of sex, age or ethnicity apart from a borderline ($p = 0.04$) difference for sex in relation to negative markers (slightly higher percentage of missing data for boys). Our investigation of the effect of recoding missing data in the same way as a negative response indicated that this would result in considerable underestimation of the consumption of relevant items. This was consistent for the two ethnic groups and both sexes and in relation to both positive and negative foods.

Results from the overall dataset

Responses to the question about breakfast indicated that 796 of 3373 (24%) of pupils who answered this question had eaten and drunk nothing before leaving home. An additional question asked whether anything had been eaten on the way to school; the combined responses to this question and the question about breakfast indicated that approximately one fifth of pupils (666 of 3358, 20% of pupils for whom there were valid

Negative markers (n = 21) Sweetened cereal (sugary) Saturated spreading fat (fatty) Biscuits fully covered in chocolate (sugary, snack) Other biscuits (sugary, snack) Cake and tea bread (sugary, snack) Puddings and sweet pies (sugary) Chocolate (sugary, snack) Other sweets including Indian sweets (sugary, snack) Ice cream (sugary, snack) Sugar added to drinks (sugary) Roast potatoes (fatty) Chips, fried potatoes and potato "shapes" (fatty) Crisps, Indian snacks and cooked ethnic snacks (fatty, salty, snack) Fried vegetables (fatty) Ordinary sausages (fatty, salty) Ordinary burgers (fatty, salty) Meat pies (fatty, salty) Take away meals (fatty, salty) Salt added to food (salty) Regular fizzy drinks (sugary) Regular still drinks (sugary)	Positive markers (n = 18): High fibre cereal (fibrous) Oat based cereal (fibrous) Bread described as brown Bread described as wholemeal (fibrous) Poly- or monounsaturated spread (altered fat) Low fat spread (altered fat) Artificial sweetener (altered sugar) Mashed potato Boiled potato Baked potato (fibrous) Fresh, tinned or dried fruit (fresh = fibrous) Salad (fibrous) Vegetables, excluding fried (fibrous) Reduced fat sausages (altered fat) Reduced fat burgers (altered fat) "Diet" fizzy drinks (altered sugar) "Diet" squash (altered sugar) Semi- or skimmed milk (altered fat) Other items included in food groups Fried fish - fatty Baked beans - fibrous, salty
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Figure 1 Items included in food and drink groups for analysis of responses to the food intake questionnaire. Positive and negative marker foods included in other food groups are indicated in parentheses.

responses to both questions) had begun the school day without eating or drinking anything.

Table 1 shows consumption of any quantity of selected key foods on the previous day for the overall multiethnic study population. Results indicated that the dietary habits of these young people were poor. Consumption of positive foods that would generally be recommended tended to be low—for example, vegetables (other than fried) had been eaten by only 34%. Although approximately two thirds (67%) said they had eaten some fruit (fresh, tinned or dried), around one third had eaten no fruit at all on the previous day. Rates of consumption of negative foods were higher, with 74% reporting that they had eaten full-fat crisps or savoury snacks, and almost two thirds (63%) had eaten sweets (including Asian sweets, but not chocolate which was considered separately). Almost half (46%) reported eating sweetened cereal or cereal bars compared with only 18% who had eaten high-fibre cereal. From answers to the questions with quantifiable responses, it was noted that 584 pupils (17% of full sample) reported eating more than one packet of full-fat crisps on the previous day and 902 (26%) said they had consumed more than one can of regular (sugar-sweetened) fizzy drink.

Comparison of results for pupils of South Asian or white European ethnic origin

For the final model used to compare pupils of South Asian and white European origin, family history of cardiovascular disease and entitlement to free school meals were excluded, in the first case because limited data would have resulted in exclusion of a high number of cases, and in the second case because of lack of significance in respect of this variable in the univariate analysis. The final model used for the multivariate analysis therefore included ethnicity, age, sex, school attended and eating a school lunch. After exclusion of cases with missing data for these possible confounding variables, 2869 pupils were included in the model (2460 South Asians, 409 white

Europeans); table 2 shows the results. White European pupils reported consuming a considerably higher proportion of items from positive food groups (positive markers, altered fat and altered sugar) and also negative food groups (negative markers, sugary, fatty and salty). Results for fibrous and snack foods were similar. When we compared the consumption of individual food items included in the food groups, some significant differences were noted. These included higher consumption of both standard and reduced fat meat products by white European pupils ($p < 0.001$ in all cases for sausages, burgers, meat pies, low-fat sausages and low-fat burgers).

DISCUSSION

Summary of main findings

We identified poor dietary habits in a large sample of secondary school pupils from a predominantly South Asian, inner-city population. Many pupils began the school day without consuming any food or drink, and their diets included poor levels of consumption of foods that would generally be recommended, with higher consumption of foods that would be discouraged. This was the case for both white European and South Asian pupils.

Strengths and limitations

Our study has the advantage of a large sample size and a good response rate. We used a validated questionnaire that had previously been used in school populations in the UK and had also been previously adapted for use in the local multiethnic community. The type of questionnaire used has the limitation of not quantifying the consumption of most foods—for example, we were unable to investigate levels of usage of fat, which tend to be high in South Asian cooking.²⁶ We were also unable to assess levels of compliance with "five-a-day" recommendations for consumption of fruit or vegetables. However, although other methods such as detailed food diaries may be able to provide quantifiable information, they are likely

Table 1 Consumption of selected key food and drink items by a multiethnic population of secondary school pupils (n=3418), predominantly of South Asian origin

	Valid responses	Pupils who consumed this item, n (%)
Positive foods and drinks		
High-fibre cereal	3062	537 (18)
Wholemeal bread	2915	391 (13)
Polyunsaturated or monounsaturated spread	3068	1196 (39)
Mashed, boiled or baked potatoes	3152	1280 (41)
Fresh fruit	3255	2177 (67)
Vegetables (excluding fried)	3033	1042 (34)
Semi-skimmed or skimmed milk	3069	1516 (49)
Negative foods and drinks		
Sweetened cereal or cereal bar	3141	1436 (46)
Saturated spreading fat	3156	1682 (53)
Fully covered chocolate biscuits	3158	1346 (43)
Sweets including ethnic sweets	3215	2015 (63)
Chips (fried) and fried potatoes	3175	1561 (49)
Crisps (full fat) and ethnic snacks	3287	2434 (74)
Regular fizzy drinks	3080	1662 (54)

to be impractical for large-scale self-report surveys and the questionnaire selected provided useful baseline data for a large sample of young people. Also, the accuracy of self-reporting in relation to diet may be limited; however, we took steps to minimise the effect of inaccurate reporting by explaining the purpose of the research, including emphasising the importance of giving honest answers. It was also emphasised that any information provided would be confidential and that individual responses would not be shared with school staff or parents.

The likelihood of missing data is an inevitable limitation associated with the use of self-report questionnaires, particularly those involving a high number of responses. However, our strategy for dealing with the problem of missing entries for composite variables was based on an informed decision. Our investigations indicated that recoding missing data in the same way as a negative response would not provide a true picture of the number of items consumed in each food group, but also that overall there was little difference between pupils who completed all the relevant questions and those who did not. The imputation approach adopted had the advantage of allowing retention of the maximum number of cases, thus providing increased power to detect real effects, while avoiding bias caused by missing data.

Although white European pupils reported consumption of more items in most food groups, this was true for both positive

and negative food and drink categories, and our investigations suggested that this was likely to be due to limitations in the questionnaire used rather than better or worse dietary habits in the two ethnic groups. Our comparison of consumption of individual foods by South Asian and white European pupils suggested that the higher mean number of items consumed by white pupils for most food groups probably resulted from the questionnaire being biased towards foods such as processed meat products, which are eaten rarely by those of South Asian origin, a high proportion of whom are either vegetarian or eat only certain types of meat. Overall, this may indicate that the modifications made to the questionnaire for use in the local multiethnic population were insufficient to facilitate an accurate comparison of dietary habits among pupils from different ethnic groups. This does not, however, negate the finding that pupils from both ethnic groups seemed to have poor diets.

Comparison with other studies

Previous reports have identified poor food choices among school children living in the UK.^{21–29} The National Diet and Nutrition Survey²⁹ confirmed the need for further improvement in the food intake of young people; in common with our findings and anecdotal reports, this study found high levels of consumption of foods such as savoury snacks and confectionery. A study of 13- and 14-year olds living in several urban areas

Table 2 Results of multivariate analysis comparing mean and (percentage maximum*) numbers of food and drink group items consumed by white European (n=409) and South Asian (n=2460) pupils on the previous day, with adjustment for age, sex, school attended and eating a school lunch

Food group	Max* (n)	SA pupils	WE pupils	p Value
Negative markers	21	8.81 (42)	9.72 (46)	<0.001†
Positive markers	18	4.24 (24)	4.81 (27)	<0.001†
Sugary items	11	5.25 (48)	5.57 (51)	0.023†
Fatty items	10	2.93 (29)	3.68 (37)	<0.001†
Fibrous items	8	2.37 (30)	2.40 (30)	0.769
Salty items	7	2.34 (33)	2.77 (40)	<0.001†
Snack items	7	3.69 (53)	3.77 (54)	0.398
Altered fat	5	1.03 (21)	1.18 (24)	0.005†
Altered sugar	3	0.47 (16)	0.58 (19)	0.002†

SA, South Asian; WE, white European.

*Maximum number of food and drink items in food group, which students could report having consumed on the previous day.

†Significantly higher mean number of items consumed by WE compared with SA pupils.

Summary and learning points

- Using a food intake questionnaire, we surveyed the diets of >3000 pupils attending secondary schools in a predominantly South Asian inner-city community in the UK.
- Our results indicate poor diets in our study population, including low consumption of foods that would generally be recommended and higher consumption of those that would not.
- We also identified difficulties with using survey methods to compare the dietary habits of different ethnic groups.
- Our study confirms the urgent need to identify methods of promoting healthy lifestyles, particularly in populations at high-risk, and also highlights the need for further work in developing relevant survey methods.

throughout the UK was conducted in 1995 using the food intake questionnaire on which our survey was based.²¹ Results from this 1995 survey—for example, the mean number of sugary (5.1–5.8), fatty (2.7–3.2) and snack (3.7–4.5) items consumed by pupils on the previous day—were in many instances similar to our own (table 2), suggesting little overall change in the quality of young people's diets over the past decade.

CONCLUSIONS

Our findings from a large-scale survey with a good response rate confirm poor dietary habits in secondary school pupils in a multiethnic, inner-city community and provide useful data for those with a professional interest in the food intake of young people. Both at school and at home, efforts are needed to find ways of dealing with this escalating problem. Young people from South Asian backgrounds are already at increased risk of developing type 2 diabetes and cardiovascular disease because of their ethnic origin, and they may need particular targeting in terms of encouraging healthy lifestyles including improved diets. Our findings also suggest that comparing the diets of young people from different ethnic groups may be difficult using methods that are practical for large-scale surveys. Further work is needed to identify accurate ways of making such comparisons.

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