Ethnic group differences in overweight and obese children and young people in England: cross-sectional survey

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Abstract

Objectives: To determine the percentage of children and young adults who are obese or overweight within different ethnic and socio-economic groups.

Design: Secondary analysis of data from the 1999 Health Survey for England, a cross-sectional survey

Subjects: 5689 children and young adults aged 2 to 20 years

Setting: Private households in England

Main outcome measures: Prevalence of overweight and obese girls and boys, as defined by the International Obesity Task Force

Results: 23 % of children (n=1311) were overweight of whom 6 % (n=358) were obese. More girls than boys were overweight (24 % vs. 22 % respectively P=0.03). Marked differences were seen between ethnic groups. Afro-Caribbean girls were more likely to be overweight (odds ratio 1.73, 95 % confidence interval 1.29 to 2.33) and Afro-Caribbean and Pakistani girls were more likely to be obese than girls in the general population (odds ratios 2.74, 1.74 to 4.31 and 1.71, 1.06 to 2.76 respectively). Indian and Pakistani boys were more likely to be overweight (odds ratios 1.55, 1.12 to 2.17 and 1.36, 1.01 to 1.83 respectively). There were no significant differences in the prevalence of obese and overweight children from different social classes.

Conclusion: The percentage of children and young adults who are obese and overweight differs by ethnic group and sex, but not by social class. British Afro-Caribbean and Pakistani girls have an increased risk of being obese and Indian and Pakistani boys have an increased risk of being overweight than the general population. These individuals may be at greater combined cumulative risk of morbidity and mortality from cardiovascular disease and so may be a priority for initiatives to target groups of children at particular risk of obesity.

Keywords: Obesity, Overweight, Children, Ethnic group, Socio-economic status, Health Survey for England,

Introduction

Obesity in children has become a public health problem worldwide and recent trends suggest obesity is also increasing among children in the UK.(1) (2;3) The UK parliament recommended initiatives to tackle obesity should target schoolchildren, lower socio-economic groups and ethnic minorities. (4) There are many immediate harmful physical and psychosocial effects of obesity in children. Long-term consequences include increased risks for cardiovascular disease and death that are independent of adult body weight. In the United States, obesity is rising significantly faster among African-American and Hispanic children than any other group. (5;6) Adult British South Asians and Afro-Caribbeans are at increased risk of coronary heart disease and stroke respectively compared with Europeans. A recent report suggested that South Asian children have more biochemical risk factors for cardiovascular disease and a higher insulin resistance than White British children do. (7) Previous studies have reported trends in growth of weight in British children are outstripping that of growth in height in all but Afro-Caribbean ethnic groups. (8) However, defining and measuring overweight and obesity is itself problematic in children. We examined ethnic differences in prevalence of obesity and overweight among children and young adults in the UK using body mass index cut off points as defined by the International Obesity Task Force.

Methods

The Health Survey for England is an annual survey of people living in private households in England conducted by the National Centre for Social Surveys and Research and University College London on behalf of the Department of Health. The 1999 survey focused upon the health of minority ethnic groups. (9)

Sampling and data collection

Three separate samples were obtained (Appendix A). Firstly, a general population sample of 6552 households was obtained using two-stage random sampling of postcode sectors and then addresses within each sector. Second, an “ethnic boost”

sample of 26528 addresses was obtained using stratified multistage probability sampling. Additional postcode sectors were selected as primary sampling units. The sampling of postcode sectors was systematic to include a greater proportion from areas with a high percentage of minority ethnic groups. Each household in the ethnic boost sample was screened initially and only included if respondents identified themselves as belonging to an ethnic minority group. A third sample was obtained for Chinese informants by following up 569 households who took part in a Health Education Authority survey in 1998. All participating households were interviewed in full. Individuals selected the most appropriate ethnic group from the categories: 'White', 'Black-Caribbean', 'Black-African', 'Black – other', 'Indian', 'Pakistani', 'Bangladeshi', 'Chinese' and 'Other'. Interviewers who could speak and read the respondent's language obtained household, socio-economic and personal information, and information on health and health service use. Social class categories, based on occupation of the head of household, were assigned using the Registrar General's classification: I-professional occupations, II Managerial occupations, IIIN Skilled non-manual occupations, IIIM Skilled manual occupations, IV Partly-skilled occupations, V Unskilled occupations. Parents or guardians responded for children aged below 13. Children aged 13 to 15 were interviewed directly with a parent present in the household. A trained nurse took anthropometric measurements including height and weight at a follow up visit soon after the interview according to survey protocols. Quality control was performed on 10 % of co operating households and found to be within acceptable limits for the Health Survey for England.

Method of analysis

We merged individual data from the ethnic boost and Chinese samples with that of the general population sample. We redefined ethnic group categories as: 'Afro-Caribbean', 'Indian', 'Pakistani', 'Bangladeshi', 'Chinese' and 'Irish', and all other ethnic groups together in a baseline group called 'general population'. We grouped social class into four groups: I & II, IIIn, IIIm, IV & V.

Defining overweight and obesity in children

Adults are defined as overweight if their body mass index (BMI) exceeds 25 kg/m^2 and obese if their BMI exceeds 30 kg/m^2. These values correspond to increased morbidity and mortality from cardiovascular disease. However no such data linked to

adverse health outcomes exist for children. We used an international standard giving BMI cut-off points for age and sex published by the International Obesity Task Force-IOTF (Appendix B). The IOTF charts were developed for young people by back-extrapolating from the centile of body mass index corresponding to values over 25 kg/m^2 (overweight) and over 30 kg/m^2 (obese) at age 18. (10) Hence, our definition of overweight includes obesity. Our data included the age of each child as an integer, so we used the mid year points from the IOTF chart to read cut off points for the outcomes. Using mid year cut off points rather than decimalising age has recently been shown not to bias prevalence rates.(6)

We examined prevalence of overweight and obesity in the sample overall and in strata according to age, sex, social class and ethnic group. We used χ^2 tests to examine the statistical significance of such differences. We used STATA version 7 and weighted all analyses according to sampling probability. We fitted multiple logistic regression models for overweight and obesity with age, socio-economic status and ethnic group as explanatory variables.

Results

Household response rates were 76 % in the general population and 71 % in ethnic boost sample. Interview response rates were 97 % in children from the general population and 92 % to 96 % in children from ethnic minority groups giving a total of 6648 interviews. Within this sample there were 5689 children agreeing to a follow up nurse visit. Height and weight response rates were 86 % overall (5689/6648), ranging from 73% in the Bangladeshi subgroup to 89 % amongst children in the general population. Response rates among children from the other ethnic minority groups in the survey were comparable to the overall rate. The baseline characteristics of the sample are shown in Appendices C and D. Age and sex distribution was similar across the different ethnic groups except for Irish children who had a lower mean age than all other ethnic groups. However there were differences in social class distribution between the ethnic groups with up to 33% of Bangladeshi children coming from social classes IV & V compared with a fifth of children from the general population (21%).

In the Afro-Caribbean sub group, only 13/6648 (0.2 %) of children were 'Black-African', the majority assigning themselves to 'Black- Caribbean' (n=495) or 'Black-other black groups' (n=176).

Overall, 23 % (n=1311) of children were overweight, and 6 % (n=358) of these were obese. More girls than boys were overweight (24 % compared with 22 %, χ^2 P= 0.03), (Table 1). We found an interaction between sex and ethnicity for overweight and obesity. Hence, we have presented results separately for girls and boys. We did not identify significant differences or gradients in the distribution of overweight or obesity by age or between social class groups. No social class gradients in overweight and obesity were seen overall or in individual strata according to age, sex or ethnic group. We found marked differences in outcomes between the ethnic groups (Tables 2 and 3). Adjusting for differences in mean height between ethnic groups in our logistic regression model made no difference to our results. Hence we have presented ethnic differences adjusted for age, sex and social class.

Boys

Indian and Pakistani boys had the highest prevalence of overweight (30 and 26 % respectively) compared with boys in the general population (22 %). Indian and Pakistani boys were more likely to be overweight (odds ratios 1.55, 95 % confidence interval 1.12 to 2.17 and 1.36, 1.01 to 1.83 respectively). By contrast, Bangladeshi and Chinese males had the lowest prevalence of overweight (14 %) and were least likely to be overweight compared with the general population (0.58, 0.40 to 0.86 and 0.58, 0.35 to 0.96).

Similarly, Indian and Pakistani boys had highest prevalence (8 % and 9 %) of obesity. Bangladeshi boys had the lowest prevalence of obesity (3 %) and were less likely to be obese (0.49, 0.25 to 0.94).

Girls

Afro-Caribbean girls had the highest prevalence of overweight, (33 %) and Afro-Caribbean girls were more likely to be overweight (1.73, 1.29 to 2.33) than girls in the general population. By contrast Chinese girls had the lowest prevalence of overweight

(13 %) and were less likely to be overweight than the general population (0.52, 0.29 to 0.91).

The prevalence of obesity in Afro-Caribbean girls was twice that in the general population (13 % vs. 6 %). Afro-Caribbean and Pakistani girls were more likely to be obese than girls in the general population (2.74, 1.74 to 4.31 and 1.71, 1.06 to 2.76 respectively). Indian and Chinese girls were less likely to be obese than girls in the general population (0.39, 0.17 to 0.86 and 0.08, 0.01 to 0.56 respectively).

Discussion

The percentage of children and young adults who are obese and overweight differs by ethnic group and sex. Within ethnic groups there are large sex differences in prevalence of overweight and obesity. Afro-Caribbean and Pakistani girls had significantly higher risks of obesity, and Indian and Pakistani boys were more likely to be overweight than children and young adults in the general population. By contrast, Indian girls and Bangladeshi boys were significantly less likely to be overweight or obese than the general population. There were no significant differences in the prevalence of obesity or overweight children in different social class groups.

Previous research

Ethnic group differences in height and weight are present within the Health Survey for England. Measures other than BMI showed that Afro-Caribbean boys were taller, and Indian, Chinese, Pakistani and Bangladeshi boys shorter, than boys in the general population. Similarly Afro-Caribbean girls were taller, and Indian, Bangladeshi and Chinese girls shorter, than girls in the general population. Bangladeshi boys were lighter on average, and Afro-Caribbean boys heavier on average, than boys in the general population. Afro-Caribbean girls were heavier, and Indian, Bangladeshi and Chinese girls lighter, than girls in the general population. Mean BMI was higher for Black Caribbean boys and girls, and for Indian boys, than for children in the general population. It was lower for Bangladeshi boys. (9)

Previous studies, based on height and weight, have reported South Asian school children to be less heavy and shorter than Afro-Caribbean and White school children.

(7) Afro-Caribbean primary school age children were taller than other ethnic groups at all the ages studied and maintained their growth in height with increases in mean weight. All other ethnic groups displayed a trend towards greater obesity over the decade 1983 to 1994. (8). Neither of these studies examined the association between obesity and socio-economic status.

The prevalence of overweight amongst British children reported previously ranged from 14 % to 19 % in 1999 and 6 % to 25 % in 2001 (Appendix E). Obesity in British children has been reported as being between 6 % to 8 % in 1999 and between 1 % to 12 % in 2001. (1;3) (2;11) The reason for this increase in reporting range can be accounted for by researchers using different standard cut off points in defining overweight and obesity in children. The international reference curves we used are more recent, provide prevalence rates that are comparable to the corresponding prevalence rates in adults, which the other child definitions do not and have been used in over 30 published studies. (10) (12) Hence, this method is more useful for international comparisons to monitor the worldwide epidemic of childhood obesity and to follow up time trends in future waves of the Health Survey for England. One limitation of this method is that the 6 countries on which the reference curves are based do not directly reflect the ethnic mix of the UK population. However this should not bias our estimates of obesity overall since it is the gradient of the growth curve that is taken into account rather than the absolute obesity level of the countries they represent. (10)

Previous research examining the relationship between socio-economic status and obesity across countries has found higher socio-economic status subjects to be more likely to be obese in China and Russia, but in the United States groups from lower socio-economic status were at higher risk. (13) Our finding of a lack of socio-economic gradient is therefore an important one and is consistent with one study that found that poor physical fitness rather than social class and lifestyle factors is strongly related to obesity in English ‘white’ children, though other reports have implicated dietary and lifestyle factors. (4) (14)

South Asian adults are known to have higher risks of cardiovascular disease and diabetes, and a lack of aerobic exercise. Afro-Caribbean and South Asian adults are at higher risk of stroke from hypertensive disease. We found little previous research

about whether our finding of increased obesity in Afro-Caribbean girls and South Asian boys was reflected in adults of the same ethnic group. Recently, South Asian children were reported to have worse biological risk factors than European children and lower weight for height and ponderal index (kg/m^3).(7) Indian adults have more body fat for a given BMI than other ethnic groups and the WHO has recently agreed to use a cut off of 23 and 25 rather than 25 and 30 in defining overweight and obesity amongst adults originating from the Indian subcontinent on the basis that they correspond to the fat mass % of ethnic Caucasians on the 25/30 cut-offs.(15) Hence, our findings that Indian and Pakistani boys and Pakistani girls are more likely to be overweight are of greater concern for South Asian children in this study than for other ethnic groups such as Afro-Caribbeans.

In other areas of child and adolescent health there are socio-economic gradients in mortality, overall health status and for specific conditions including risks for cardiovascular diseases. (16;17) Other socio-economic factors including poverty and social exclusion of families as a result of migration may act cumulatively to increase these risks. (4;18) In addition, we found certain ethnic groups have a sex-specific risk of overweight and obesity. This may reflect culture specific ideals of body morphology around critical stages in child development and peri-pubertal development. Our findings that Indian boys are more likely to be overweight or obese but that Indian girls were markedly less likely to be overweight or obese raises questions about nutritional status in Indian girls. Although this outcome was not specifically examined, it may bear scrutiny in further study. More information about levels of physical exercise and diet is needed to assess whether children from Afro-Caribbean and some South Asian ethnic groups are at risk from environmental factors or greater genetic susceptibility. Future work could focus on familial patterns of overweight and obesity by ethnic group and provide longitudinal data about adverse outcomes.

Strengths and weaknesses of the study

Ours is among the first community based studies examining ethnic group differences in overweight and obesity. The study strengths are its large nationally representative sample, use of an objective measure (body mass index) not subject to reporting or

misclassification bias as with other measures, quality and consistency of data collection, and use of multivariate analysis to adjust for potential confounding factors.

Body mass index (weight/ (height) ^{2} provides a more robust measure on which to base definitions of overweight and obesity than using weight or weight for height measurements alone and is useful for large epidemiological comparisons.(19) Although body mass index acts as a proxy for both lean and fat mass it does not reflect body composition. A range of physiological indices can be used to measure and define obesity and overweight in children including waist and hip circumference and subcutaneous fat measurement such as triceps skinfold thickness. However, these methods are subject to potential sources of bias due to measurement error and do not provide absolute measures of fat mass.

The WHO now recommends using lower BMI cut off points to define overweight and obesity for South Asian adults on the basis of higher percentage body fat composition for the same BMI amongst Caucasians. Some studies suggest that there may be ethnic group differences in body fat amongst infants with the same body mass index. While body mass index is a much more readily measurable index of obesity than more sophisticated methods interethnic differences in body composition could be a confounding factor in comparing obesity levels between ethnic groups. In our study higher levels of overweight and obesity in Pakistani and Indian boys are likely to underestimate their health risks on the basis of body fat alone. The mean heights of ethnic groups varied with Afro-Caribbeans being taller and South Asians shorter than the general population. In the case of Afro-Caribbean children this may result in a higher proportion who are defined as overweight and obese. In South Asian groups who tended to be shorter than the general population this may further underestimate levels of obesity and overweight.

Our sample only included private addresses and may underestimate refugees and the homeless. Given the scale of the study it is likely that there was some variation in the consistency of data collection between interviewers and trained nurses responsible for recording physiological measurements. Inevitably, surveys of some ethnic groups will be subject to language and communication difficulties, which in turn may compromise the accuracy of self reported data, but not outcomes based on height and weight. The definitions of ethnicity in this study rely on self-assigned categories from

the pragmatic classification system devised in the 1991 Census. These categories are subject to misclassification and are constantly changing. Given that our study population is children and teenagers, the ethnic categories themselves may be relatively crude in identifying risk in sub populations of children that may be second or even third generation ethnic minority groups. The response rate for interview was high in Bangladeshis but low for the nurses visit (73% compared with 86% in the general population). Finally, our data are cross sectional and we therefore cannot track the consequences of overweight and obesity on individuals over time.

Policy and public health implications

Our finding that ethnic group is more important than social class as a determinant of obesity and overweight in children has enormous chronic health disease burden and cost implications. The medical treatment of obesity is difficult and has only limited success. Hence, prevention in childhood is essential to limiting the potential ill effects of the epidemic of obesity. (20) Policies to tackle obesity through population-based measures such as promoting healthier diets and more exercise require resolve from government and other agencies across the spheres of health, transport, education, media and culture. (21) Large epidemiological studies of mixed ethnic groups examining prevalence of overweight and obesity should consider that the definitions of overweight and obesity might differ with ethnicity.

Conclusions

Ethnicity and sex are stronger determinants than social class of whether children are obese or overweight. British Afro-Caribbean and Pakistani girls have a significantly increased risk of being obese and Indian and Pakistani boys are more likely to be overweight than the general population. These individuals may be at greater combined cumulative risk of morbidity and mortality from cardiovascular disease, and so may be a priority for initiatives to target groups of children at particular risk of obesity.

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Contributors

AM and SS conceived the original idea for the study, and planned the study with help from GA and TC. GA and SS carried out the data analysis with advice from TC. SS wrote the paper and all authors contributed their comments to drafts of the paper.

Conflict of interest

None

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Table 1. Prevalence of obesity and overweight in children and young adults in England*

Characteristic	Subgroup		Overweight		Obesity	
		N	n	%	n	%
Age group (years)	2 to 4	965	208	20.8	55	5.8
	5 to 9	1660	395	24.0	117	7.0
	10 to15	1841	421	23.0	95	5.6
	16 to 20	1223	287	22.6	91	6.8
Sex	Male	2853	612	21.5	164	5.7
	Female	2836	699	24.2	194	6.8
	Overall	5689	1311	22.9	358	6.3

* All survey percentages are calculated using sample weight

Table 2. Prevalence of obesity and overweight in males and female children and young adults in England by ethnic group and social class

		MALES					FEMALES				
			Overweight		Obesity			Overweight		Obesity	
		N	n	%	n	%	N	n	%	n	%
Age (years)	2 to 4	489	91	19.2	30	6.9	476	117	22.4	25	4.7
	5 to 9	849	177	21.0	48	5.5	811	218	27.0	69	8.4
	10 to 15	954	218	23.0	46	4.7	887	203	22.9	49	6.5
	16 to 20	561	126	21.5	40	6.7	662	161	23.7	51	6.8
				P=0.46		P=0.31			P=0.21		P=0.12
Social class	I & II	794	172	21.6	41	5.1	769	171	23.8	53	8.6
	IIIn	309	67	22.7	12	4.1	355	92	23.5	33	8.2
	IIIm	871	192	22.1	55	6.3	842	218	24.3	58	6.0
	IV&V	683	141	20.5	44	6.3	659	175	26.1	44	6.2
				P=0.88		P=0.48			P=0.79		P=0.19
Ethnic group	General population	950	206	21.7	54	5.8	916	204	22.3	54	5.8
	Afro-Caribbean	322	68	22.6	16	5.1	373	119	33.3	47	13.0
	Indian	304	84	29.6	23	7.9	267	64	24.0	8	2.1
	Pakistani	436	110	26.2	36	9.0	458	119	25.7	38	8.0
	Bangladeshi	377	66	14.2	15	2.8	335	77	20.7	23	5.8
	Chinese	160	23	14.4	8	4.7	150	18	13.0	2	1.2
	Irish	304	55	17.3	12	3.3	337	98	25.6	22	8.3
				P<0.0001		P<0.0001			P<0.0001		P<0.0001
Total		2853	612	21.5	164	5.7	2836	699	24.2	194	6.8

* All survey percentages are calculated using sample weights

P values refer to chi square significance tests for a difference across groups

Table 3 Odds ratios (OR) for multiple logistic regression analysis model of factors affecting prevalence of overweight and obesity in children and young adults in England. [#†]

		MALES				FEMALES			
Factors		**Overweight**		**Obesity**		**Overweight**		**Obesity**	
		OR	95% CI	OR	95% CI	OR	95%CI	OR	95%CI
Age (continuous)		1.012	(0.997-1.037)	0.997	(0.961-1.034)	0.997	(0.979-1.016)	1.006	(0.977-1.036)
Social class	I & II [γ]	1		1		1		1	
	IIIn	1.09	(0.77-1.54)	0.81	(0.40-1.66)	0.91	(0.66-1.26)	0.80	(0.48-1.35)
	IIIm	1.03	(0.80-1.34)	1.23	(0.78-1.94)	1.01	(0.77-1.31)	0.62	(0.40-0.96)
	IV&V	0.93	(0.70-1.22)	1.24	(0.77-2.01)	1.07	(0.81-1.42)	0.62	(0.39-1.00)
Ethnic group	General population[γ]	1		1		1		1	
	Afro-Caribbean	1.11	(0.80-1.56)	0.87	(0.46-1.64)	1.73	(1.29-2.33)	2.74	(1.74-4.31)
	Indian	1.55	(1.12-2.17)	1.38	(0.79-2.42)	1.07	(0.74-1.53)	0.39	(0.17-0.86)
	Pakistani	1.36	(1.01-1.83)	1.53	(0.94-2.51)	1.22	(0.91-1.64)	1.71	(1.06-2.76)
	Bangladeshi	0.58	(0.40-0.86)	0.49	(0.25-0.94)	0.99	(0.67-1.46)	1.25	(0.66-2.37)
	Chinese	0.58	(0.35-0.96)	0.74	(0.31-1.77)	0.52	(0.29-0.91)	0.08	(0.01-0.56)
	Irish	0.81	(0.54-1.20)	0.57	(0.28-1.17)	1.17	(0.84-1.63)	1.49	(0.83-2.68)

[γ] baseline group for adjusted odds ratios for categorical variables

[#] Odds ratios from multiple logistic regression model

[†] All odds ratios calculated using sample weights

CI =confidence interval