Physical activity and sedentary behaviours of South Asian and white European children in inner city secondary schools in the UK

Kamlesh Khuntia, Margaret A Stone, John Bankart, Paul K Sinfield, Diane Talbot, Azhar Farooqi and Melanie J Davies


Background. People of South Asian (SA) origin have an increased risk of premature coronary heart disease. In children of SA origin, there is an increased prevalence of obesity and evidence of insulin resistance. Risk factors for cardiovascular disease in children often persist into adulthood. Low levels of physical activity are likely to be linked to the rise in obesity.

Objective. To determine levels of physical activity and sedentary behaviours in secondary school pupils in the UK, including comparison of SA and white European (WE) children and those with and without a family history of cardiovascular disease.

Method. Questionnaire survey conducted within an action research study in five inner city secondary schools serving a predominantly SA population.

Results. We obtained 3601 responses from 76% of eligible pupils. WE pupils were more likely to have walked to and from school compared to SAs. However, overall we identified low levels of physical activity and higher levels of inactive behaviours in both ethnic groups. Almost half (46%) of respondents spent four or more hours per day watching television or videos or playing computer games. An overall low level of active behaviour during school breaks was particularly emphasized in girls. We found no evidence of an association between physical activity levels and family history of cardiovascular disease.

Conclusions. There is an urgent need for those with responsibility for young people’s health, including parents, schools and community health providers, to consider and address the need for effective interventions to encourage increased physical activity levels.

Keywords. Cardiovascular disease, ethnicity, physical activity, schoolchildren.

Introduction

People of South Asian (SA) origin comprise significant-sized minority ethnic populations in many countries worldwide. A consistent finding in SA migrant populations, wherever they are located, is a higher incidence and prevalence of premature coronary heart disease (CHD) compared with the indigenous population. Insulin resistance, which is commonly associated with obesity, type 2 diabetes mellitus, hypertension and dyslipidaemia, is thought to be a major underlying factor in the increased mortality from CHD in people of SA origin. Increased prevalence and incidence of type 2 diabetes in young people is now recognized as a major public health problem in North America where it has been estimated that type 2 diabetes accounts for 8–45% of all new cases of diabetes diagnosed in large US paediatric centres. Reports of type 2 diabetes in obese SA

Received 11 August 2006; Revised 29 January 2007; Accepted 18 March 2007.

"Department of Health Sciences, University of Leicester, Leicester, "Leicestershire Dietetic and Nutrition Service, Leicestershire, "The East Leicester Medical Practice, Leicester and "Department of Cardiovascular Sciences, University of Leicester and University of Leicester Hospitals NHS Trust, Leicester, UK. Correspondence to: Dr Kamlesh Khunti, Department of Health Sciences (General Practice), University of Leicester, Leicester General Hospital, Gwendolen Road, Leicester LE5 4PW, UK; Email: kk22@le.ac.uk
and white European (WE) children in the UK are also emerging.6,7

Obesity is now reaching epidemic proportions and in Europe has increased by 10–15% within the past decade. It may overtake smoking as the leading health problem in many developed countries.8 In the UK, the percentage of young children aged 2–10 who were overweight or obese rose from 22.7% in 1995 to 27.7% in 2003, with the highest percentage increases in the oldest age groups.9 The prevalence of obesity is higher in SA children.10

Metabolic abnormalities precede the development of type 2 diabetes by some years and risk factors for cardiovascular disease in children often persist into adulthood.11 There is also evidence of increased risk of insulin resistance in children of SA origin compared to WE children. In the UK, higher insulin levels after adjustment for potential confounders have been identified in SA children aged 10–1112 and also in SA adolescents aged 13–16.13 Furthermore, children of parents with a history of cardiovascular disease show adverse cardiovascular risk factors in childhood.14,15

The need to implement prevention strategies for childhood obesity has been emphasized.16 Inactive behaviour, such as watching television, may predict subsequent overweight and obesity in children and adolescents.17,18 The prevalence of obesity is high in the US and Europe19 and there are a few relevant national studies of mixed ethnic populations.20–22 However, there is a lack of data on physical activity levels of SA children despite them having a higher cardiovascular risk profile.

As part of an action research programme, we carried out a baseline questionnaire survey of lifestyle behaviours of children in inner city schools serving an ethnically diverse population. In this community, the SA population, mainly of Indian origin, is the dominant ethnic group. In the present study, we aimed to report the prevalence of active and inactive behaviours, including consideration of two groups at high risk of developing cardiovascular disease, through comparison of the behaviours of SA and WE secondary school pupils and those with and without a family history of cardiovascular disease.

Methods

Six eligible secondary schools in the city of Leicester, UK, were identified, on the basis of having more than 60% children of SA origin according to the local authority database; these were all inner city schools serving relatively deprived populations. These six schools were approached to participate in the action research project. As part of this project, pupils in years 7–10 in each participating school were included in a cross-sectional baseline lifestyle survey. This involved a single administration of diet and exercise questionnaires; the exact date varied between schools within the calendar year 2003. Our physical activity survey included questions about active and inactive behaviours throughout the day derived from the Four by One-Day Recall Physical Activity Questionnaire.23 These questions invited pupils to indicate participation in a range of activities such as playing football or talking with friends. There were some additional questions about methods of travel to and from school on the previous day and also some questions relating to activity and inactivity derived from the Youth Risk Behaviour Survey24 as used in the Modifiable Activity Questionnaire for Adolescents.25 These comprised questions based on recall of activity levels during the previous 2 weeks, including average hours per day spent watching television or videos or playing computer games and the number of days on which respondents had engaged in strenuous (aerobic) or light (non-aerobic) activity. Examples of the format of questions used in the survey are shown in Figure 1.

Schools played an active role in planning and conducting the survey; questionnaires were completed in school during lesson or tutor time or they were taken home for completion. In accordance with usual policy in the schools, it was assumed that completion of questionnaires would indicate consent to participate in the survey. In three schools, we also collected self-report data from pupils and parents relating to family medical history including cardiovascular disease. These data were based on responses to a series of simply worded questions asking whether the pupils themselves or any sibling or parent had a history of diabetes, angina, heart attack, stroke or high blood pressure. These questions were included within pupils’ questionnaires or related questionnaires taken home by pupils for their parents to complete. Prior to questionnaire completion, pupils were informed about the research context including confidentiality and the importance of giving honest responses. The proposal was reviewed by the local ethics committee who indicated that formal approval was not required for this community study.

Prior to carrying out the analysis, dichotomous variables were created as follows from questionnaire responses relating to active and inactive behaviours. For travel to and from school, active methods of travel (walking or cycling) were compared to travel by motorized transport. Responses for activities during school breaks and in the evening were categorized as either active (for example playing ball games) or inactive (such as chatting to friends); pupils who had engaged in one or more active behaviours during each time period were compared with those who had engaged in none. Levels of television, computer or video viewing were considered in terms of those who engaged in these activities for an average of four or more hours per day and those who spent 3 hours or less. For
consideration of levels of light and strenuous exercise, pupils who had undertaken each type of exercise on six or more days in the past 2 weeks were compared to those who had exercised on less than 6 days. We also created a dichotomous variable for family history of cardiovascular disease, comparing pupils with and without any relevant family history.

SPSS v12 was used to obtain descriptive statistics for activity levels in the overall sample of all respondents. For more detailed consideration of responses, including comparisons between ethnic groups, SAS v9 software was used to analyse data for the subset of pupils who could be categorized as either SA or WE from pupil self-report responses. Logistic regression was used for main effects modelling with adjustments for the following potential confounders: school, gender, age and ethnic group (SA or WE). To investigate interactions, we also carried out modelling including fitting two-way interactions. Goodness-of-fit tests (Hosmer and Lemeshow test and Pearson and Deviance statistics) were used to assess the fit of each model. In order to improve goodness-of-fit in the modelling, a dichotomous variable was created for age, which had previously been considered as a continuous variable. This variable compared pre-teenage pupils aged under 13 years to pupils who were at least 13 years of age. Main effects modelling adjusting for age group, school, gender and ethnic group was used to consider the influence of family medical history on five activity types (television, video or computer viewing; light exercise; strenuous exercise; travel to school; travel home).

Results

All six eligible schools initially agreed to take part but one withdrew before the start of the study for reasons relating to other commitments. There were 4763
children in years 7–10 in the five participating schools; of these, 3601 (76%) responded to the questionnaire. Most responders were aged between 11 and 15 (median age 13), including similar proportions of boys and girls (51%, 49%, respectively). A subset of 3179 responders could be categorized from self-report responses as either SA (2732, 86% of subset) or WE (447, 14%). The remaining responders were of mixed race, other ethnic origin or had failed to provide information about their ethnicity. Table 1 describes activity patterns in the subset of pupils who could be categorized for ethnic group and Table 2 shows odds ratios for main effects comparing active behaviours in the two ethnic groups. Table 3 summarizes results from modelling involving main effects and interactions. Overall, reasonable goodness-of-fit of the models to the data was suggested.

**Television, videos and computer games**

In the overall sample, there were 3372 valid responses to the question about average daily levels of television, video or computer game viewing. Almost half of these responders (1557, 46%) recorded average daily viewing levels of four or more hours. Table 1 shows television, video or computer game viewing in the subset of SA and WE pupils. Data modelling, including adjustment for potential confounders (Table 3) indicated that there was no overall main effect of gender in relation to viewing levels, suggesting similar levels in boys and girls. In addition, the relationship between gender and viewing levels was similar for SA and WE pupils. Although SA pupils spent more time on television, video or computer viewing than WE pupils, this difference was not statistically significant. School attended and age group (higher viewing hours in older

### Table 1

**Active and inactive behaviours, by gender and ethnicity [number/valid responses (% who engaged in each type of behaviour]**

<table>
<thead>
<tr>
<th></th>
<th>All SA</th>
<th>SA male</th>
<th>SA female</th>
<th>All WE</th>
<th>WE male</th>
<th>WE female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean television viewing hours per day over previous 2 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 hours or less</td>
<td>1373/2573 (53%)</td>
<td>710/1325 (57%)</td>
<td>663/1250 (53%)</td>
<td>238/420 (57%)</td>
<td>104/193 (54%)</td>
<td>134/227 (59%)</td>
</tr>
<tr>
<td>4 hours or more</td>
<td>1202/2575 (47%)</td>
<td>615/1325 (43%)</td>
<td>587/1250 (47%)</td>
<td>182/420 (43%)</td>
<td>89/193 (46%)</td>
<td>93/227 (41%)</td>
</tr>
<tr>
<td>Light and hard (aerobic) exercise on six or more days during previous 2 weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light exercise</td>
<td>1019/2579 (40%)</td>
<td>530/1328 (40%)</td>
<td>489/1251 (39%)</td>
<td>165/419 (39%)</td>
<td>81/191 (42%)</td>
<td>84/228 (37%)</td>
</tr>
<tr>
<td>Hard exercise</td>
<td>942/2558 (37%)</td>
<td>633/1307 (48%)</td>
<td>309/1251 (25%)</td>
<td>169/414 (41%)</td>
<td>97/188 (52%)</td>
<td>72/226 (32%)</td>
</tr>
<tr>
<td>Active (walking or cycling) rather than inactive (motorized) methods of travel to and from school on previous day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Travel to school</td>
<td>1297/2680 (48%)</td>
<td>679/1394 (49%)</td>
<td>618/1286 (48%)</td>
<td>210/438 (48%)</td>
<td>97/206 (47%)</td>
<td>113/232 (49%)</td>
</tr>
<tr>
<td>Travel home</td>
<td>2036/2688 (76%)</td>
<td>1074/1395 (77%)</td>
<td>962/1293 (74%)</td>
<td>316/438 (72%)</td>
<td>147/203 (72%)</td>
<td>169/234 (72%)</td>
</tr>
<tr>
<td>Any active behaviourb on previous day during school breaks and in the evening</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morning break</td>
<td>675/2672 (25%)</td>
<td>579/1388 (42%)</td>
<td>96/1284 (7%)</td>
<td>103/433 (24%)</td>
<td>85/196 (43%)</td>
<td>18/237 (8%)</td>
</tr>
<tr>
<td>Lunch break</td>
<td>841/2393 (35%)</td>
<td>681/1245 (55%)</td>
<td>160/433 (14%)</td>
<td>130/391 (33%)</td>
<td>95/175 (54%)</td>
<td>35/216 (16%)</td>
</tr>
<tr>
<td>Evening</td>
<td>1405/2690 (52%)</td>
<td>735/1396 (53%)</td>
<td>670/1294 (52%)</td>
<td>261/433 (60%)</td>
<td>119/200 (60%)</td>
<td>142/233 (53%)</td>
</tr>
</tbody>
</table>

aDescribed as exercise hard enough to make you breathe heavily and make heart beat fast.
bSchool breaks: includes football, other ball games or chasing games in the playground, any organized sporting activity, or ‘other’ activities which we were able to categorize as active from details given. Evening: includes brisk walking or jogging, gardening, paper round, heavy household chores, cycling, sport, dancing or ‘other’ activities which we were able to categorize as active from details given.

**Table 2**

**Adjusted odds ratios for ethnic group from main effects models, comparing active behaviour indicators in SA and WE secondary school pupils**

<table>
<thead>
<tr>
<th>Active behaviour indicator</th>
<th>Odds ratio (SA versus WE)</th>
<th>95% CI</th>
<th>Probability</th>
<th>Higher odds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower TV viewing hoursa</td>
<td>0.867</td>
<td>0.695, 1.083</td>
<td>0.2082</td>
<td>WE</td>
</tr>
<tr>
<td>Increased light exercise level</td>
<td>1.035</td>
<td>0.827, 1.295</td>
<td>0.7657</td>
<td>SA</td>
</tr>
<tr>
<td>Increased hard exercise level</td>
<td>0.868</td>
<td>0.687, 1.097</td>
<td>0.2371</td>
<td>WE</td>
</tr>
<tr>
<td>Active travel to school</td>
<td>0.586</td>
<td>0.445, 0.772</td>
<td>0.0001*</td>
<td>WE</td>
</tr>
<tr>
<td>Active travel home</td>
<td>0.725</td>
<td>0.564, 0.932</td>
<td>0.0098*</td>
<td>WE</td>
</tr>
<tr>
<td>Active behaviour during morning break</td>
<td>1.048</td>
<td>0.789, 1.391</td>
<td>0.7484</td>
<td>SA</td>
</tr>
<tr>
<td>Active behaviour during lunch break</td>
<td>0.938</td>
<td>0.712, 1.237</td>
<td>0.6520</td>
<td>WE</td>
</tr>
<tr>
<td>Active behaviour during evening</td>
<td>0.820</td>
<td>0.658, 1.022</td>
<td>0.0776</td>
<td>WE</td>
</tr>
</tbody>
</table>

Odds ratios adjusted for age group, gender and school attended. CI = confidence interval; *P = < 0.05.
aIncludes watching videos and playing computer games.
pupils) were both significant confounding variables ($P < 0.0001$ in both cases) but none of the two-way interactions was significant.

**Frequency of light and strenuous exercise**

Valid responses indicated that considerably less than half of pupils in the full sample had engaged in light (1318/3376, 39%) or strenuous (1262/3349, 38%) exercise on six or more days in the previous 2 weeks. Table 1 shows levels of light and hard exercise by gender and ethnicity. For light exercise, there were no main effects of gender and ethnicity (Table 3), suggesting that boys and girls engaged in this type of exercise with similar frequency, as did SA and WE pupils. For frequency of strenuous exercise, there was a significant main effect of gender (boys exercising more frequently than girls, $P = 0.0065$) and WE pupils ($P < 0.0001$) being more likely to have walked or cycled to school when compared to girls and SA pupils, respectively. There was also a main effect for ethnicity in relation to travel home from school (Table 3), with results after adjustment indicating that overall WE pupils were again more likely to walk or cycle. Adjusted odds ratios for reduced likelihood of active travel by SA pupils to and from school were $0.586$ (95% confidence interval $0.445–0.772$) and $0.725$ (0.564–0.932), respectively (Table 2). There were wide variations between schools for travel both to and from school ($P < 0.0001$ in each case), including a significant interaction ($P < 0.0001$) between school attended and ethnicity for method of travel home, suggesting a lack of consistency between schools in respect of results comparing SA and WE pupils. Although younger pupils were more likely to have walked or cycled to school ($P = 0.0146$), the situation was reversed at the end of the school day, when older pupils more commonly used active methods of travel home ($P < 0.0001$).

**Travel to and from school**

Approximately half of all responders (1815/3512, 52%) had travelled to school by motorized transport, usually car. Among the 48% who used an active method of travel to school, most walked and it was noted that only 46 pupils (1% of responders) had cycled. A somewhat higher percentage of responders (2632/3533, 75%) had used an active method of travel home in the afternoon. Overall proportions were similar when comparing boys and girls and the two ethnic groups (Table 1). However, after adjustment for confounding variables including school attended, there were significant main effects of both gender and ethnicity in relation to method of travel to school (Table 3), with boys ($P = 0.0065$) and WE pupils ($P < 0.0001$) being more likely to have walked or cycled to school when compared to girls and SA pupils, respectively.

**Break time and evening activities**

Numbers reporting active behaviour during school breaks and in the evening were low (Table 1) and the
most frequently reported behaviour during school breaks was ‘chatting to friends’. Boys were more likely to have been active than girls during both morning and lunchtime breaks at school \( (P \leq 0.0001 \text{ in each case, Table 3}) \), with boys being more likely than girls to have engaged in football or other ball games. Both SA and WE girls had very low levels of physical activity during school breaks, with only 7% and 8%, respectively, reporting any active behaviour during the morning break on the previous day (Table 1). There was no main effect for ethnic group in relation to either of the school breaks or evening activities and levels of active behaviour in boys and girls were similar during the evening. For school breaks, age group had a significant confounding effect, with younger pupils recording more active behaviour \( (P \leq 0.0001) \) and school attended was also again noted to have a significant effect for activity during the two school breaks and in the evening \( (P \leq 0.0001 \text{ in each case}) \). Significant two-way interactions (Table 3) suggested inconsistencies, particularly between patterns of behaviour in pupils attending different schools and between those of different ages.

### Influence of diabetes and cardiovascular disease within the family

We obtained data relating to family medical history from a subset of 1333 pupils from three schools. After adjustment for confounding variables, there were no significant differences in relation to any of the five activity types considered when comparing pupils with and without a history of diabetes and/or cardiovascular disease.

### Discussion

#### Summary of main findings

Our survey relating to selected active and inactive behaviours focused on inner city secondary schools with a high proportion of pupils of SA origin. We identified suboptimal levels of physical activity, for example, only a quarter of pupils had engaged in any active behaviour during morning break at school on the previous day and only half had walked or cycled to school. High prevalence of inactive behaviours included almost half of pupils spending four or more hours per day watching television or videos or playing computer games. There were variations between the five schools and girls were less likely than boys to have been active during school breaks, but overall activity levels were low in both genders. After adjustment for confounding variables, modelling suggested that WE pupils were more likely to have walked or cycled to school than their SA peers, but overall, low levels of physical activity behaviours were indicated in both ethnic groups.

We had surmised that family history of diabetes or cardiovascular disease might influence pupils’ activity levels in either direction, through cause (increased prevalence of these conditions in families with inactive lifestyles) or effect (greater emphasis on improved lifestyle habits in families where these conditions had been diagnosed). However, we found no indication of any influence.

#### Strengths and weaknesses

The study has a number of strengths, including the benefits of a large sample size and high response rate obtained through active involvement of schools as part of an action research project. Although we were unable to obtain data relating to non-responders, these were most commonly pupils who were absent from school on the day of the survey. We used questions derived from validated instruments, and to minimize inaccuracy of self-reporting, we ensured that pupils had been informed about the importance of honest responses. One of the limitations of the type of questionnaire used is that we were unable to accurately measure actual energy expenditure, which would require more detailed methods of data collection. Such methods are likely to be impractical for large-scale surveys and our results provided a good overview of active and inactive behaviours in our study population, including comparisons between two ethnic groups and consideration of the influence of family medical history.

Our results suggested variations between schools and between older and younger pupils, but we addressed this lack of homogeneity by adjusting for these variables including the cluster effect of school attended. Variations between schools may be explained by factors such as ethnic mix and location, for example, the school which most consistently differed from the others had a higher proportion of Muslim pupils of whom a high proportion would be likely to attend faith schools in the evening, thus limiting time for other activities. This school was also the nearest to the city centre with no playing fields on site and a lack of green space in the immediate environment. In addition, participating schools varied in terms of the number of timetabled physical education lessons per week which would be likely to affect frequency of strenuous exercise. We did not measure distance of residence from the school, so we are unable to comment on whether this influenced the variation between schools in relation to active and inactive modes of travel.

#### Comparison with other studies

A study involving a sample of multi-ethnic elementary school pupils in Canada suggested that children of Asian family origin are less active than those of other family origins.\(^{26}\) A systematic literature review of studies involving adults and children also suggested lower levels of activity in SA populations in the UK,\(^{27}\) but the authors noted poor reporting and failure to use validated instruments in these studies. Overall,
our results indicated similar levels of active and inactive behaviours in SA and WE secondary school pupils in the UK, possibly suggesting increased adoption of western lifestyle patterns in the SA pupils attending our participating schools.

An association has been shown between higher overall moderate to vigorous physical activity and walking to school rather than travelling by motorized transport.\(^{28}\) We identified higher levels of motorized transport for travel to and from school in our multi-ethnic inner city secondary schools compared to some previous reports from both primary\(^{29}\) and secondary\(^{28}\) schools, but the children in our study had a higher prevalence of active mode of travel compared to the National Travel Survey.\(^{22}\)

### Implications of study findings

In the UK, the recommendation is that children and young people should participate daily in at least 60 minutes of moderately intense physical activity.\(^{30}\) Our results suggest that most inner city secondary schoolchildren do not achieve these recommended levels. It is therefore important that those with responsibility for the present and future health of young people should seek ways to address this problem, which is likely to have a major impact on future health. This includes an urgent need to implement effective interventions aimed at encouraging increased activity levels. Limited research on the prevention and treatment of obesity in children has suggested that school-based programmes may be effective, but results from intervention studies have not been consistent\(^{31}\) suggesting that further work is needed in terms of developing and rigorously evaluating programmes. Parents may also be able to contribute, for example, by acting as good role models in terms of physical activity. Consideration may also need to be given to the potential contribution that could be made by primary health care providers, particularly in terms of raising awareness of the risks associated with lifestyle habits including levels of inactive behaviour. This may be of increased importance in groups such as children of SA origin living in the UK, in whom there is already an increased risk of developing cardiovascular disease in adulthood because of ethnic origin.

### Acknowledgements

We wish to acknowledge the involvement of the five participating schools.

### Declaration

Funding: British Heart Foundation.

Ethics committee approval: Not required.

Conflicts of interests: None in relation to this study.

---

### References


