

Original Article

Physical Activity, Sedentary Behaviours, and Snacking in Youth of Northeast England and Harbin, Northeast China

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Abstract: Recent cross-cultural studies explore the worldwide variability of physical activity, sedentary behaviours, and snacking in different countries and age groups. Health behaviours in young people in different countries are explained by cultural differences as well as by the influence of psychosocial characteristics and socioeconomic status. In the United Kingdom, modern westernised inactive lifestyles and unhealthy diet are both responsible for the prevalence of obesity. China has seen significant economic development in the past few years and this has been hypothesised to have major changes in lifestyles, including decreased physical activity and increased energy intake. Along with higher income, the likelihood of people having a healthy lifestyle has decreased. Therefore, present study aimed to describe young people's involvement in physical activity, sedentary behaviours, and snacking in the northeast of England and Harbin in the northeast of China. Our results show that the youth from the United Kingdom were more active through sport; however, they also spent more time in front of the TV and computer screen compared with Chinese counterparts. Snacking on sweets appeared to be higher in the United Kingdom, which is associated with screen time. This finding supports the need of further studies to look at how sedentary behaviours are associated with other health behaviours.

Keywords: *Physical activity, sedentary behaviours, snacking, youth*

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Introduction

A number of cross-cultural comparative studies have attempted to explore the world-wide variability of sedentary behaviour (Guthold, Ono, Strong, Chatterji, & Morabia, 2008), leisure-time physical activity (Haase, Steptoe, Sallis, & Wardle, 2004), and snacking (Snoek, van Strien, Janssens, & Engels, 2006; Sanchez et al., 2007) in different age groups. Researchers have reported evidence that physical inactivity makes an impact on public health in general (Biddle, 2007; Blair, 2009). Furthermore, obese and overweight children and adolescents are at increased risk for adult health conditions (Trost, Kerr, Ward, & Pate, 2001). Industrialized and “Westernised” lifestyles, including excessive energy intake and sedentary behaviour, at least partially account for the development of type 2 diabetes mellitus and obesity in youth (Patrick et al., 2004). In developed countries childhood obesity has reached epidemic levels as a consequence of increased energy-dense food intake and personal lifestyle choices, such as sedentary behaviours (Dehghan, Akhtar-Danesh, & Merchant, 2005). Experts have stressed the importance of eating more healthful diets, especially less fast food snacks in front of the television (Robinson, 1999). This can be a significant strategy in obesity and overweight prevention by increasing physical activity and decreasing time spent with viewing television and playing video games (Rey-López, Vicente-Rodriguez, Biosca, & Moreno, 2008). Shephard (2005) asserted that obesity is easier to prevent rather than to correct; therefore, intervention strategies should target combining reductions in sedentary behaviours as well as promoting physical activity and healthy diets (Elgar, Roberts, Moore, & Tudor-Smith, 2005).

Health behaviours in young people in different countries can be explained by cultural differences as well as by the influence of parents’ psychosocial characteristics and socioeconomic status (Lynch, Kaplan, & Salonen, 1997). In the United Kingdom, gluttony, sloth, unhealthy diet, and inactive lifestyles are major reasons for the prevalence of obesity, which has increased in recent years (Prentice & Jebb, 1995; World Health Organization, 1998). Likewise, the accelerating economic boom in China is dramatically changing people’s lifestyles on account of increased energy intake and decreased physical activity (Li, Dibley, Sibbritt, Zhou, & Yan, 2007). Higher income has significantly decreased chances of a healthier lifestyle in many ways (Kim, Symons, & Popkin, 2004).

The present study, therefore, is an analysis of young people’s physical activity, sedentary behaviours, and snacking in two culturally and geographically distinct countries—the northeast of England and the city of Harbin in the northeast of China. At the end of the 1980s, only 16% of households in China had personal motorised transportation, 2% owned a computer, 91% owned a TV, and 28% lived in an urban setting (Bell, Ge, & Popkin, 2002).

The combination of the decline in school, work, and leisure-time physical activity, the increase in energy intake, smoking and alcohol consumption, and the effects of household ownership of a computer and TV, and urban residence have contributed to higher odds of being obese. Also, the risk of being obese in China is 70% greater in men and 85% greater in women if they have household ownership of a motorised vehicle, compared with those who did not own a vehicle (Bell et al., 2002).

After 2000, television ownership has become relatively high in China, but television viewing is lower than some countries (e.g., the Philippines) and a lot lower than in U.S. youth (Tudor-Locke et al., 2005). In China, less than 1% of young people watch TV more than four hours a day, and a high proportion of youth watch less than two hours a day.

This may reflect on the inability of fitting more TV watching into already busy schedules (Tudor-Locke et al., 2005). Chinese youth are pressed by heavy homework loads in school and youth are compelled to sustain a high level of scholastic achievement (Wei, 2000). Chinese youth, on average, spend seven hours in study-related extracurricular activities a week (Tudor-Locke, Ainsworth, Adair, Du, & Popkin, 2003).

The introduction of satellite television and multiple channels in China offers the opportunity of reality-based shows, prime-time dramas, game shows, and product advertisements (Granitsas, 2002), and this may increase young people's snacking behaviour (Waller, Du, & Popkin, 2003). A higher amounts of TV viewing combined with excessive snacking is associated with youth overweight and obesity (Pearson & Biddle, 2011). Kim, Symond, and Popkin (2004) found a contrasting gradient in the relation of socioeconomic status and healthfulness of lifestyle. In developing countries, such as China, nutrition-related non-communicable diseases are more prevalent among people who are in a high socioeconomic status, while in high-income societies, such as the United States or United Kingdom, often the opposite is found (Kim et al., 2004). Therefore in our study, we proposed to investigate British and Chinese students' snacking habits as part of their dietary behaviour as well as their sedentary behaviour and physical activity in free time on weekdays and weekends.

Methods

Participants

Secondary school students ($n = 189$ in total; 101 males, 53.4%; 88 females, 46.6%; mean age 15.9 ± 1.1 years) were assessed in the United Kingdom ($n = 77$) and China ($n = 112$). This age group was selected as physical activity decline is the steepest between the ages of 13 and 18 (Sallis, 2000), and the erosion in physical activity patterns is especially striking from ages 15 to 18 (Caspersen, Pereira, & Curran, 2000).

Participants were randomly selected students from government-funded secondary schools. Neither special physical education class nor sports college students were involved in this study. In the northeast of England, two schools participated in this study in two towns. In the City of Harbin, in the northeast of China, the diaries were administered in two schools.

Instruments

The principal data collection instrument was a self-report diary of "free-time" that students completed outside of school hours. Diary methods are useful for assessing everyday events and experiences because they can be completed in naturalistic settings and are less prone to reporting bias caused by recall error (Bolger, Davis, & Rafaeli, 2003). The diary used in the present study is based on principles of Ecological Momentary Assessment (EMA; Stone & Shiffman, 2002) and has been described previously as a valid and reliable tool for assessing sedentary behaviour and physical activity in secondary school children (Biddle, Gorely, Marshall, & Cameron, 2009; Marshall, Biddle, Murdey, Gorely, & Cameron, 2003). This type of data capture technique is not influenced by cognitive and memory limitations, but rather provides researchers with ecological validity and generalizability of behaviours that occur in the "real" world (Smyth & Stone, 2003).

The diary was divided into two parts, and both student and parent/carer consent forms were included in the diary. The first part involved questions about child-level variables

(nine items: "About You"), family-level variables (11 items: "About Your Family"), and environmental-level variables (15 items: "About Your Home") that have been hypothesised to correlate with sedentary behaviour and physical activity (Sallis, Prochaska, & Taylor, 2000). The second part of the diary was for recording the behaviours, locations, and social contexts that young people engage in each day. These momentary data, captured in a free-living environment, provide investigators with a dynamic picture of young people's daily lives in their free time (Smyth & Stone, 2003). This is described in more detail below.

The time sampling diary. Participants were instructed to complete the diary for four days (three weekdays and one weekend day). Data collection days were randomly assigned. At 15-minute intervals, participants self-reported (free response) their behaviour in response to a single item: "What are you doing now?" Participants were instructed to wear a wristwatch during diary completion days so that the recording schedule (15 minute intervals) could be followed. The 15-minute timeframe was found the most reliable timeframe compared with 30-minute and other time-sampling frames (Marshall, 2001; Murdey, 2004). To help solicit an appropriate level of response, examples common to young people were provided (e.g., talking with friends, watching TV, walking to school, etc.). To reduce response ambiguity for children who were engaged in multiple behaviours (e.g., "doing homework and listening to the radio") each free-response box included the stem "The main thing I am doing now is..."

At each interval, participants also responded to two closed-response items: "Where are you?" (LOCATION) and "Who's with you?" (WHO). For LOCATION, participants selected one location from a list of 12 that we had identified previously through focus groups as common places for youth to spend time when not in school. For the WHO item, participants selected one context from a list of five (Alone, With friends, With family, With friends and family, or Other) that were also based on focus group discussions.

Because no data exist about the number of measurement days needed for a reliable assessment of habitual sedentary behaviour among youth, students completed the diary for four days (three weekdays and one weekend day). Data collection days were randomly assigned by weekday and weekend day. For each weekday, 44 time samples were obtained (one every 15 minutes from 7:00 a.m. to 8:45 a.m. and from 3:00 p.m. to 11:45 p.m.). For the weekend day, 68 time samples were obtained (one every 15 minutes from 7:00 a.m. to 11.45 p.m.). Data were not collected during school hours because the focus of the study was on free-choice out-of-school behaviour and there was potential for the diary assessment procedures to disrupt academic learning time. However, to control for different levels in school-based physical activity affecting out-of-school behaviour, two items assessed participation in physical education ("Did you take part in a PE lesson today?") and engagement in moderate-to-vigorous physical activity ("At school today, did you run around or breathe hard enough to make you sweat?").

At the end of each diary day, participants also responded to an additional 10 closed-response items that solicited information about snacking behaviour during the day and events that may have affected diary entries (e.g., weather, injury/illness, etc.). Snacking habits were measured by collection data of students' crisps, sweets, fruit, and other snacks consumption on a daily basis. The last part of the diary also provided opportunity to students to give feedback on the data collection instrument as well as on the punctuality of the responses (how close to each 15-min interval students completed the diary).

Diary scoring procedures. The behavioural reports (the free-responses to the item "What are you doing now?") were coded into 23 mutually exclusive categories of leisure-

time behaviour that had been derived inductively from pilot studies of the diary as well as our own focus group research with British youth.

To estimate the time spent in each behaviour category, at each location, and in each social context, the interval-level data were aggregated for each individual (separately by weekday and weekend day) by multiplying the daily frequency of the event by 15 (1 interval = 15 minutes). The weekday data were then aggregated further to produce a mean, in minutes per day, across weekdays. Because only one weekend day was reported, no further aggregation for weekend reports was necessary. The outcome variables for all analyses are minutes per day engaged in 23 categories of behaviour, in 12 locations, and in five social contexts. Pilot data suggest that aggregating across 15-min intervals yields valid behavioural samples when compared to a diary that records behaviours in “real time.” Only data on the behaviours and snacking are reported here.

A bilingual speaker translated the original English diary into Chinese language. Then another bilingual speaker compared the translations with the original diary. The final versions of the diary were sent to the main investigator in order to check the format for consistency.

Procedure

The main investigator obtained ethical approval from the University Ethics Committee. The regional research coordinators obtained ethical approval in their universities in the three countries, and the head teachers, the parents, and the participants in the schools gave consent. In the two countries the return rate was over 90%; however, only 65–70% of the diaries were properly filled in and used for data analyses. This tends to be a satisfactory outcome, as the compliance rate is usually 11–19% with the paper and pencil diaries as opposed to 94% with electronic diaries (Stone, Schiffman, Schwartz, Hufford, & Broderick, 2002).

Data handling

PASW for Windows V18.0 was used for data handling and analyses. Demographic data and time sampling data were coded and entered in two separate files, because time sampling data had 200 time intervals and consequently required 200 rows for each participant. The two templates (demographic data and time sampling data template), the description of data coding and entering procedure, and the behaviours codes were sent to the regional coordinator in China. The regional coordinator coded and entered their national data, as they speak the language of their own country, and they were able to code the behaviours of local participants. The first and second author received a sample (10 completed diaries) from each country for quality control; in addition, the main investigator corresponded with the Chinese national coordinator in order to provide them with the required information.

Raw data were sent to the main investigator from China. The first named author carried out data cleaning. Then the time sampling data were aggregated by using syntax commands, thus the mean values were calculated, and the 200 rows were collapsed into one row in order to merge it with the demographic data. This procedure was carried out on the data sets, and then the data sets were merged in order to have one analysis file. The manipulation of these very “tall” data files often go well beyond the programming skill level of the average social scientist (Smyth & Stone, 2003).

Data Analysis

Descriptive statistics and multivariate analysis of variance (MANOVA) were performed to test associations and group differences in sedentary behaviours, physical activity, and snacking by country and gender.

Results

Weekdays

In the United Kingdom, males on weekdays overall spent 350 minutes with sedentary activities compared with 80 minutes of physical activity, and females spent 314 minutes with sedentary activities and 97 minutes with physical activity. Chinese males spent 381 min with sedentary activities compared with 51 minutes of physical activity, while females spent 399 minutes with sedentary activities compared with 43 minutes of physical activity.

Weekend

In the United Kingdom, males spent 473 minutes in sedentary behaviours compared with 99 minutes of physical activity, and females spent 417 minutes with sedentary activities and 147 minutes with physical activity. Chinese males spent 559 minutes in sedentary activities and 100 minutes in physical activity, while females spent 576 minutes in sedentary behaviours and 81 minutes in physical activity.

Figures 1 to 4 show weekday and weekend descriptive data for physical activity, sedentary behaviours, and snacking. Sedentary behaviours in the northeast of England (named as United Kingdom) seem broadly similar to the data that were collected in Scotland (Biddle et al., 2009), but with different values displayed in China. Physical activity levels appear to be moderately high, although this varies across countries.

A 2 (country) x 2 (gender) x 2 (age groups) MANOVA was conducted to test for differences in physical activity, sedentary behaviours, and snacking. Dependent variables were light, moderate, and vigorous physical activity (active travel, unstructured play, sport and exercise, behavioural hobbies, doing chores), sedentary behaviours (TV/video viewing, computer/Internet use, computer games, phoning, listening to music, sitting and talking, sitting doing nothing, doing homework, nonschool reading, cognitive hobbies, motorised travel) and snacking (crisps, sweets, fruit, other snacks). We also included fruit here, as snacking habits seem not to differ by health-conscious food selection. In other words, those who take a lot of snacks eat all kind of snacks.

Analyses were conducted for weekdays and weekends separately.

Weekdays

Physical activity. There was no three-way interaction, but two-way interactions for country x gender (Pillai's Trace = .128, $F_{5,177} = 5.178$, $p < .001$) and country x age group (Pillai's Trace = .078, $F_{5,177} = 2.997$, $p = .013$) were significant. There were significant multivariate main effects for country (Pillai's Trace = .583, $F_{5,177} = 49.446$, $p < .001$), gender (Pillai's Trace = .124, $F_{5,177} = 5.027$, $p < .001$), and age group (Pillai's Trace = .071, $F_{5,177} = 2.709$, $p < .022$). Univariate tests showed significant differences by country for active transport ($F = 59.192$, $p < .001$), unstructured play ($F = 48.672$, $p < .001$), playing sport ($F = 34.248$, $p < .001$), behavioural hobbies ($F = 58.412$, $p < .001$), and doing chores ($F = 21.261$, $p < .001$); by

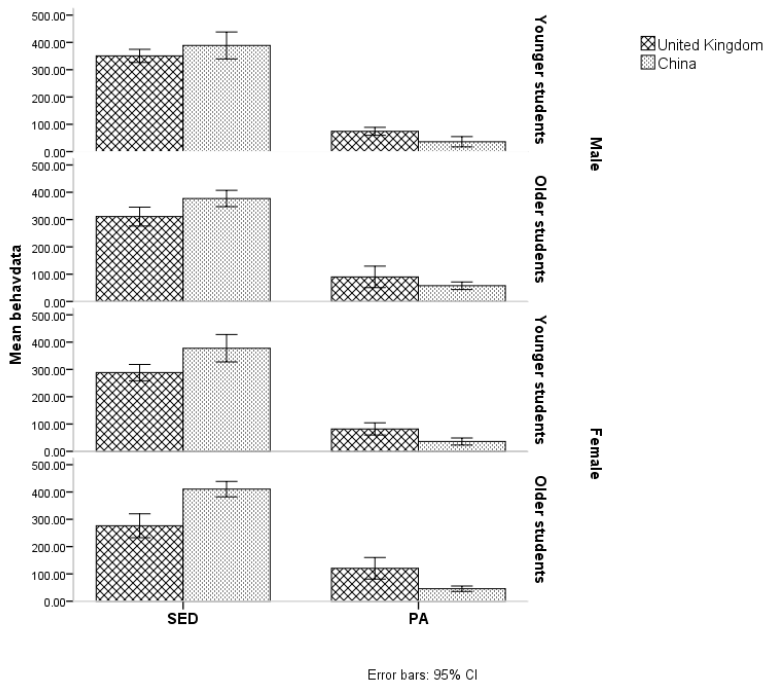


Figure 1. Weekdays-Sedentary behaviors (SED) and physical activity (PA) in males and females in the United Kingdom and China.

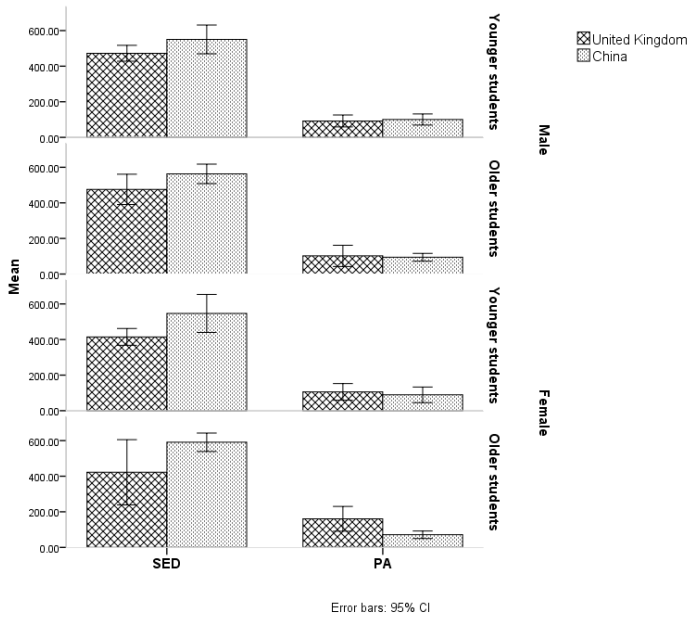


Figure 2. Weekend-Sedentary behaviors (SED) and physical activity (PA) in males and females in the United Kingdom and China.

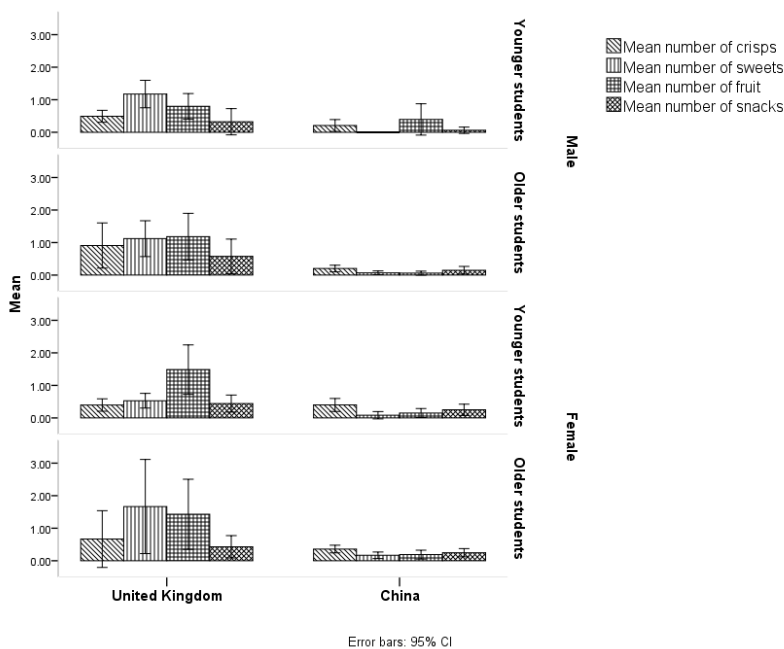


Figure 3. Weekdays-Snacking in males and females in the United Kingdom and China.

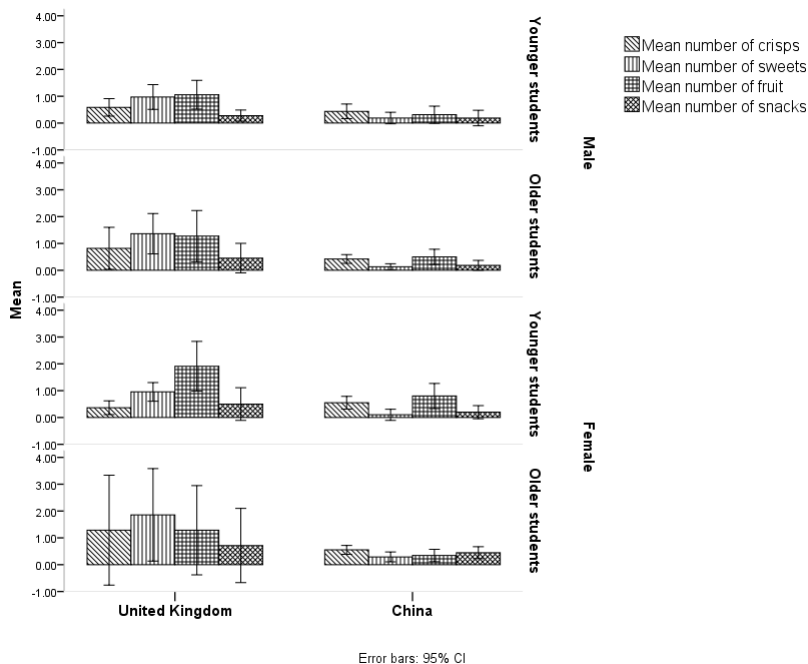


Figure 4. Weekend-Snacking in males and females in the United Kingdom and China.

gender for behavioural hobbies ($F = 16.238, p < .001$) and doing chores ($F = 8.443, p = .004$), but not for active transport, unstructured play, and playing sport ($p > .05$); and by age group for behavioural hobbies ($F = 6.527, p = .011$), but not for active transport, unstructured play, playing sport, and doing chores ($p > .05$). Specifically, the highest rates of active transport and playing sport were in the United Kingdom. Unstructured play was higher in China for males and females and behavioural hobbies in the United Kingdom for females.

Sedentary behaviours. There was no three-way interaction, but two-way interactions for country x gender (Pillai's Trace = .123, $F_{11,171} = 2.181, p < .017$), country x age group (Pillai's Trace = .131, $F_{11,171} = 2.347, p < .01$), and gender x age group (Pillai's Trace = .106, $F_{11,171} = 1.853, p < .049$) were significant. There were significant multivariate main effects for country (Pillai's Trace = .562, $F_{11,171} = 19.952, p < .001$) and gender (Pillai's Trace = .139, $F_{11,171} = 2.518, p = .006$), but not for age group ($p > .05$). Univariate tests showed significant differences by country for motorised transport ($F = 4.238, p = .041$), using a computer ($F = 8.056, p = .005$), TV/video viewing ($F = 22.587, p < .001$), playing computer games ($F = 39.408, p < .001$), using a telephone ($F = 6.592, p = .011$), listening to music ($F = 31.261, p < .001$), doing homework ($F = 115.529, p < .001$), and reading ($F = 10.009, p = .002$), but not for sitting and talking, sitting doing nothing, and cognitive hobbies ($p > .05$); by gender for TV/video viewing ($F = 6.258, p = .013$), playing computer games ($F = 8.652, p = .004$), using a telephone ($F = 3.861, p = .050$), and listening to music ($F = 5.358, p = .022$), but not for motorised transport, using a computer, sitting and talking, sitting doing nothing, doing homework, reading, and cognitive hobbies ($p > .05$); and by age group for motorised transport ($F = 4.412, p = .037$), but not for using a computer, TV/video viewing, playing computer games, using a telephone, listening to music, sitting and talking, sitting doing nothing, doing homework, reading, and cognitive hobbies ($p > .05$).

Specifically, according to a within country ranking, the highest rates of TV/video viewing, motorised transport, and playing computer games were in the United Kingdom; and doing homework and motorised transport in China.

Snacking. There were no three-way or two-way interactions. There were significant multivariate main effects for country (Pillai's Trace = .367, $F_{4,177} = 25.687, p < .001$), but not for gender and age group ($p > .05$). Univariate tests showed significant differences by country for eating crisps ($F = 11.308, p = .001$), eating sweets ($F = 69.398, p < .001$), eating fruit ($F = 32.507, p < .001$), and eating other snacks ($F = 5.006, p = .026$); and by age group for eating sweets ($F = 6.193, p = .014$), but not by gender ($p > .05$). Specifically, the highest rate of eating sweets occurred in the United Kingdom.

Weekends

Physical activity. There was no three-way interaction between country, gender, and age group, but the two-way interaction for country x gender (Pillai's Trace = .072, $F_{5,177} = 2.742, p = .021$) was significant. There was a significant multivariate main effect for country (Pillai's Trace = .308, $F_{5,177} = 15.769, p < .001$), but not for gender and age group ($p > .05$). Univariate tests showed significant differences by country x gender for doing chores ($F = 5.929, p = .016$); by country for playing sport ($F = 9.271, p = .003$), unstructured play ($F = 37.525, p < .001$), behavioural hobbies ($F = 17.112, p < .001$), and doing chores ($F = 7.236, p = .008$), but not for active transport ($p > .05$); by gender for doing chores ($F = 4.621, p = .033$), but not for active transport, unstructured play, playing sport, and behavioural hobbies ($p > .05$); and no significant differences were found by age group ($p > .05$).

Specifically, according to the within country ranking, the highest rates of playing sports and behavioural hobbies for males and females and doing chores for females were in the United Kingdom; and unstructured play, playing sport, and active travel for males and females in China.

Sedentary behaviours. There was a three-way interaction (Pillai's Trace = .124, $F_{11,171} = 2.194$, $p < .017$), but no two-way interactions ($p > .05$). There were significant multivariate main effects for country (Pillai's Trace = .452, $F_{11,171} = 12.848$, $p < .001$), but not for gender and age group ($p > .05$). Univariate tests showed significant differences by country x gender x age group for playing computer games ($F = 5.844$, $p = .017$), listening to music ($F = 4.623$, $p = .033$), and sitting doing nothing ($F = 7.370$, $p < .001$), but not for motorised transport, TV/video viewing, using a computer, using a telephone, sitting and talking, doing homework, reading, and cognitive hobbies ($p > .05$); by country x gender for playing computer games ($F = 7.463$, $p = .007$) and sitting doing nothing ($F = 4.823$, $p = .029$), but not for motorised transport, TV/video viewing, using a computer, using a telephone, listening to music, sitting and talking, doing homework, reading, and cognitive behaviours ($p > .05$); by country x age group for TV/video viewing ($F = 4.642$, $p = .033$) and playing computer games ($F = 6.545$, $p = .011$), but not for motorised transport, using a computer, using a telephone, listening to music, sitting and talking, sitting doing nothing, doing homework, reading, and cognitive behaviours ($p > .05$); by gender and age group for sitting doing nothing ($F = 6.860$, $p = .010$), but not for motorised transport, TV/video viewing, using a computer, playing computer games, using a telephone, listening to music, sitting and talking, doing homework, reading, and cognitive behaviours ($p > .05$); by country for playing computer games ($F = 17.423$, $p < .001$), listening to music ($F = 13.312$, $p < .001$), sitting doing nothing ($F = 6.972$, $p = .009$), and doing homework ($F = 99.647$, $p < .001$), but not for motorised transport, TV/video viewing, using a computer, using a telephone, sitting and talking, reading, and cognitive hobbies ($p > .05$); by gender for sitting and talking ($F = 4.189$, $p = .042$) and sitting doing nothing ($F = 4.055$, $p = .046$), but not for motorised transport, TV/video viewing, using a computer, playing computer games, using a telephone, listening to music, doing homework, reading, and cognitive hobbies ($p > .05$); and by age group for sitting doing nothing ($F = 6.166$, $p = .014$) and reading ($F = 4.075$, $p = .045$), but not for motorised transport, TV/video viewing, using a computer, playing computer games, using a telephone, listening to music, sitting and talking, doing homework, and cognitive hobbies ($p > .05$).

Specifically, and according to the within country ranking, the highest rates of TV/video viewing, playing computer games, sitting and talking, motorised transport, and doing homework were in the United Kingdom; and doing homework, TV/video viewing, sitting and talking, and motorised transport in China.

Snacking. There were no three-way or two-way interactions. There were significant multivariate main effects for country (Pillai's Trace = .271, $F_{4,177} = 16.473$, $p < .001$) and age group (Pillai's Trace = .064, $F_{4,177} = 3.041$, $p = .019$), but not for gender ($p > .05$).

Univariate tests showed significant differences by country for eating crisps ($F = 3.900$, $p = .049$), eating sweets ($F = 52.195$, $p < .001$), and eating fruit ($F = 14.741$, $p < .001$), but not for eating other snacks ($p > .05$); and by age group for eating crisps ($F = 4.481$, $p = .036$) and eating sweets ($F = 5.891$, $p = .016$), but not for eating fruit and eating other snacks ($p > .05$); no significant difference was found by gender ($p > .05$).

Specifically, the highest rate of eating sweets and fruits was in the United Kingdom.

Discussion

Physical activity, sedentary behaviour, and diet are important health behaviours. These may vary across settings, including country. For this reason, we compared data across two countries differing in their development. Future trends should be assessed to see how such behaviours might change over time, especially as countries develop economically.

The literature on physical activity and sedentary behaviour has shown that young people are able to engage in both clusters of behaviour and that the association between the two may be small, at least for TV viewing and physical activity (Marshall, Biddle, Gorely, Cameron, & Murdey, 2004). This may be the case in our data as the youth from the United Kingdom were more active through sport yet also indulged in more screen time. However, emerging evidence is showing that high levels of sedentary behaviour (often assessed as screen time) can have deleterious health effects independent of physical activity (Tremblay, Colley, Saunders, Healy, & Owen, 2010). For this reason it is prudent to keep leisure time screen time down and to encourage young people to be sitting less and moving more. This is consistent with recently issued guidelines (Chief Medical Officers of England, Scotland, Wales, & Northern Ireland, 2011).

Young people in China appear to do more homework than their United Kingdom counterparts. This appears to be a strong norm and expectation in Asian cultures. Such behaviours may create unhealthy outcomes through high levels of sitting and low levels of physical activity. However, clearly this is productive sedentary behaviour and, as such, may not be the type of sedentary behaviour we should be concerned about.

Snacking on sweets appears to be higher in the United Kingdom, and recent systematic review evidence supports the view that unhealthy diets are associated with screen time (Pearson & Biddle, 2011). This supports the need to reduce some sedentary behaviour, as they are likely to be associated with other health behaviours.

Key issues for future research in this field include the need to study changing patterns of sedentary behaviour in different countries. This may be particularly important in respect of leisure time behaviours using new technologies. While TV viewing is important in this regard, it will gradually be just one of many screen- or technology-based behaviours that young people undertake. For this reason, studies must assess more than just TV viewing or even screen time.

The study has a number of strengths, including an analysis across two countries and the use of detailed ecological momentary assessment. However, one limitation of the current study that we acknowledge is the cross-sectional design.

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