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LEISURE ACTIVITY PATTERNS AND THEIR ASSOCIATIONS WITH OVERWEIGHT: A PROSPECTIVE STUDY AMONG ADOLESCENTS

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Abstract

We examined longitudinal associations between individual leisure activities (television viewing, video viewing, computer games, listening to music, board games, musical instrument playing, reading, arts, crafts, socializing, clubs or scouts, sports, outdoor activities) and being overweight using logistic regression and latent class analysis in a cohort of Finnish twins responding to self-report questionnaires at 11–12 (N=5184), 14, and 17 years. We also studied activity patterns (“Active and sociable”, “Active but less sociable”, “Passive but sociable”, “Passive and solitary”) thought to represent different lifestyles. Among boys, activity patterns did not predict becoming overweight, but sports and playing an instrument reduced the risk and arts and listening to music increased it. Among girls, few individual leisure activities predicted becoming overweight. However, girls in the “Passive and solitary” cluster carried the greatest risk of becoming overweight in late adolescence. Studying leisure activities related to overweight may help focus specific interventions on high risk groups.

Keywords

leisure activities; hobbies; overweight; obesity; body mass index; adolescent; cohort studies

BACKGROUND

Obesity among children and adolescents is a major public health problem. It arises from a complex interaction of hereditary, social, socioeconomic, and behavioral factors not yet fully understood. Low socio-economic status of a family is a risk factor for pediatric obesity (Lobstein, Baur, & Uauy, 2004) and puberty modifies patterns of weight gain, too (Kaprio et al., 1995; Lobstein, Baur, & Uauy, 2004; Adair, 2007). Genetic factors explain a large proportion of the variation of body weight among children (Maes, Neale, & Eaves, 1997), but it is believed that dietary factors, decreased physical activity, and increased sedentary leisure time are major environmental determinants in early-onset obesity (Lobstein, Baur, & Uauy, 2004).

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American adolescents aged 15–19 years reported 4.85 hours of daily leisure time during the week and 6.68 hours per day during weekends/holidays in 2006, of which television viewing took up almost 40% and sports/exercise about 10% (U.S. Bureau of Labor Statistics, 2007). Finnish elementary school pupils aged approximately 7–15 years reported 5.95 hours of daily leisure time during the week and 9.85 hours per day during weekends/holidays in 1999–2000, of which television viewing took up 32% and sports/exercise 13% (Paakkonen, 2002). Quite likely, similar amounts of leisure time are available to adolescents in other post-industrial countries with extended schooling and relatively little pressure to start fulltime employment.

In most cross-sectional studies in youth, television viewing has been positively associated (Marshall, Biddle, Gorely, Cameron, & Murdey, 2004; Must & Tybor, 2005) and physical activity negatively associated with being overweight (Must & Tybor, 2005). The mixed results of prospective studies give a less clear picture (Must & Tybor, 2005). Although roughly half of daily leisure time is devoted to activities other than television viewing and physical activity (U.S. Bureau of Labor Statistics, 2007; Paakkonen, 2002), the role of these in weight development remains largely unknown.

Some studies have found a positive association between use of electronic games and weight (O'Loughlin, Gray-Donald, Paradis, & Meshefedjian, 2000; Stettler, Signer, & Suter, 2004) while others have not (Kautiainen, Koivusilta, Lintonen, Virtanen, & Rimpela, 2005; McMurray et al., 2000). Combined video game/computer time was not associated with BMI (Wake, Hesketh, & Waters, 2003) but computer use has been positively associated with weight status in girls, but not in boys (Utter, Neumark-Sztainer, Jeffery, & Story, 2003; Kautiainen, Koivusilta, Lintonen, Virtanen, & Rimpela, 2005) and also in both boys and girls (Lajunen et al., 2007) while others have not found any association (Janssen, Katzmarzyk, Boyce, King, & Pickett, 2004). Reading and homework were associated with higher BMI among adolescent boys but not among girls (Utter, Neumark-Sztainer, Jeffery, & Story, 2003). Overweight adolescents were also more likely to be socially isolated (Falkner et al., 2001; Strauss & Pollack, 2003) and may therefore spend less time with friends than their normal-weight peers.

Overweight is a result of over-intake of energy in relation to energy expenditure and energy required for growth. However, the relationship is complex, e.g. higher percentage of total energy intake at breakfast has been inversely associated with future weight gain, even when accounting for total energy intake (Purslow et al., 2008). Different eating styles are associated with weight status (Keski-Rahkonen et al., 2007), and environmental factors are interrelated: television viewing is associated with snacking (Snoek, van Strien, Janssens, & Engels, 2006) and television advertisements with increased consumption of food (Halford, Gillespie, Brown, Pontin, & Dovey, 2004); playing electronic games and television viewing are associated with decreased time spent in physical activities (Marshall, Biddle, Gorely, Cameron, & Murdey, 2004), and breakfast skipping with infrequent exercise and other health-compromising behaviors among adolescents (Keski-Rahkonen, Kaprio, Rissanen, Virkkunen, & Rose, 2003).

Another problem is that accurate direct measurements of diet and physical activity level are extremely challenging in large sample studies. Gold-standard methods such as double-labeled water for total energy expenditure cannot readily be exported to large samples and assessed over long periods. Hence assessments of physical activity and diet mostly rely on self-assessments, which are prone to report bias, such that overweight subjects underreport their dietary intake (Heitmann & Lissner, 1995; Lissner et al., 2007) and overreport their physical activity (Brown & Werner, 2008; Irwin, Ainsworth, & Conway, 2001) more than subjects of normal weight.

To address these issues, related to measurement of diet and physical activity and interrelatedness of potential risk factors, we became interested also in looking beyond the direct effects of individual leisure activities on weight and chose to analyze patterns of leisure activities. So doing permits study of combinations of leisure activities, which more closely represent real life. We also believe that leisure activity patterns can represent different lifestyles and can help to identify specific population groups at high risk for becoming overweight.

Most of the extant research is cross-sectional and encompasses only a few types of activity. Apart from television viewing and physical activity, longitudinal studies of associations between leisure activities and being overweight are almost entirely lacking. We therefore set out to explore whether leisure activities have longitudinal associations with being overweight in a population-based sample of adolescents. We hypothesized that physically active leisure interests (sports, outdoor activities) would be associated with a decreased risk of being overweight, and sedentary ones (television viewing, video viewing, computer games, listening to music, board games, musical instrument playing, reading, arts, crafts, clubs or scouts) with an increased risk of being overweight. We also expected to find positive associations between low level of sociability and being overweight.

METHODS

Participants

The *FinnTwin12* study ascertained all twins in the Finnish birth cohorts 1983–1987 (Kaprio, Pulkkinen, & Rose, 2002). Written informed consent was obtained from participating families. Data on 5184 twins at 11–12 years (participation rate 92%), 2736 mothers (94%), and 2636 fathers (88%) were assessed by self-report questionnaires. The twins were followed up at 14 years ($N=4643$, 82% of the original sample) and 17 years ($N=4168$, 74%). The last wave (mailed at average age 17.5 y) was completed in 2000–2005. In this study we used the questions concerning leisure activities and pubertal development at 11–12 and 14 y, weight and height at 11–12, 14, and 17 y, and parental education at baseline (when twins were 11–12 y) for analyses. Local ethics committees in Helsinki and Indiana reviewed and approved the study protocol.

Measures

Overweight—We calculated BMIs (weight/height²) using self-reported height and weight at 11–12, 14, and 17 years. Overweight was defined according to International Obesity Task Force age- and sex-specific BMI cut-off points (Cole, Bellizzi, Flegal, & Dietz, 2000) analogous to BMI cut-off points of 25 kg/m² and 30 kg/m² for adult overweight and obesity. Adolescents were categorized as normal weight, overweight, or obese based on the above-mentioned sex-specific BMI cut-off points and the exact age at response. Because of low numbers, we merged the last two categories (overweight and obesity). Participants who were 18 years or older when responding to the 17-year-olds' questionnaire (4.8 %) were categorized using adult definitions of overweight and obesity.

To eliminate outliers resulting from data errors, we excluded participants with BMI z-scores over 5 or under –5 from the analyses. Z-scores were created using the 1990 British Growth Reference data (Cole, Freeman, & Preece, 1998). There was no difference in the mean BMI and prevalence of overweight between non-participants, 11–12-year-olds participating in the 14-year-olds' and 17-year-olds' questionnaires, or 14-year-olds participating in the 17-year-olds' questionnaire.

Leisure activities—We asked how often adolescents engaged in individual activities: television viewing, video viewing, computer games, listening to music, board games, musical

instrument playing, reading, arts, crafts, socializing, clubs or scouts, sports, and outdoor activities (Pulkkinen & Narusk, 1987) at 11–12 years and 14 y. Arts were defined as drawing or painting and crafts as handicrafts, woodwork, or building scale models. Socializing at home was defined as meeting peers at home and at friends' home. A separate item on meeting peers away from home was also used. The term socializing refers to all of the three above mentioned activities. Other leisure activities were not more specifically defined than in the list above. The frequency scale given was daily, 2–3 times a week, 2–3 times a month, 2–3 times half-yearly, and never. All of the activities were dichotomized in the individual activity analyses. Television viewing, listening to music, and outdoor activities were dichotomized by defining a frequency of daily as high usage and less often as low usage. Other activities were dichotomized as daily or 2–3 times a week as high usage and less frequently as low usage based on the original distribution of the variables.

Potential confounders—Because pubertal timing could affect both weight status (Kaprio et al., 1995; Lobstein, Baur, & Uauy, 2004; Adair, 2007) and adolescents' leisure activity choices, we adjusted the models for pubertal status. It was measured by the Pubertal Development Scale (PDS) (Petersen, Crockett, Richards, & Boxer, 1988; Dick, Rose, Pulkkinen, & Kaprio, 2001) at ages 11–12 and 14 y. PDS is based on responses given by the adolescents to five questions concerning their physical maturation. A missing pubertal development level measure (2% of subjects at 11–12 years and 3% at 14 y) was replaced by the mean of the PDS for the specific sex and age group.

Because socio-economic status of a family could affect both the risk of being overweight (Lobstein, Baur, & Uauy, 2004) and leisure activity choices of adolescents, we adjusted the models for it, too. Parents were divided based on their basic education to those who had completed the mandatory school requirement (9 years) and senior high school ("high education") versus those who had completed the mandatory school requirement only ("low education"). Education levels of both parents were included in the analysis. A missing answer (for mothers 2%, for fathers 12%) was defined as a third category of education variables.

Data analysis

We used logistic regression models to study associations of individual leisure activities and leisure activity patterns with being or becoming overweight. Prospective analyses used either baseline age (11–12 y) or age at first follow-up (14 y) as a starting point. The analyses were corrected for clustered sampling within families (i.e., twins within twin pairs) to obtain correct confidence intervals (Williams, 2000). Television viewing was not studied as an independent predictor of later overweight risk, because we could not assess television viewing hours, but it was measured in the same way as the other activities. In the leisure activity pattern analyses, the most passive and solitary class (the one with the lowest frequency of participation in almost all leisure interests, sports, sedentary activities, and socializing) served as a reference class. We adjusted the models for PDS and parental education and because of BMI tracking in adolescence (Fuentes, Notkola, Shemeikka, Tuomilehto, & Nissinen, 2003; Magarey, Daniels, Boulton, & Cockington, 2003), we also adjusted the models for BMI at the outset in the prospective analyses. The analyses were also conducted in a subsample which excluded those who were overweight at the outset.

Assuming that subjects could be grouped into distinct groups known as latent classes based on their profile of leisure activity involvement, we conducted latent class analysis (LCA) using the software Latent Gold 4.0. LCA treats ordinal leisure activity ratings as imperfect indicators of an otherwise unobserved discrete and categorical variable. Estimates for the posterior membership probabilities are obtained to assign cases to a class for which the probability is highest (Vermunt & Magidson, 2005; Magidson & Vermunt, 2004). Modeling aims to obtain

the smallest number of classes that accounts for all the associations between variables, starting with a one-class model and then adding another class for each successive model. The optimal number of classes can be determined in a variety of ways (Magidson & Vermunt, 2004; Dunn, Jordan, & Croft, 2006). We selected the smallest number of classes that afforded adequate fit to the data (as measured by reduction of the likelihood-ratio goodness-of-fit value or L^2) and that could be interpreted.

RESULTS

Overweight

The prevalence of overweight and obesity among boys was 10.3% at 11–12 y, 10.2% at 14 y, and 11.9% at 17 y. Among girls the prevalence was 9.3% at 11–12 y, 7.9% at 14 y, and 7.9% at 17 y.

Individual leisure activities and overweight risk

A few of the leisure activities at age 11–12 and 14 years were predictive of future weight development. Those statistically significantly associated with being overweight later in adolescence, at 14 or 17 y, are shown in Tables 1 and 2. Among boys, sports at 11–12 years decreased the risk of being overweight at 14 years but not at 17 y. Musical instrument playing at 14 years was associated with a decreased risk of being overweight at 17 years and a similar trend was observed for participation in boys' clubs or scouts. Arts and socializing at home at 14 years and listening to music at 11–12 years were associated with an increased risk of being overweight at 17 y. The results remained essentially unchanged when boys who were overweight at the outset were excluded (Table 1). Among girls, crafts and board games at 14 years predicted being overweight at 17 years and a similar trend was observed for video viewing at 11–12 y. These three associations did not remain statistically significant when individuals who were overweight at the outset were excluded (Table 2).

Composition of leisure activity classes

All of the leisure activities were included in each latent class; classes were distinguished by their members' average level of participation in each leisure activity which then yielded an individual profile of each class. In both genders, the leisure activity classes differed from each other by two dimensions: the general level of involvement in both sedentary and physically active leisure interests and the frequency of socializing. Surprisingly, adolescents most often involved in physically active leisure interests were usually most often involved in sedentary leisure interests, too. The two classes with the highest level of this "general activity" were defined as "active". These two classes still differed from each other by the level of socializing. Another one of them was named as "Active and sociable" and the other one as "Active but less sociable". The same difference was seen among the two classes of adolescents who had the lowest level of the general activity, defined as "passive". Another class was clearly higher in the level of socializing than the other one. Therefore the classes were named as "Passive but sociable" and "Passive and solitary".

Among both boys and girls at 12 years, the "Active and sociable" class was defined by the highest or second highest participation level in every activity, including socializing. The "Active but less sociable" class was defined by the highest or second highest level in every activity except meeting peers at home or at friends' home, and among boys playing computer games too. The "Passive but sociable" class was defined by the lowest or second lowest level in every activity except meeting peers at home or at friends' home, and among boys playing computer games too. The "Passive and solitary" class was defined by the lowest or second lowest level in every activity, including socializing.

At 14 years among both sexes, the “Active and sociable” class was defined by the highest or second highest level of participation in every activity, including socializing. The “Active but less sociable” class was defined by the highest or second highest level in every activity except both music listening, and video viewing among girls, and the second lowest level of socializing. The “Passive but sociable” class was defined by the lowest or second lowest participation level in every activity except both music listening, and video viewing among girls and the highest or second highest level of socializing. The “Passive and solitary” class was defined by the lowest or second lowest participation level in every activity and the lowest level of socializing. Figures 1 and 2 show the approximate mean level of each leisure activity in the four classes at 14 y. The proportions of adolescents in each class participating frequently in individual leisure activities at 14 years are shown in Tables 3 and 4. The leisure activity classes of 11–12-year-olds followed the same broad patterns in boys and girls (available from the first author).

Leisure activity classes and overweight risk

In cross-sectional analyses among boys aged 11–12 y, the proportion of overweight boys was significantly lower among the classes “Active and sociable” (OR 0.36, 95% CI 0.22–0.58), “Active but less sociable” (OR 0.41, 95% CI 0.28–0.62), and “Passive but sociable” (OR 0.42, 95% CI 0.26–0.68) when compared to the “Passive and solitary” class. However, belonging to a specific leisure activity class did not predict the risk of being overweight later in adolescence, at 14 or 17 years (detailed prospective results available from the first author).

In cross-sectional analyses among girls aged 11–12 y, the proportion of overweight girls was lower only among the “Passive but sociable” class (OR 0.56, 95% CI 0.36–0.88) than among the “Passive and solitary” class. However, belonging to a specific leisure activity class at 11–12 years did not predict the risk of being overweight later in adolescence, at 14 or 17 years (further results available from the first author).

The proportion of overweight boys was lower in the “Passive but sociable” and “Active and sociable” classes than in the “Passive and solitary” class at 14 years (Table 4). However, belonging to a specific leisure activity class at 14 years did not predict the risk of being overweight at 17 y. The results were similar when boys who were already overweight at 14 years were excluded (Table 5).

The proportion of overweight girls did not differ between leisure activity classes at 14 years in cross-sectional analyses (Table 5). However, in prospective analyses, girls who at 14 years belonged to the “Passive but sociable” class had a smaller risk of being overweight at 17 years than those who belonged to the “Passive and solitary” class at 14 y. When the girls who were already overweight at 14 years were excluded from the analyses, the risk of becoming overweight by 17 years was lower among girls who at 14 years belonged to the “Active and sociable”, “Active but less sociable”, and “Passive but sociable” classes than among girls in the “Passive and solitary” class (Table 5).

DISCUSSION

The associations of leisure activities with being overweight were studied by focusing on both individual activities and activity patterns. Among boys, sports and musical instrument playing reduced the later risk of being overweight and arts and listening to music increased it, while activity patterns did not predict the later risk of being overweight. Among girls, few individual leisure activities were associated with the later risk of being overweight. However, girls who belonged to the most passive and solitary activity class had the greatest risk of being overweight later in adolescence.

In relation to overweight, leisure activities have traditionally been divided into physically active (such as organized sports) and sedentary ones (e.g., television or video viewing). We found a negative association between being overweight and sports among boys and a positive association between being overweight and many sedentary activities: listening to music, arts, crafts, and board games, and a marginally significant positive association between being overweight and video viewing. However, explaining associations between leisure interests and weight status based only on energy expenditure level may be too simplistic. An active lifestyle may increase energy expenditure but also offer pleasure and entertainment, thus possibly diminishing pleasure seeking from eating. Some leisure activities engaging the whole body (e.g., musical instrument playing) simply do not leave hands free for eating. Leisure interests could thus also influence weight independently of their energy expenditure level. This could explain the finding that 14-year-old girls in the latent class with the lowest level of participation in almost all activities, sedentary, physically active, as well as social ones, had the greatest risk of being overweight later in adolescence.

We defined sociability as the extent to which people prefer to have social relationships as opposed to being alone, and operationalized it by asking about the frequency of socializing with friends. The four leisure activity classes differed greatly in the frequency of socializing: 100% of 14-year-old boys and 98% of girls in the most sociable class vs. 9% of boys and 0% of girls in the least sociable class were meeting peers at friends' home frequently (Tables 3 and 4). Previous studies have established that social marginalization is more common among overweight adolescents (Falkner & et al., 2001; Strauss & Pollack, 2003). Social isolation may be a consequence of being overweight, and vice versa. Social isolation has been shown to promote obesity in mice (Nonogaki, Nozue, & Oka, 2007), and has been associated with higher mortality and broad-based morbidity (House, Landis, & Umberson, 1988). Our study suggests that activity patterns among girls with reduced frequency of socializing at 14 years result in increased risk of being overweight at 17 y. Possible mechanisms may involve alterations in the function of the autonomic nervous system, of sleep regulation, and of the hypothalamus-pituitary-axis, all of which have been associated with loneliness (Cacioppo et al., 1999). However, this finding held only for girls. Low level of sociability could also be associated with depressive symptoms, which have increased the risk of later obesity among girls but not boys (Richardson et al., 2003; Anderson, Cohen, Naumova, & Must, 2006).

The finding that certain multidimensional leisure activity patterns may predict the later overweight risk among adolescent girls but not among boys is in line with a very recent study focusing on the associations of behavior patterns with obesity risk among 8840 American adolescents (Boone-Heinonen, Gordon-Larsen, & Adair, 2008). The study differed from ours in several aspects - the method used to create behavior patterns (cluster analysis vs. latent class analysis), the input variables, and the age range of the study sample (11–22 years at baseline vs. our standardized age at each measurement point). Hence the behavior patterns of the US study and leisure activity patterns in Finland are unfortunately not directly comparable, but both studies highlight the importance of looking simultaneously at multiple aspects of behavior for their impact on weight gain and obesity risk.

Various fundamental personality traits, such as level of impulsiveness, and other obesity-related behaviors, such as eating patterns, maybe related to specific leisure activities (such as musical instrument playing, arts, clubs or scouts) and leisure activity patterns. E.g. among American adolescents behavior patterns such as "Average diet & activity" and "Junk food & low activity" were found (Boone-Heinonen, Gordon-Larsen, & Adair, 2008). The aforementioned behavioral traits may mediate the effects of leisure activities on overweight risk. Leisure activities also reflect various lifestyles and levels of academic performance, as well as general psychological, social, and behavioral functioning (Mahoney & Stattin, 2000; Bartko & Eccles, 2003; Piko & Vazsonyi, 2004). Regular musical instrument playing can be

expected to be associated with an overall regular lifestyle, perhaps even with a regular meal pattern.

Weight gain results on average from only a minor imbalance between food intake and activity. It is extremely difficult to detect minor differences in large, prospective, epidemiological studies using self-assessments (Heitmann & Lissner, 1995; Lissner et al., 2007), and measuring energy intake and expenditure directly would involve unrealistic financial resources and the risk of disturbing and changing the behavior of participants. We believe that the study of leisure activity patterns can help to identify specific population groups at high risk for becoming overweight among adolescent girls. Eating patterns, energy and nutrient intakes, personality traits, and exact physical activity levels in these groups could be explored in detail in future studies to identify the predisposing lifestyle factors. Studying leisure activities may also serve to identify the more distal determinants of obesity and overweight.

Limitations

Information on dietary intake was unfortunately not available for this study. However, dietary assessments, including extended food frequency and eating behavior questionnaires, are included in the ongoing third follow-up of the FinnTwin12 study at 20–24 y.

Measuring leisure activities accurately is difficult because of large inter- and intraindividual variation in activities and their temporal patterns. Better measurement strategies for leisure activities (e.g., hours per day) or more objective measures than self-administered questionnaires would have yielded more precise estimates. This is particularly true for television viewing: we were not able to assess hours of television viewing and thus could distinguish between daily and non-daily viewing habits only. The number of non-viewers was only 7%, so the reference group was too small for reliable analyses and we did not therefore conduct analyses with television viewing as an independent predictor of later risk of being overweight.

Self-reported heights and weights are also potential sources of bias. Reliance on self-reporting underestimates the true prevalence of overweight (Crawley & Portides, 1995; Elgar, Roberts, Tudor-Smith, & Moore, 2005). However, our main goal of studying associations between leisure activities and being overweight would be confounded only in the unlikely event of differing self-reported biases of weight and height by leisure activities.

Finally, twin-specific differences in anthropometric, socioemotional, and physical activity measures during late adolescence are minor (Moilanen & Rantakallio, 1990; Aarnio, Kujala, & Kaprio, 1997; Pietilainen et al., 1999; Pulkkinen, Vaalamo, Hietala, Kaprio, & Rose, 2003) and unlikely to affect the relationship of leisure activities and being overweight.

The strengths of this study include its large sample size, high participation rates, and prospective, population-based setting. The age of the participants was standardized at baseline and at each follow-up point, and information from parents was also available.

Conclusions

This study, although not fully explaining the associations of complex leisure activity patterns with weight status, suggests that leisure activities and level of socializing influence the development of overweight among adolescents. Identification of behavior and activity patterns predisposing to obesity may help focus specific intervention on high risk groups among adolescent girls and therefore merit further study.

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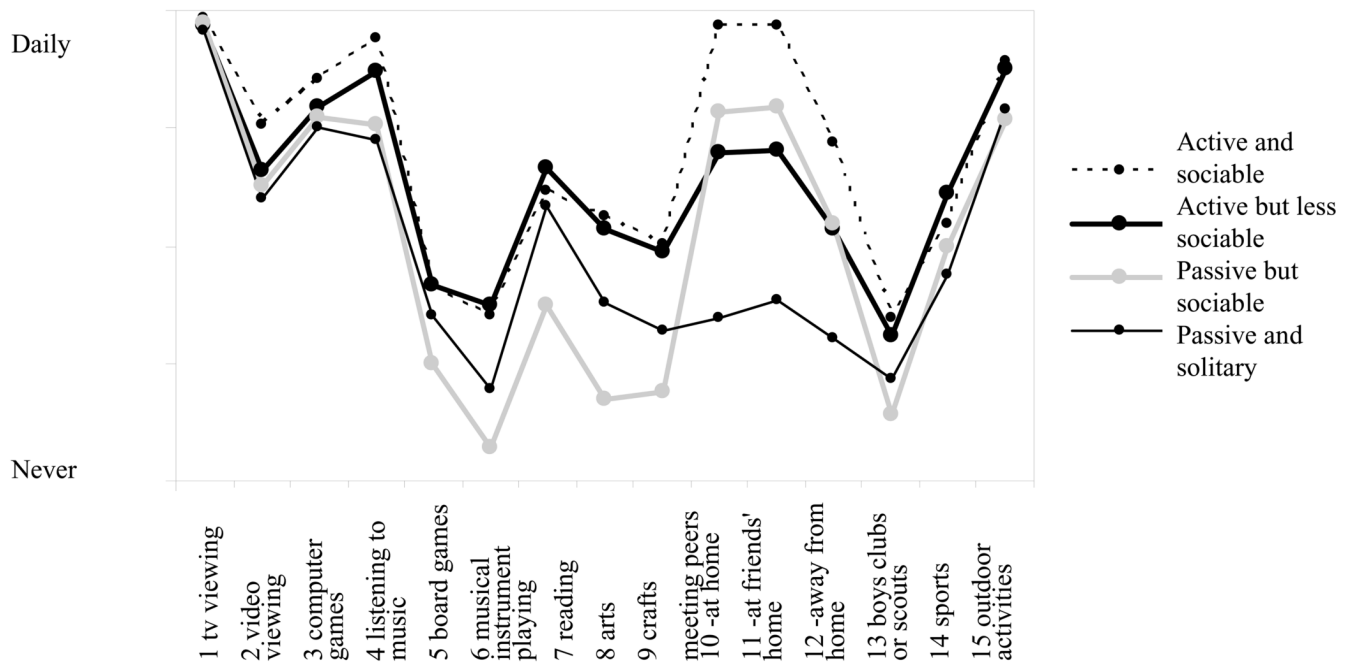


Figure 1.

Leisure activity profiles of boys aged 14 years. The figure shows the approximate mean level of ordinal leisure activity variables in each profile.

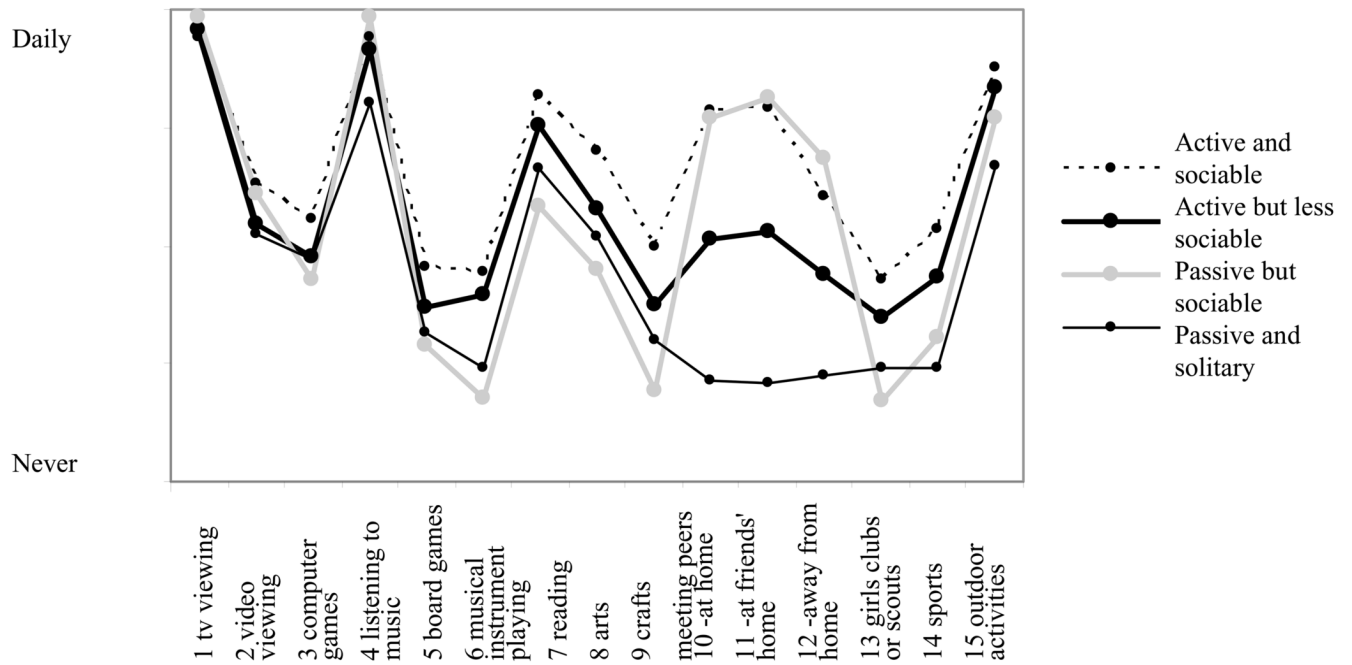


Figure 2.

Leisure activity profiles of girls aged 14 years. The figure shows the approximate mean level of ordinal leisure activity variables in each profile.

Table 1

Leisure activities and overweight risk among boys

Leisure activity	Outset age	Partici pation	Total N	Outcome	% of overweight boys	Adj. OR ^a	95% CI	Adj. OR ^{a,b}	95% CI
Sports	11–12	No	589	overweight at 14 y	15	1.0	-	1.0	-
		Yes	1550		8	0.63	0.41–0.98	0.51	0.30–0.88
Listening to music(daily)	11–12	No	1121	overweight at 17 y	11	1.0	-	1.0	-
		Yes	778		14	1.4	1.0–2.1	1.3	0.81–2.0
Musical instrument playing	14	No	1469	overweight at 17 y	12	1.0	-	1.0	-
		Yes	415		9	0.58	0.38–0.90	0.28	0.14–0.56
Arts	14	No	1277	overweight at 17 y	10	1.0	-	1.0	-
		Yes	609		16	1.5	1.0–2.3	1.6	0.97–2.6
Socializing at home	14	No	734	overweight at 17 y	12	1.0	-	1.0	-
		Yes	1120		12	1.8	1.2–2.7	1.8	1.1–3.0
Boys' clubs or scouts	14	No	1361	overweight at 17 y	13	1.0	-	1.0	-
		Yes	509		9	0.66	0.43 – 1.0	0.51	0.29 – 0.90

^a Adjusted for BMI and pubertal development at the outset and parental education.

^b Only participants of normal weight at the outset were included in the analyses.

Table 2

Leisure activities and overweight risk among girls

Leisure activity	Outset age	Partici pation	Total N	Outcome	% of overweight girls	Adj. OR ^a	95% CI	Adj. OR ^{ab}	95% CI
Crafts	14	No	1482	overweight at 17	7	1.0	-	1.0	-
		Yes	552		10	1.7	1.0-2.9	1.8	0.96-3.4
Board games	14	No	1833	overweight at 17	7	1.0	-	1.0	-
		Yes	202		12	2.0	1.1-3.5	1.2	0.48-2.8
Video viewing	11-12	No	879	Overweight at 17	5	1.0	-	1.0	-
		Yes	1127		9	1.6	1.0-2.5	1.4	0.81-2.4

^a Adjusted for BMI and pubertal development at the outset and parental education.

^b Only participants of normal weight at the outset were included in the analyses.

Table 3Proportions of 14-y-o boys participating in specific leisure activities^a by leisure activity classes

Leisure activity	The "Passive and solitary" class	The "Passive but sociable" class	The "Active but less sociable" class	The "Active and sociable" class
Number of participants (n)	389	425	948	317
Television viewing (daily) (%)	92	94	94	97
Video viewing (%)	50	61	63	82
Computer games (%)	76	76	81	90
Listening to music (daily) (%)	39	44	63	82
Board games (%)	7	2	12	16
Musical instrument playing (%)	15	2	31	32
Reading (%)	45	24	60	52
Arts (%)	26	4	44	51
Crafts (%)	20	8	41	45
Socializing at home				
- meeting peers at home (%)	5	89	75	100
- meeting peers at friends' home (%)	9	93	78	100
Meeting peers away from home (%)	18	47	46	74
Boys' clubs or scouts (%)	20	14	33	36
Sports (%)	49	57	68	60
Outdoor activities (daily) (%)	45	40	58	66

^a2–3 times a week or daily

Table 4Proportions of 14-y-o girls participating in specific leisure activities^a by leisure activity clusters

Leisure activity	The "Passive and solitary" class	The "Passive but sociable" class	The "Active but less sociable" class	The "Active and sociable" class
Number of participants (n)	162	405	705	845
Television viewing (daily) (%)	87	94	90	92
Video viewing (%)	34	48	38	55
Computer games (%)	44	26	32	44
Listening to music (daily) (%)	55	93	75	83
Board games (%)	4	4	8	16
Musical instrument playing (%)	19	10	34	36
Reading (%)	61	43	71	82
Arts (%)	37	28	49	70
Crafts (%)	21	7	25	38
Socializing at home				
- meeting peers at home (%)	0	86	19	93
- meeting peers at friends' homes (%)	0	98	15	98
Meeting peers away from home (%)	8	66	26	54
Girls' clubs or scouts (%)	26	15	37	50
Sports (%)	27	27	45	58
Outdoor activities (daily) (%)	23	37	49	57

^a2–3 times a week or daily

Table 5
Associations of 14-year-olds' leisure activity profiles with overweight: odds ratios (OR) and 95% confidence intervals (CI)

Class	Total N	% of overweight at 14 y	% of overweight at 17 y	adj. ^a OR & 95% CI for overweight at 14 y	adj. ^b OR & 95% CI for overweight at 17 y	adj. ^{bc} OR & 95% CI for overweight at 17 y
Boys						
"Passive and solitary" (reference)	375	14	13	1.0	1.0	1.0
"Passive but sociable"	414	8	10	0.49 (0.30–0.80)	1.5 (0.77–3.0)	1.5 (0.73–3.2)
"Active but less sociable"	918	10	13	0.70 (0.47–1.0)	1.4 (0.82–2.6)	1.2 (0.62–2.3)
"Active and sociable"	304	8	10	0.47 (0.26–0.84)	1.1 (0.55–2.3)	0.55 (0.20–1.5)
Girls						
"Passive and solitary" (reference)	156	9	12	1.0	1.0	1.0
"Passive but sociable"	394	7	5	0.67 (0.34–1.4)	0.20 (0.07–0.59)	0.12 (0.03–0.44)
"Active but less sociable"	691	8	8	0.90 (0.47–1.7)	0.46 (0.19–1.1)	0.32 (0.14–0.76)
"Active and sociable"	827	8	9	0.91 (0.48–1.7)	0.63 (0.26–1.5)	0.36 (0.16–0.82)

^a Adjusted for pubertal status and parental education

^b Adjusted for BMI and pubertal development at the outset and parental education.

^c Only participants of normal weight at 14 y were included in the analyses.