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Sedentary patterns and media availability in European adolescents: The HELENA study[☆]

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ABSTRACT

Objective: To describe sedentary behaviors in adolescents and to examine the influence of media availability on TV viewing.

Method: The study assessed 3278 adolescents (1537 males and 1741 females, 12.5–17.5 years) involved in the HELENA study (2007). Adolescents reported hours of TV viewing, computer games, console, internet for study and non-study reasons, and study, as well as availability of TVs, computers and consoles.

Results: Time spent in sedentary behaviors was higher during weekends (all $p < 0.001$). Males spent more hours on TV viewing (for ≥ 15 years at weekends), playing computer games and console games while females spent more time studying and surfing for non-study reasons. During weekdays, one third of adolescents exceeded the screen time guidelines (> 2 h/day) based solely on TV viewing, whereas around 60% exceeded it at weekends. Having a TV or a console in the bedroom was associated with higher TV viewing (OR = 2.66; 95% CI 2.23–3.18; and OR = 1.92; 95% CI 1.61–2.28, respectively) whereas the presence of computer reduced it (OR = 0.57; 95% CI 0.48–0.68).

Conclusion: Adolescents living in Europe are not meeting media recommendations, especially during weekend. The absence of a TV in the adolescents' bedroom might reduce TV viewing. Further studies are needed to confirm or contrast our findings.

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Introduction

Physical inactivity is considered one of the biggest public health concerns (Blair, 2009). In developed countries, physical inactivity is an important cause of chronic diseases and premature mortality (Mokdad et al., 2004). Physical activity guidelines have focussed largely on accumulate enough moderate-to-vigorous physical activity (Owen et al., 2009). However, recently special attention has been given to the deleterious effects of sedentary behaviors. In adults, there is a dose–response association between sitting time and mortality from all causes and cardiovascular disease (Katzmarzyk et al., 2009). In adolescents, television (TV) viewing is associated with obesity (Vicente-Rodríguez et al., 2008), even in those who achieve high levels of physical activity (Eisenmann et al., 2008), and with metabolic cardiovascular disease risk factors (Ekelund et al., 2006; Martínez-Gómez et al., 2010).

With the aim of reducing the screen-time among children and adolescents, the American Academy of Pediatrics (AAP) already in 2001 recommended (i) that youth should not spend more than 2 hours on TV viewing and (ii) to remove TVs from youth's bedrooms (American Academy of Pediatrics, AAP, 2001). Later, other countries also launched screen-time recommendations for children and adolescents (Department of Health and Aging, DoHA, 2004; The Public Health Agency of Canada, PHAC, 2002). Although the prevalence of TV viewing in European adolescents showed minimal changes since 1985/86 to 1997/98 (Samdal et al., 2007), nowadays, the electronic offer for entertainment is much more accessible. In this sense, 65% of U.S. children had 3 or more TVs at home and 80% had access to computer and videogames in 2005 (Roberts et al., 2005). In Australia, 95% of children used computers and 71% played with electronic games during 2003 (Australian Bureau of Statistics, ABS, 2003).

There is evidence that the prevalence of sedentary behaviors increases through adolescence (Brodersen et al., 2007; Hardy et al., 2007). Indeed, there seem to be an increase in time spent in sedentary behaviors during the transition from high school to university (Pullman et al., 2009). Shi et al. (2006) found that adolescents reported on average 11 h/day studying during weekdays (including school schedules). On the other hand, sedentary behaviors seem to be gender-specific, with males reporting more TV (te Velde et al., 2007) or screen-time than females (Sisson et al., 2009). Furthermore, having a TV in the adolescent's bedroom seem to be associated with a higher screen time (Delmas et al., 2007), but more studies are needed to confirm this observation.

The prevalence of sedentary behaviors in current adolescents living in Europe is now known. The HELENA study (Healthy Lifestyle

in Europe by Nutrition in Adolescence) allows us to describe the prevalence of sedentary behaviors in a sample of adolescents from nine European countries. The objectives of this study were: (1) to describe the prevalence of sedentary behaviors by age and gender, (2) to describe the electronic media availability at home (TV, computer and console), and (3) to examine the relationship between electronic media availability and the risk of excess TV viewing (> 2 h/day).

Methods

Study design

The HELENA study (www.helenastudy.com) is a European Union-funded project on lifestyle and nutrition among adolescents from 10 European cities: Athens and Heraklion in Greece, Dortmund in Germany, Ghent in Belgium, Lille in France, Pecs in Hungary, Rome in Italy, Stockholm in Sweden, Vienna in Austria, and Zaragoza in Spain. Data collection took place between October 2006 and December 2007. More detailed information on the study design has been published elsewhere (Moreno et al., 2008). The study was approved by the Research Ethics Committees of each city involved. Written informed consent was obtained from the parents of the adolescents and the adolescents themselves (Béghin et al., 2008). As the aim of the study was to assess the nutritional status of the adolescent population in Europe during the design phase, we checked for the variability of a large set of nutritional status indices obtained in previous studies. The one showing the largest variability was body mass index (BMI). Therefore, we estimated the sample size according with the mean BMI and variance values, for each sex and age strata. This procedure ensured us to adequately describe all the variables included in the study. For the sample size calculation, a confidence level of 95% and an error of ± 0.3 was assumed. The sampling was performed in a multiple-stage random sample manner, using first schools as random units and subsequently, school-classes as the secondary sampling units. Complete school classes had a minimum of 20 students, and similar age and sex distribution was assumed.

From a total sample of 3528 adolescents who participated in the HELENA study, 3278 adolescents (1537 males and 1741 females, 12.5–17.5 years) fulfilled at least 75% of the sedentary questionnaire and were included in the present report.

Data collection

A self-report sedentary behavior questionnaire (designed *ad hoc*) was administered during the school hours as described elsewhere (Vicente-Rodríguez et al., 2008). Adolescents reported for both the

hours TV viewing, playing with computer games, playing with console games, surfing by internet for reasons other than study, surfing by internet due to study reasons, and studying (non-school time) for week and weekends days. They selected one of the following categories: (1) none, (2) less than ½ hour, (3) between ½–1 h, (4) between 1 and 2 h, (5) Between 2 and 3 h, (6) between 3 and 4 h, (7) more than 4 h. Finally, number of TVs, computers and consoles at home, and the presence or not of these technologies in the bedroom were collected.

We studied the reliability of the sedentary questionnaire in 183 adolescents (13–18 years). Adolescents completed the questionnaire two times, one week apart. This sub-sample did not participate in HELENA study, yet it did not differ in age, ethnicity or socioeconomic status from the final HELENA study sample. Cohen's Kappa coefficients using quadratic weights during weekdays were: 0.71 for TV viewing; 0.82 for computer games; 0.82 for console games; 0.86 for internet no study; 0.46 for internet studying; 0.73 for studying. During weekend days, the coefficients were: 0.68 for TV viewing; 0.79 for computer games; 0.81 for console games; 0.71 for internet no study; 0.33 for internet studying; 0.82 for studying. The strength of agreement for the Kappa values can be interpreted as: 0–0.20, slight; 0.21–0.40, fair; 0.41–0.60, moderate; 0.61–0.80, substantial; and 0.81–1.00, almost perfect (Landis and Koch, 1977). For the majority of the cases the agreement was substantial or almost perfect, except for internet studying that resulted fair (weekend) or moderate (weekdays).

The adolescents also completed a questionnaire asking for the number of cars and computers at home, having internet at home and whether or not the adolescent had its own bedroom. The Family Affluence Scale (FAS) was calculated, based on a model developed by Currie et al. (2008), but slightly adapted by replacing the item on holidays by internet at home. The FAS indicated the socio-economic status (SES) of the adolescent on a scale from 0 (very low SES) to 8 (very high SES).

Statistical analysis

Descriptive statistics for sedentary behaviors stratified by sex and age (<15 years and ≥15 years) were computed. According to the categorical nature of the variables, Pearson Chi-square tests were used to compare proportions by gender and age. Spearman correlation

coefficients were calculated as measures of association between variables. Binary logistic regression analyses were performed to obtain the odds ratio (OR) of TV viewing >2 h/day after adjusting for socioeconomic status according to age, gender, having TV, console or computer in the bedroom. Because socioeconomic position could potentially affect media availability and hence, the TV consumption, we adjusted by FAS in the regression model. For all statistical tests a p -value ≤0.05 was considered to be statistically significant. Statistical procedures were performed by using SPSS software, version 15.0. (SPSS, Chicago, IL) and STATA software, version 10.0.

Results

Table 1 shows descriptive information on sedentary behaviors in weekdays and weekends by sex and age groups. A more detailed description of the prevalence by four age-groups is showed in *Supplementary material (Tables 1–2)*.

Viewing

At weekends, the consumption of TV was higher than weekdays. A higher percentage of males watched TV for >2 h/day compared with females (58.3% vs. 52.8%, $p < 0.05$, in older than 15 years), while during weekdays no sex difference was observed in both age-groups. TV viewing was significantly lower with age in girls, but higher in boys (only during weekdays).

Electronic games (computer games and console games)

Males played more than females (in each age-group) during both week and weekend days ($p < 0.001$). Comparing age-groups in each sex, females significantly played more when they were <15 years, but the opposite was found for males.

Internet for non-study reasons

The percentage of using internet for non-study reasons were higher in females during both, week ($p = 0.001$) and weekend days ($p = 0.025$), but only in the younger group. Older adolescents

Table 1

Percentage of adolescents according to time spent in sedentary behaviors by sex and age groups (the HELENA study, Europe, 2007).

	Males							Females								
	<15 years			≥15 years				p (age diff.)	<15 years			≥15 years				p (sex diff.)
	<2 h	2–4 h	>4 h	<2 h	2–4 h	>4 h	<2 h		2–4 h	>4 h	<2 h	2–4 h	>4 h	<15 years	≥15 years	
TV viewing																
Weekdays	69.7	24.7	5.6	64.8	29.8	5.4	0.05	67.3	26.6	6.1	67.7	28.6	3.7	0.04	0.39	0.18
Weekend * †	39.6	44	16.4	41.7	40.2	18.1	0.26	37.4	44.5	18.1	47.2	38.8	13.9	<0.001	0.43	0.01
Computer games																
Weekdays	81.5	13.2	5.3	78.4	17.2	4.4	0.04	90.7	7.9	1.4	91	6.2	2.8	0.04	<0.001	<0.001
Weekend * †	73.5	17.6	9	81.6	12.2	6.2	<0.001	93.2	5.2	1.6	97.6	1.9	0.5	<0.001	<0.001	<0.001
Console games																
Weekdays	90.6	6.6	2.8	92.4	5.6	2	0.37	97.5	2.1	0.4	99.5	0.4	0.1	0.001	<0.001	<0.001
Weekend * †	73.5	17.6	9	81.6	12.2	6.2	<0.001	93.2	5.2	1.6	97.6	1.9	0.5	<0.001	<0.001	<0.001
Internet (non-study)																
Weekdays	86.6	8.5	4.9	81.9	12.5	5.6	0.02	83	13.7	3.3	80.5	13.7	5.8	0.03	0.001	0.72
Weekend * †	75.6	16	8.4	69.6	19.9	10.5	0.02	70	20.1	9.9	65.8	23.2	10.9	0.14	0.02	0.25
Internet (study reasons)																
Weekdays	96.5	2.4	1.1	96.9	2.7	0.4	0.14	96.2	3.2	0.6	95.8	3.8	0.4	0.67	0.31	0.54
Weekend * †	94.6	4.2	1.2	96.9	2.7	0.4	0.03	95.3	3.9	0.8	95	4.6	0.4	0.52	0.49	0.14
Studying																
Weekdays	84	12.1	3.9	89.1	9.7	1.2	<0.001	77.1	18.7	4.2	78.9	17.2	3.9	0.64	<0.001	<0.001
Weekend * †	78	17.3	4.7	84.8	13.1	2.1	<0.001	71.5	22.4	6.1	72.8	23.9	3.3	0.01	0.005	<0.001

Gender, age and weekdays-weekend differences using Pearson Chi-square test.

* $p < 0.001$ weekdays vs. weekend in males; † $p < 0.001$ weekdays vs weekend in females.

Table 2
Proportions of adolescents having TVs, computers and consoles at home and in the bedroom (the HELENA study, Europe, 2007).

	At home								In the bedroom	
	0		1		2		≥3		Yes	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Television	0.4	0.6	15.9	17.3	37.9	40.1	45.8	42.0*	63.4	54.2***
Computer	4.9	7.5	47.0	48.2	28.1	27.3	20.0	17.1*	62.0	48.9***
Console	25.0	43.1	44.3	37.9	17.1	11.6	13.6	7.4***	51.1	23.0***

Gender significant differences using Pearson Chi-square test (* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$).

Table 3
Sedentary behaviors according to the presence of television in the bedroom (the HELENA study, Europe, 2007)

TV in the bedroom	Males						P	Females						p
	NO			YES				NO			YES			
	0–2	2–4	>4	0–2	2–4	>4		0–2	2–4	>4	0–2	2–4	>4	
Hours														
TV viewing weekdays	79.1	18	2.9	60.4	32.7	6.9	<0.001	74.4	22.1	3.5	61.6	32.4	6	<0.001
TV viewing weekend	47.8	41	11.2	37.2	42.1	20.7	<0.001	45.5	40.2	14.4	39.7	42.9	17.3	<0.05
Computer games weekdays	85.7	12.8	1.5	76.7	16.3	6.9	<0.001	93.4	5.6	1	89.4	7.8	2.8	<0.01
Computer games weekend	58.8	27.5	13.7	57.5	25	17.5	NS	84	11.9	4.1	79.3	13.5	7.2	<0.01
Console games weekdays	96.6	2.4	1	88.3	8.3	3.4	<0.001	99.1	0.8	0.1	98	1.6	0.4	NS
Console games weekend	84.3	11.7	3.9	73.5	16.7	9.9	<0.001	96.9	2.6	0.5	94.5	4	1.5	<0.05
Internet (non-study) weekdays	90.6	7.4	2	80.9	11.6	7.5	<0.001	86.1	10.7	3.2	78.4	16.1	5.5	<0.001
Internet (non-study) weekend	79.8	14.9	5.3	69.2	18.8	12	<0.001	70.8	21.4	7.8	65.9	21.8	12.3	<0.01
Internet (study) weekdays	98.2	1.4	0.5	96.3	2.8	0.9	NS	97.3	2.2	0.5	95.1	4.5	0.4	<0.05
Internet (study) weekend	97.6	1.6	0.8	94.8	4.3	0.9	<0.05	95.5	4	0.5	94.8	4.6	0.6	NS
Studying weekdays	82.8	14.2	3	88.8	8.9	2.3	<0.01	74.9	20.8	4.3	80.9	15.3	3.8	<0.01
Studying weekend	74.3	20.4	5.2	85.5	12.1	2.4	<0.001	66.6	27.3	6.1	76.8	19.7	3.5	<0.001

Values are percentages. NS, non-significant differences.

(≥15 years) presented higher prevalence in both sexes ($p < 0.05$), except for weekend days in females.

Internet for academic reasons

The use of internet for academic reasons was slightly lower in males aged ≥15 years ($p < 0.05$) than in their younger peers, yet no significant differences were found between sexes.

Study

Finally, the reported time studying was significantly higher in females during both weekdays and weekend (in the two age-groups). Both sexes aged ≥15 years reported less hours studying than younger ones, except for females during the weekdays.

Electronic availability at home and in the bedroom

Number of TV sets, computers and consoles are depicted in Table 2. Males had more TVs their room, computers and consoles than females (all $p < 0.001$).

Correlations among time estimated in sedentary behaviors

Bivariate correlations among the time spent in the six sedentary behaviors studied are shown in *Supplementary material* (Table 3). We observed significant positive correlations among TV viewing and screen time behaviors (rho values range: 0.13–0.30).

TV in the bedroom and prevalence of sedentary behaviors

Table 3 shows the time devoted to sedentary behaviors according to having or not TV in the bedroom. Adolescents with a TV in the

bedroom reported significantly less time studying but higher in other screen-time behaviors.

Odds ratio of TV viewing (>2 h/day)

Table 4 shows the results of the binary logistic regression. Those having TV (OR = 2.66; 95% CI 2.23–3.18) or console (OR = 1.91; 95% CI 1.61–2.28) in the bedroom were more likely to watch TV >2 h/day, whereas those older than 15 years and who had a computer in the bedroom, were 22% and 43% less likely to watch TV >2 h/day, respectively. We repeated the analysis without adjustment for FAS and found similar results (i.e. having TV: OR = 2.68; 95% CI 2.26–3.16 or console (OR = 1.93; 95% CI 1.63–2.30).

Discussion

This study describes the prevalence of sedentary behaviors in a sample of European adolescents. Males spent more time watching TV (only in adolescents >15 years), playing with computer and console games, while females spent more time studying and surfing internet for reasons not related with study (in adolescents <15 years). For all the sedentary behaviors assessed, adolescents reported more time during weekends than weekdays.

Table 4
Binary logistic regression analyses predicting TV viewing >2 h/day (the HELENA study, Europe, 2007).

Variable	OR	95% CI	p
Gender (boys ref)	1.11	0.94–1.32	0.21
Age (<15 years ref)	0.78	0.65–0.92	0.004
TV in the bedroom	2.66	2.23–3.18	<0.001
Computer in the bedroom	0.57	0.48–0.68	<0.001
Console in the bedroom	1.92	1.61–2.28	<0.001

Adjusted OR by socioeconomic status (FAS, Family Affluence Scale).

Sedentary patterns

Based on the AAP recommendations for media time (≤ 2 h/day), one third of adolescents exceed this limit based solely on their TV viewing during weekdays, whereas six out of ten exceed it during weekend days. In other studies, TV viewing was also higher during weekends compared with weekdays (Scully et al., 2007; McMurray et al., 2000; Straker et al., 2006; Gorely et al., 2007; Viner and Cole, 2005). However, our prevalence during weekdays was lower than reported in the Health Behavior in School Aged Children (HBSC) study, where 40–80% watched >2 h/day TV (Vereecken et al., 2006). Recent data from USA (Eisenmann et al., 2008) and Brazil (Wells et al., 2008) showed alarming results (with a 58–65% and 73% of adolescents watched more than 2 h/day, respectively). Closer rates were found in Australian adolescents (33–37%) (Scully et al., 2007). The sex differences observed in the present study are in agreement with other studies (Eisenmann et al., 2008; te Velde et al., 2007; Ortega et al., 2007a,b; Scully et al., 2007). In a large one carried out in Europe ($n = 12538$ children), males spent more time watching TV than females (te Velde et al., 2007). Sex differences were also found in Spain (Ortega et al., 2007a), Finland (Tammelin et al., 2007) and US (Eisenmann et al., 2008). In contrast, this was not observed in Swedish (Ortega et al., 2007b) and Australian adolescents (Scully et al., 2007).

Regarding to electronic games, computers were predominantly chosen and males played more than females ($p < 0.001$). This is a consistent finding in the literature (Biddle et al., 2009; Kautiainen et al., 2005; Carvalhal et al., 2007). A novel contribution of this study was to distinguish the aims when surfing by internet (non-study and study reasons). Adolescents reported more time connected for non-study reasons. Females surfed more than males, but only in those under 15 years and due to non-academic chores.

Finally, females reported more time studying than males, as shown in other studies previously (Tammelin et al., 2007; Scully et al., 2007; Straker et al., 2006; Utter et al., 2003; Barr-Anderson et al., 2008), yet a lack of differences have been also reported (Shi et al., 2006). A recent study observed that during the transition to university, adolescents spent more time in academic chores (Pullman et al., 2009). However, our results were in the opposite direction, a lower time studying in those older than 15 years.

Availability of TV, computers and consoles

Current generations have an increased use of information and communication technologies (Kautiainen et al., 2005). TV remained the dominant medium, followed by computer and consoles. It is worth mentioning that 99% of adolescents had at least one TV set at home. Furthermore, 40–46% had three or more. Remarkably almost two thirds of males and half of females had TV in their room. In a similar way, 92–95% had at least a computer at home. More males reported having computer in the bedroom than females (62% vs. 49%, respectively; $p < 0.001$). In our study, 75% of males and 57% of females had availability of consoles at home.

Media availability as determinant of excessive TV watching (>2 h/day)

Adolescents with a TV set in the bedroom were more engaged in screen time behaviors but less in academic tasks (Table 3). Those with TV set were less likely to meet TV recommendations (OR = 2.66; 95% CI 2.23–3.18). These data are in agreement with the literature. In boys, but not in girls, Delmas et al. (2007) showed that having TV was associated with higher TV viewing (OR = 1.87; 95% CI, 1.2–2.8), and in both sexes, a lower reading time. Evidence of the benefits of reducing TV levels on health outcomes (like body composition) comes from two randomised controlled interventions (Epstein et al., 2008; Robinson, 1999). Children who decreased TV and computer use by

50% had significant reductions in body mass index, and these changes were more related to changes in energy intake than in physical activity level (Epstein et al., 2008). In another intervention study, again, a significant reduction in the number of meals eaten in front of TV was found (Robinson, 1999).

Mass sedentary lifestyle is a recent public health concern (Morabia and Costanza, 2009). Our results suggest the importance of keeping TV out of adolescent's bedrooms in order to reduce TV consumption, yet more interventional studies are needed to confirm this recommendation.

Strengths and limitations

Certain weaknesses and strengths need to be commented. This was a cross-sectional study, thus, we cannot determine the direction of our findings. A self-reported sedentary behavior questionnaire was used. Although the HELENA sedentary questionnaire recorded detailed information about sedentary behaviors, it did not gather all the types of sedentary pursuits that adolescent were able to do. The odds ratio regarding availability of TV in the bedroom and TV consumption are larger than 2, which is considered a meaningful effect (Ferguson, 2009), whereas the odds were smaller for having console in the bedroom.

The strength of this study was a large sample of adolescents from southern, western, eastern and northern Europe, and the implementation of a harmonized methodology.

Conclusion

The majority of adolescents living in Europe are not meeting media recommendations (especially during weekend days). The absence of a TV set in the adolescents' bedroom might reduce TV consumption. Further studies are needed to confirm or contrast our findings.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jpmed.2010.03.013.

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