

Food and drink intake during television viewing in adolescents: the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study

Juan Pablo Rey-López^{1,*}, German Vicente-Rodríguez¹, Judith Répásy², Maria Isabel Mesana¹, Jonatan R Ruiz³, Francisco B Ortega^{3,4}, Anthony Kafatos⁵, Inge Huybrechts⁶, Magdalena Cuenca-García⁴, J Francisco León⁷, Marcela González-Gross^{8,9}, Michael Sjöström³, Ilse de Bourdeaudhuij¹⁰ and Luis A Moreno^{1,7}

¹GENUD Research Group, University of Zaragoza, C/Corona de Aragón 42, 50009 Zaragoza, Spain:

²Department of Paediatrics, University of Pécs, Pécs, Hungary: ³Unit for Preventive Nutrition, Department of Biosciences and Nutrition, Karolinska Institutet, Huddinge, Sweden: ⁴Department of Medical Physiology, Faculty of Medicine, University of Granada, Granada, Spain: ⁵Preventive Medicine and Nutrition Clinic, University of Crete, Heraklion, Greece: ⁶Department of Public Health, Ghent University, Ghent, Belgium: ⁷Escuela Universitaria de Ciencias de la Salud, University of Zaragoza, Zaragoza, Spain: ⁸Department of Health and Human Performance, Faculty of Physical Activity and Sport Sciences–INEF, Technical University of Madrid, Madrid, Spain: ⁹Institut für Ernährungs- und Lebensmittelwissenschaften, Humanernährung, Rheinische Friedrich-Wilhelms Universität, Bonn, Germany: ¹⁰Department of Movement and Sport Sciences, Ghent University, Ghent, Belgium

Submitted 21 July 2010: Accepted 24 January 2011: First published online 22 February 2011

Abstract

Objective: To compare food consumption during television (TV) viewing among adolescents who watched >2 h/d *v.* ≤2 h/d; and to examine the association between sociodemographic variables (age, gender and socio-economic status (SES)) and the consumption of energy-dense foods and drinks during TV viewing.

Design: The data are part of the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) cross-sectional survey. Data on time watching TV, types of foods and drinks consuming during TV viewing and parental SES (parental education, parental occupation and family affluence) were measured by questionnaires completed by adolescents. Binary logistic regression tested the association between energy-dense foods and drinks and (i) sociodemographic variables and (ii) TV time.

Setting: Ghent (Belgium), Heraklion (Greece), Pecs (Hungary) and Zaragoza (Spain).

Subjects: Girls (*n* 699) and boys (*n* 637) aged 12·5–17·5 years.

Results: Boys reported more frequent consumption of beer and soft drinks whereas girls selected more fruit juice, water, herbal infusions and sweets (all $P \leq 0\cdot05$). Watching TV for >2 h/d was associated with the consumption of energy-dense foods and drinks. Girls whose mothers achieved the lowest education level had an adjusted OR of 3·22 (95% CI 1·81, 5·72) for the consumption of energy-dense drinks during TV viewing *v.* those whose mothers had the highest educational level.

Conclusions: Excessive TV watching may favour concurrent consumption of energy-dense snacks and beverages. Adolescents from low-SES families are more likely to consume unhealthy drinks while watching TV.

Keywords
Adolescents
Parental socio-economic position
Screen time
Food choices

There is compelling evidence about the relationship between socio-economic status (SES) and health in adulthood⁽¹⁾ but whether this is also the case in adolescence is less clear owing to the homogenising effect produced by the influence of school, peers and youth culture⁽¹⁾. Several studies have indicated that SES may influence certain health-related behaviours (sedentary

behaviours and nutrition) at childhood and adolescence. For instance, diets with a high nutritional value (rich in fruits, vegetables and dairy) are more common in high-SES adolescents⁽²⁾, yet not all SES markers are associated with adolescents' health-related dietary habits in the same direction. For example, in a recent study conducted in Norway, only parental education was associated with

*Corresponding author: Email jprey@unizar.es

adolescents' health-related dietary habits⁽³⁾. Moreover, some demographic factors, such as age and gender, seem to be important determinants of the prevalence of health-related behaviours during adolescence⁽⁴⁾.

A growing number of studies indicate that the obesogenic effect of television (TV) viewing in young people may be attributed more to increased food intake than to decreased physical activity levels^(5,6). In fact, adolescents or families who watch TV excessively are less likely to eat fruit and vegetables^(7,8) and more likely to eat sweets^(7,8), savoury snacks⁽⁹⁾, soda⁽⁹⁾ and soft drinks^(7,8,10). One mechanism by which excessive TV viewing may lead to the adoption of unhealthy dietary habits could be the higher exposure time to food commercials, which advertise energy-dense products with lower nutritional value^(11,12). Alternatively, it could be also possible that sociodemographic factors may explain the association between TV viewing and food energy content. It is known that families with low economic resources buy less-nutritious, energy-dense foods owing to their reduced cost⁽¹³⁾. These same families may prefer watching TV during their leisure time as it is also an inexpensive behaviour. Whatever the mechanisms involved, knowledge provided by observational studies is useful for the design of future interventions.

In the present European multicentre study we investigated: (i) whether consumption of high-energy-dense food products during TV viewing was more frequent in adolescents who reported more time watching TV (>2 h/d); and (ii) the association between sociodemographic variables (age, gender and SES) and the consumption of energy-dense food products during TV viewing.

Methods

Design

The Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) cross-sectional study (CSS) is a European Union-funded project on lifestyle and nutrition among European adolescents⁽¹⁴⁾. Data collection took place between October 2006 and December 2007. More detailed information on the study design has been published elsewhere⁽¹⁵⁾. Participants were recruited at schools. To guarantee that the heterogeneity of social background of the population would be represented, schools were randomly selected after stratification on school zone or district. In the case that the selected schools refused to participate, a second list of substitute schools had already been foreseen. Up to three classes from two grades were selected per school. A class was considered eligible if the participation rate was at least 70%. The HELENA-CSS inclusion criteria were age range 12·5–17·5 years, not participating simultaneously in another clinical trial, and free of any acute infection lasting less than 1 week before inclusion⁽¹⁵⁾.

From an initial sample of 1413 (730 girls and 683 boys) adolescents who met the HELENA inclusion criteria, 1336 adolescents (699 girls and 637 boys) had valid information from the sedentary behaviour questionnaire (with at least 75% of answers). Non-significant differences were found in SES level between the initial sample and the group finally included in the present study. The current study collected data from Ghent (Belgium), Heraklion (Greece), Pecs (Hungary) and Zaragoza (Spain) since other cities that took part in the HELENA-CSS did not examine food consumption during sedentary behaviours. During school visits, researchers asked adolescents about their habitual TV viewing time and the concurrent food choices in a self-reported sedentary behaviour questionnaire. In addition, parental SES was registered by the adolescents. In all schools, researchers explained the aims of the questionnaires and clarified questions asked by adolescents. The study was approved by the Research Ethics Committee of each city involved. Written informed consent was obtained from the parents of the adolescents and the adolescents themselves⁽¹⁶⁾.

Parental socio-economic status

Family Affluence Scale

Each adolescent was asked for the number of cars and computers at home, whether the Internet was available at home, and whether or not the adolescent had his/her own bedroom. The Family Affluence Scale (FAS) was calculated based on a model developed by Currie *et al.*⁽¹⁷⁾, but adapted slightly by replacing the item on holidays by Internet at home. FAS indicates the SES of the adolescent on a scale from 0 (very low SES) to 8 (very high SES). We recoded the scores as low SES (0–2), medium SES (3–5) and high SES (6–8)⁽¹⁸⁾. To our knowledge, the test–retest reliability of adolescents' reports on FAS has never been measured. Despite this, the proportion of missing data on FAS items⁽¹⁷⁾ was low and FAS presents good criterion validity against a national wealth indicator (Gross Domestic Product)⁽¹⁹⁾.

Parental occupation

Information on parental occupation was collected using the International Standard Classification of Occupations (<http://unstats.un.org/unsd/class/family/family2.asp?Cl=224>), a hierarchical scale developed to be used as a nine-class classification of occupations (armed forces are added but not really part of the classification). In social epidemiology, the scale is mainly used as a nine-class classification system, 1 being the highest category and 9 being the lowest. We recoded the occupations into three levels: (i) low (Skilled agricultural and fishery workers, Craft and manual workers, Machine operators and assemblers, Workers and elementary occupations); (ii) medium (Intermediate occupations, Administration/clerical, Business services); and (iii) high (Managerial staff, Intellectual and scientific occupations).

Parental education

The parents' educational level was considered as the highest level of education attained by each parent. Adolescents selected one of the following levels: (i) lower education; (ii) lower secondary education; (iii) higher secondary education; or (iv) higher education/university degree.

Television viewing

Habitual TV time was estimated by the HELENA sedentary behaviour questionnaire⁽¹⁸⁾, which asked the question: 'During weekdays, how many hours do you usually watch TV?' Possible answers were: (i) none; (ii) less than 0.5 h; (iii) between 0.5 and 1 h; (iv) between 1 and 2 h; (v) between 2 and 3 h; (vi) between 3 and 4; (vii) more than 4 h. The reliability (1-week test-retest) of the HELENA sedentary behaviour questionnaire was studied in 183 adolescents (seventy-nine males, 104 females; age range 12.5–17.5 years). They were recruited from two schools involved in the HELENA study, Ghent (Belgium) and Zaragoza (Spain). Cohen's κ using quadratic weights showed a substantial agreement (0.71 and 0.68 during weekdays and weekend days, respectively)⁽²⁰⁾.

Dietary habits during television viewing

Dietary habits during TV viewing were obtained by the HELENA sedentary behaviour questionnaire with the questions: 'How often do you drink while you watch TV?' and 'How often do you eat while you watch TV?' The answers were: (i) never; (ii) less than once per week; (iii) between 1 and 2 times per week; (iv) between 3 and 4 times per week; (v) almost every day; (vi) several times per day. In addition, the adolescent were asked 'What do you usually drink while you watch TV?' and 'What do you usually eat while you watch TV?' The answers were: nothing, water, milk, fruit juices, light drinks, soft drinks, beer, herbal infusions, coffee (for drinks); and nothing, fruits, dried fruits, savoury, pastry, sweets, sandwich, dairy (for foods). We categorized beer, soft drinks and fruit juices as energy-dense drinks; and pastry, savoury (salty products) and sweets as energy-dense foods. The categorization was based on the energy content: all energy-dense drinks contained a minimum of 159 kJ (38 kcal)/100 ml and the energy-dense foods at least 1675 kJ (400 kcal)/100 g⁽²¹⁾. The reliability of the HELENA sedentary behaviour questionnaire was examined in a sub-sample of adolescents. Cohen's κ coefficients for most of the dietary items showed substantial agreement (0.61–0.80) between test and retest, except for beer consumption (moderate agreement, $\kappa = 0.60$)⁽²⁰⁾.

Statistical analyses

Descriptive statistics (frequency and percentage) of drinks and foods consumed during TV viewing are presented by media recommendations for children (≤ 2 h/d and > 2 h/d)⁽²²⁾ but based on exclusively TV viewing.

Statistical differences between groups or genders were tested by χ^2 analysis. Crude odds ratios with 95% confidence intervals of having energy-dense dietary habits (drinks and foods) during TV viewing were calculated by logistic regression analysis. We included as independent variables age (< 15 years, ≥ 15 years), parental education, parental occupation, FAS and time watching TV in separate univariate models. In addition, a multivariate model was performed. Adjusted odds ratios were obtained accounting for clustering of schools within cities. All analyses were carried out separately for girls and boys. Statistical analyses were performed using the STATA statistical software package version 10.0 (StataCorp., College Station, TX, USA). The significance level was set at $P \leq 0.05$.

Results

The number of adolescents included in the current study is presented as Supplementary Material. Table 1 summarizes food and drink consumption during TV viewing in adolescents by time watching TV. In the group of adolescents who watched TV for > 2 h/d, a higher percentage of girls reported a daily consumption of beverages (while watching TV) than boys (50% *v.* 43%, respectively; $P \leq 0.05$ (χ^2 test); Table 1). The results showed that girls tended to consume more water, fruit juice and herbal infusions, whereas boys drank significantly more soft drinks and beer (all $P \leq 0.05$). Regarding food items, girls had a higher frequency of eating food during TV viewing than boys (for those watching > 2 h/d, 41% of girls reported a daily consumption *v.* 35% of boys; $P \leq 0.05$). Girls reported a more frequent intake of sweets than boys ($P \leq 0.05$). For the rest of the food items, non-significant gender differences emerged. Dietary habits also differed between groups of TV viewing time. Compared with their counterparts watching TV for ≤ 2 h/d, boys watching TV for > 2 h/d had more frequent consumption of soft drinks, savoury, pastry, sweets and sandwiches, and less frequent intake of herbal infusions; and girls watching for > 2 h/d had more frequent consumption of fruit juice, soft drinks, beer, coffee, pastry, sweets and sandwiches.

Tables 2 and 3 show the odds of having energy-dense dietary habits during TV viewing by age, parental SES markers and time spent watching TV. Age was associated with the consumption of energy-dense drinks only in adolescent boys aged ≥ 15 years (adjusted OR = 1.65, 95% CI 1.04, 2.62). None of the studied SES indicators was consistently associated with the consumption of energy-dense foods during TV viewing, in both genders. By contrast, girls whose mothers achieved a low educational level had an increased risk (adjusted OR = 3.22, 95% CI 1.81, 5.72) of consumption of energy-dense drinks during TV viewing compared with those whose

Table 1 Drink and food consumption during television viewing in adolescents aged 12.5–17.5 years from Ghent (Belgium), Heraklion (Greece), Pecs (Hungary) and Zaragoza (Spain); the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study

	Boys (n 637)				P†	Girls (n 699)				P†
	≤2 h/d		>2 h/d			≤2 h/d		>2 h/d		
	n	%	n	%		n	%	n	%	
Drinking frequency										
Almost never	156	36	53	18	<0.001	156	41	53	18	<0.001
1–4 d/week	163	38	110	38		93	24	98	32	
Every day	115*	26	124	43		136	35	151	50	
Type of drink										
Nothing	82	10	24	4	<0.001	53	6	15	2	0.007
Water	170*	20	100	18	0.17	240	27	136	22	0.19
Milk	73	9	63	11	0.18	97	11	71	12	0.21
Fruit juice	162*	19	117	21	0.61	218	24	158	26	0.02
Light drinks	55	7	33	6	0.72	53	6	39	6	0.48
Soft drinks	181*	21	156	27	0.001	111	12	111	18	<0.001
Beer	33*	4	29	5	0.32	3	0.3	6	1	0.03
Herbal infusions	61*	7	24	4	0.05	93	10	46	8	0.24
Coffee	27	3	22	4	0.44	24	3	27	4	0.03
Eating frequency										
Almost never	185	43	63	23	<0.001	48	18	52	18	<0.001
1–4 d/week	169	39	116	42		112	42	120	41	
Every day	77*	18	98	35		109	40	121	41	
Type of food										
Nothing	74*	10	26	5	0.002	60	7	22	3	0.02
Fruits	130	18	92	16	0.52	180	20	133	20	0.06
Dried fruits	42	6	23	4	0.45	45	5	20	3	0.60
Savoury	136	19	117	21	0.006	168	19	113	17	0.48
Pastry	94	13	89	16	0.004	130	14	102	15	0.04
Sweets	84*	11	74	13	0.04	116	13	110	17	<0.001
Sandwich	114	16	103	18	0.004	116	13	110	17	0.002
Dairy	57	8	37	7	0.93	90	10	56	8	0.94

* $P \leq 0.05$ between genders.† P for difference between ≤ 2 h/d and > 2 h/d (χ^2 test).

mothers attained the highest educational level. Similarly, girls whose mothers attained lower secondary or higher secondary education had higher odds compared with those whose mothers had the highest level (adjusted OR = 1.76, 95% CI 1.10, 2.82 and adjusted OR = 1.85, 95% CI 1.19, 2.88, respectively). Girls with low FAS were more likely to consume energy-dense drinks during TV viewing (adjusted OR = 2.03, 95% CI 1.19, 3.47). However, in girls the association with energy-dense drinks was less pronounced when paternal occupation and education were tested.

Discussion

The main findings of the current study are: (i) energy-dense dietary choices were more likely in adolescents who watched TV excessively (> 2 h/d); and (ii) maternal educational level showed the highest impact on the adolescents' dietary habits during TV viewing.

Gender differences in the types of drink consumed during TV viewing were particularly evident. Boys reported more frequent consumption of beer and soft drinks, whereas girls tended to consume more water, fruit juices and herbal infusions. These results concur with recent studies^(3,23). For instance, in Norwegian adolescents, 15% of girls and 29% of boys had soft drinks

daily⁽³⁾. In Australian adolescents, about 44% reported consuming energy-dense drinks at least four times in the previous week. Older students and males had higher consumption of energy-dense drinks⁽²³⁾. It should be noted, however, that we did not observe gender differences in food consumption during TV viewing, except for sweets, consumed more frequently by girls.

Foods and drinks consumed during TV viewing were more energy-dense in adolescents who exceeded the media recommendations (watching TV for > 2 h/d). As depicted in Table 1, adolescents had more frequent consumption of energy-dense food products (sweets, bakery, soft drinks) if they watched TV for > 2 h daily, which agrees with previous studies^(7–9). Furthermore, the regression model confirmed that exceeding screen time recommendations was associated with the selection of energy-dense foods and drinks (Tables 2 and 3). Several mechanisms may explain why TV viewing associates with poorer dietary choices. Children's food preferences may be a function of copying the food preferences of their parents. Parents not only provide the food that will be eaten at home, but also the feeding style (i.e. eating in front of the TV or not). An indirect pathway could be the effect of food commercials, which produce more likely consumption of the advertised products (generally energy-dense)^(11,12). Alternatively, it is possible that TV

Table 2 Odds ratio and 95 % confidence interval for consuming energy-dense foods (pastry or savoury or sweets) during television (TV) viewing by sociodemographic variables and TV time in adolescents aged 12.5–17.5 years from Ghent (Belgium), Heraklion (Greece), Pecs (Hungary) and Zaragoza (Spain); the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study. Crude and adjusted for clusters (schools) of each city

Independent variable	Crude				Adjusted			
	Boys (n 625)		Girls (n 690)		Boys (n 625)		Girls (n 690)	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Age								
<15 years	Ref.		Ref.		Ref.		Ref.	
≥15 years	1.25	0.91, 1.71	1.27	0.93, 1.74	1.29	0.93, 1.78	1.27	0.82, 1.98
Family affluence								
High	Ref.		Ref.		Ref.		Ref.	
Medium	0.53	0.37, 0.77	0.77	0.52, 1.13	0.53	0.39, 0.74	0.77	0.46, 1.27
Low	0.87	0.50, 1.51	0.92	0.54, 1.56	0.89	0.55, 1.44	0.91	0.52, 1.60
Mother's education								
Higher education/university	Ref.		Ref.		Ref.		Ref.	
Higher secondary	0.89	0.51, 1.58	1.06	0.72, 2.04	0.95	0.62, 1.47	1.05	0.65, 1.70
Lower secondary	0.92	0.59, 1.43	1.27	0.82, 1.95	0.90	0.46, 1.78	1.22	0.86, 1.73
Lower education	0.89	0.51, 1.58	1.21	0.72, 1.57	0.88	0.50, 1.53	1.15	0.67, 1.95
Father's education								
Higher education/university	Ref.		Ref.		Ref.		Ref.	
Higher secondary	0.91	0.61, 1.36	1.86	1.23, 2.80	0.93	0.55, 1.60	1.83	1.27, 2.65
Lower secondary	0.79	0.52, 1.21	1.36	0.90, 2.05	0.81	0.51, 1.28	1.38	1.02, 1.86
Lower education	0.85	0.48, 1.51	1.04	0.60, 1.80	0.92	0.55, 1.44	1.01	0.55, 1.83
Mother's occupation								
High	Ref.		Ref.		Ref.		Ref.	
Medium	1.42	0.90, 2.26	1.88	1.18, 2.98	1.44	0.81, 2.57	1.80	1.01, 3.21
Low	1.21	0.79, 2.05	1.39	0.83, 2.36	1.24	0.64, 2.38	1.34	0.72, 2.50
Father's occupation								
High	Ref.		Ref.		Ref.		Ref.	
Medium	0.96	0.63, 1.49	0.82	0.52, 1.29	0.93	0.56, 1.55	0.86	0.54, 1.37
Low	1.11	0.72, 1.71	1.36	0.89, 2.08	1.13	0.77, 1.66	1.35	0.91, 2.01
TV viewing								
<2 h/d	Ref.		Ref.		Ref.		Ref.	
≥2 h/d	1.89	1.35, 2.63	1.58	1.14, 2.19	1.88	1.15, 3.08	1.58	1.15, 2.17

Ref., referent category.

viewing may operate as a confounding factor. There is evidence that families with reduced income have diets with a higher energy content⁽¹³⁾. These same families could also spend more time watching TV. However, the effect size and the direction of our findings did not change when the odds were additionally adjusted for family affluence, which reinforces a probable causal link between TV viewing and the consumption of energy-dense drinks.

Another relevant finding was that low SES (maternal education and occupation) was associated with the consumption of energy-dense drinks (soft drinks or beer or fruit juice) while watching TV, but only in girls. Our results are in agreement with those reported by Aranceta *et al.*⁽²⁴⁾, who observed that children whose mother had a low level of education were more likely to drink soft drinks. Richter *et al.*⁽¹⁾ explored the association between socio-economic position and four different aspects of adolescents' health behaviour in 28 countries from Europe, USA, Canada and Israel. Occupational status of the parents exerted a strong effect on the time watching TV, in agreement with a recent study published by our group⁽²⁵⁾. Thus, adolescents with less favourable socio-economic circumstances are at risk of having unhealthy behaviours.

Strengths of our study lie in the use of a large and cultural diverse sample of European adolescents (Belgium, Hungary, Greece and Spain). It should be noted that the sedentary behaviour questionnaire showed a good reliability. Another strength is that we studied the specific types of foods and drinks consumed while viewing TV. By contrast, previous studies have used FFQ^(7,8) or 24 h dietary recalls which cover intake over the whole day to compare 'high TV viewers' with 'low' ones^(9,10). Although food intake during TV viewing represents between approximately 17 and 26% of daily energy intake⁽²⁶⁾, the direction of our findings does not differ from that of a recent study which included an FFQ to assess dietary health-related behaviours in Norwegian adolescents⁽³⁾, which strengthens our results. Thus, perhaps the nutritional quality of snack foods during TV viewing may be a proxy of habitual dietary patterns. As main limitations, conclusions could be drawn only for TV viewing and not for other modern types of sedentary behaviour. Moreover, we collected information only about the consumption of food when watching TV and not during the whole day. Nevertheless, there is evidence that reductions in screen time are related with reduced total energy intake⁽²⁷⁾. Another limitation is the assessment of SES using adolescents' self-reports. Parental education and family

Table 3 Odds ratio and 95 % confidence interval for consuming energy-dense drinks (beer or soft drinks or fruit juice) during television (TV) viewing by sociodemographic variables and TV time in adolescents aged 12·5–17·5 years from Ghent (Belgium), Heraklion (Greece), Pecs (Hungary) and Zaragoza (Spain); the Healthy Lifestyle in Europe by Nutrition in Adolescence (HELENA) study. Crude and adjusted for clusters (schools) of each city

Independent variable	Crude				Adjusted			
	Boys (n 631)		Girls (n 694)		Boys (n 631)		Girls (n 694)	
	OR	95 % CI	OR	95 % CI	OR	95 % CI	OR	95 % CI
Age								
<15 years	Ref.		Ref.		Ref.		Ref.	
≥15 years	1·65	1·21, 2·26	1·04	0·76, 1·43	1·65	1·04, 2·62	1·04	0·61, 1·77
Family affluence								
High	Ref.		Ref.		Ref.		Ref.	
Medium	0·77	0·54, 1·09	1·37	0·91, 2·06	0·77	0·59, 1·03	1·37	0·85, 2·20
Low	1·60	0·92, 2·78	2·03	1·20, 3·44	1·59	0·95, 2·68	2·03	1·19, 3·47
Mother's education								
Higher education/university	Ref.		Ref.		Ref.		Ref.	
Higher secondary	1·55	1·06, 2·27	1·85	1·22, 2·80	1·55	0·93, 2·57	1·85	1·19, 2·88
Lower secondary	1·40	0·89, 2·18	1·91	1·22, 2·99	1·12	0·83, 1·51	1·76	1·10, 2·82
Lower education	1·22	0·68, 2·17	3·22	1·91, 5·45	1·22	0·71, 2·08	3·22	1·81, 5·72
Father's education								
Higher education/university	Ref.		Ref.		Ref.		Ref.	
Higher secondary	1·20	0·81, 1·77	1·43	0·94, 2·18	1·20	0·74, 1·95	1·43	0·85, 2·41
Lower secondary	1·12	0·73, 1·72	1·76	1·15, 2·71	1·12	0·83, 1·51	1·76	1·10, 2·82
Lower education	1·01	0·57, 1·80	1·76	0·99, 3·13	1·01	0·68, 1·49	1·76	0·85, 3·53
Mother's occupation								
High	Ref.		Ref.		Ref.		Ref.	
Medium	1·22	0·77, 1·93	1·40	0·84, 2·33	1·22	0·73, 2·04	1·40	0·84, 2·33
Low	1·38	0·82, 2·33	1·71	0·97, 3·02	1·38	0·85, 2·24	1·71	0·75, 3·38
Father's occupation								
High	Ref.		Ref.		Ref.		Ref.	
Medium	1·48	0·96, 2·28	0·84	0·51, 1·39	1·48	0·87, 2·53	0·84	0·48, 1·48
Low	1·35	0·88, 2·07	1·82	1·17, 2·83	1·34	0·80, 2·28	1·82	1·31, 2·53
TV viewing								
<2 h/d	Ref.		Ref.		Ref.		Ref.	
≥2 h/d	1·74	1·26, 2·40	2·10	1·52, 2·91	1·74	1·31, 2·29	2·11	1·39, 3·17

Ref., referent category.

affluence were easily reported by adolescents. In contrast, researchers observed that some adolescents had more problems in indicating their parents' occupation. If missing or unclassifiable responses were unequally distributed among social groups, it might have influenced the results. Finally, we did not assess the amounts of food or drinks consumed during TV viewing which would have provided more detailed knowledge on this topic.

As previously commented, intervention studies have shown that reductions in TV viewing are related to changes in energy intake⁽²⁷⁾. To what extent a reduction in the time spent watching TV also modifies diet quality should be studied. A complementary way to reduce adolescents' energy intake would be to limit TV food advertising. According to a mathematical model, TV food advertising may be responsible for 15–40% of the obesity prevalence among 6- to 12-year-old US children⁽²⁸⁾. Although the aetiology of obesity may differ among countries, if TV fast-food advertising for children were banned, lower overweight/obesity rates could be observed⁽²⁹⁾. Our study has an important public health message. Young people should minimize the time spent watching TV, especially socio-economically disadvantaged adolescents. Theoretically this would allow a decrease in the consumption of unhealthy

beverages; but due to the cross-sectional design of our study, we cannot conclude on this issue. Intervention studies should be conducted to replicate our findings.

In conclusion, excessive TV viewing during adolescence was associated with more likely consumption of energy-dense food and drink products. Energy-dense foods were not associated with parental SES. Maternal education (in girls) was associated with the consumption of energy-dense drinks. In developed countries, efforts to promote healthy eating behaviours should prioritize children whose parents have low SES.

Acknowledgements

The HELENA Study was carried out with financial support of the European Community Sixth RTD Framework Programme (Contract FOOD-CT-2005-007034). The content of this article reflects only the authors' views, and the European Community is not liable for any use that may be made of the information contained herein. The present analysis was also supported (J.P.R.-L., L.A.M.) by the Spanish Ministry of Health's Maternal, Child Health and Development Network (grant no. RD08/0072) and the

Spanish Ministry of Education (grant nos. EX-2007-1124, DEP2007-29933-E and AP2006-02464). J.P.R.-L. was also supported by the Fundación Cuenca Villoro (Spain). The authors declare no conflict of interest. J.P.R.-L. was involved in the acquisition, analysis and interpretation of the data. L.A.M., J.R.R., F.B.O., I.d.B. and M.S. made substantial contributions to the conception and design of the manuscript. L.A.M., I.d.B. and M.S. gave final approval of the version to be published. All authors read and approved the final manuscript.

References

- Richter M, Vereecken CA, Boyce W *et al.* (2009) Parental occupation, family affluence and adolescent health behaviour in 28 countries. *Int J Public Health* **54**, 203–212.
- Abudayya AH, Stigum H, Shi Z *et al.* (2009) Sociodemographic correlates of food habits among school adolescents (12–15 year) in North Gaza Strip. *BMC Public Health* **9**, 185.
- Nilsen SM, Krokstad S, Holmen TL *et al.* (2010) Adolescents' health-related dietary patterns by parental socioeconomic position, The Nord-Trøndelag Health Study (HUNT). *Eur J Public Health* **20**, 299–305.
- Alamian A & Paradis G (2009) Clustering of chronic disease behavioral risk factors in Canadian children and adolescents. *Prev Med* **48**, 493–499.
- Jackson DM, Djafarian K, Stewart J *et al.* (2009) Increased television viewing is associated with elevated body fatness but not with lower total energy expenditure in children. *Am J Clin Nutr* **89**, 1031–1036.
- Manios Y, Kourlaba G, Kondaki K *et al.* (2009) Obesity and television watching in preschoolers in Greece: the GENESIS study. *Obesity (Silver Spring)* **17**, 2047–2053.
- Vereecken CA, Todd J, Roberts C *et al.* (2006) Television viewing behaviour and associations with food habits in different countries. *Public Health Nutr* **9**, 244–250.
- Campbell KJ, Crawford DA & Ball K (2006) Family food environment and dietary behaviors likely to promote fatness in 5–6 year-old children. *Int J Obes (Lond)* **30**, 1272–1280.
- Coon KA, Goldberg J, Rogers BL *et al.* (2001) Relationships between use of television during meals and children's food consumption patterns. *Pediatrics* **107**, E7.
- Ng C, Young TK & Corey PN (2010) Associations of television viewing, physical activity and dietary behaviours with obesity in aboriginal and non-aboriginal Canadian youth. *Public Health Nutr* **13**, 1430–1437.
- Hitchings E & Moynihan PJ (2008) The relationship between television food advertisements recalled and actual foods consumed by children. *J Hum Nutr Diet* **11**, 511–517.
- Wiecha JL, Peterson KE, Ludwig DS *et al.* (2006) When children eat what they watch – impact of television viewing on dietary intake in youth. *Arch Pediatr Adolesc Med* **160**, 436–442.
- Drewnowski A & Darmon N (2005) The economics of obesity: dietary energy density and energy cost. *Am J Clin Nutr* **82**, 1 Suppl., S265–S273.
- Moreno LA, González-Gross M, Kersting M *et al.* (2008) Assessing, understanding and modifying nutritional status, eating habits and physical activity in European adolescents: the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) Study. *Public Health Nutr* **11**, 288–299.
- Moreno LA, De Henauw S, González-Gross M *et al.* (2008) Design and implementation of the Healthy Lifestyle in Europe by Nutrition in Adolescence Cross-Sectional Study. *Int J Obes (Lond)* **32**, 4–11.
- Béghin L, Castera M, Manios Y *et al.* (2008) Quality assurance of ethical issues and regulatory aspects relating to good clinical practices in the HELENA Cross-Sectional Study. *Int J Obes (Lond)* **32**, 12–18.
- Currie C, Molcho M, Boyce W *et al.* (2008) Researching health inequalities in adolescents: the development of the Health Behavior in School-Aged Children (HBSC) family affluence scale. *Soc Sci Med* **66**, 1429–1436.
- Rey-López JP, Vicente-Rodríguez G, Ortega FB *et al.* (2010) Sedentary patterns and media availability in European adolescents: the HELENA study. *Prev Med* **51**, 50–55.
- Boyce W, Torsheim T, Currie C *et al.* (2006) The family affluence scale as a measure of national wealth: validation of an adolescent self-report measure. *Soc Indic Res* **78**, 473–487.
- Landis JR & Koch GG (1977) The measurement of observer agreement for categorical data. *Biometrics* **33**, 159–174.
- Farran A, Zamora R & Cervera P (2004) *Tablas de composición de alimentos del CESNID*. Barcelona: McGraw-Hill-Interamericana de España, SAU.
- American Academy of Pediatrics, Committee on Public Education (2001) Children, adolescents, and television. *Pediatrics* **107**, 423–426.
- Scully M, Dixon H, White V *et al.* (2007) Dietary, physical activity and sedentary behaviour among Australian secondary students in 2005. *Health Promot Int* **22**, 236–245.
- Aranceta J, Pérez-Rodrigo C, Ribas L *et al.* (2003) Socio-demographic and lifestyle determinants of food patterns in Spanish children and adolescents: the enKid study. *Eur J Clin Nutr* **57**, 40–44.
- Rey-López JP, Tomas C, Vicente-Rodríguez G *et al.* (2010) Sedentary behaviours and socio-economic status in Spanish adolescents: the AVENA study. *Eur J Public Health* (Epublication ahead of print version).
- Matheson DM, Killen JD, Wang Y *et al.* (2004) Children's food consumption during television viewing. *Am J Clin Nutr* **79**, 1088–1094.
- Epstein LH, Roemmich JN & Robinson JL (2008) A randomized trial of the effects of reducing television viewing and computer use on body mass index in young children. *Arch Pediatr Adolesc Med* **162**, 239–245.
- Veerman JL, Van Beeck EF, Barendregt JJ *et al.* (2009) By how much would limiting TV food advertising reduce childhood obesity? *Eur J Public Health* **19**, 365–369.
- Chou SY, Rashad I & Grossman M (2008) Fast food restaurant advertising on television and its influence on childhood obesity. *J Law Econ* **51**, 599–618.