Effect of activity and television viewing on BMI z-score in early adolescents in Turkey

Elif N. Özmert, Ramazan Özdemir, Ayhan Pektaş, Yasemin Üçkardeş, Kadriye Yurdakök

Ankara, Turkey

Background: **Television, computer and other causes of increased inactivity are reported to be among the major causes of obesity. This cross-sectional study was aimed to evaluate the effect of television viewing and other daily activities on body mass index (BMI) z-score of early adolescents.**

Methods: **A total of 860 students and their parents (581) from different socioeconomic level schools were included. They were instructed to fill in a self-designed questionnaire. Weight and height were measured, and BMI z-scores were calculated.**

Results: **BMI z-score was higher in boys and in those attending high socioeconomic level schools. Children with a BMI z-score >2SD watched television (2.5±0.9 h/day) longer than those with <-2SD (1.6±0.8 h/day) (*P*=0.027). The three categories (<-2SD, -2SD–2SD, >2SD) differed significantly according to maternal (*P*<0.05) and paternal (*P*<0.005) BMI. Linear logistic regression analysis revealed that socioeconomic level, maternal BMI and paternal BMI are factors affecting BMI z-score significantly.**

Conclusion: **Genetic and/or family environment which may affect the nutrition and activity of adolescents seems to be the most important factor affecting their BMI z-score.**

World J Pediatr 2011;7(1):37-40

Key words: **activity;**
body mass index;
television

Author Affiliations: Department of Pediatrics, Social Pediatrics Unit, Hacettepe University Faculty of Medicine, Ankara, Turkey (Özmert EN, Özdemir R, Pektaş A); Department of Pediatrics, Başkent University Faculty of Medicine Ankara, Turkey (Üçkardeş Y); Department of Social Pediatrics, Hacettepe University Institute of Child Health, Ankara, Turkey (Yurdakök K)

Corresponding Author: Elif N. Özmert, MD, PhD, Department of Pediatrics, Social Pediatrics Unit, Hacettepe University Faculty of Medicine, 06100, Sıhhıye, Ankara, Turkey (Email: nozmert@hacettepe.edu.tr)

doi:10.1007/s12519-011-0243-2

Introduction

Obesity is prevalent in the developed world,[1] and an emerging morbidity for the developing countries where undernutrition is still prevalent.[2] Television, computer and others causes of increased inactivity are reported to be among the major causes of obesity.[3-7] However, several studies found no correlation between obesity and television viewing,[8,9] and some long-term follow-up studies[10] and a meta-analysis[11] showed a mild effect of television viewing on obesity.

Undernutrition is mostly related to feeding,[2] and the association between undernutrition and television viewing/computer use or activity is not well studied. There are studies on the influence of viewing thin models in media and women's body dissatisfaction,[12] but no studies on the association between thinness or undernutrition and duration of television viewing.

Several methods are available for evaluating nutritional status, but the parametric value z-score is recommended as a measure of evaluation.[13] Earlier studies on the relation between activity and obesity were conducted using body mass index (BMI) or body mass index percentile. However, BMI z-score is recommended as the best measure of adiposity on single occasion measurements.[14] BMI z-score, a proxy for body fat, is interpreted as BMI and BMI percentile. One study using BMI z-score as a measure of the nutritional status found no relation between obesity and activity.[9]

Although there is a trend for globalization of social life, there are cultural and social differences. Thus this study aimed to define the cross-sectional associations between different self-reported activities and BMI z-scores (both under- and over nutrition) in early adolescents from a country bridging Europe and Asia both geographically and culturally.

Methods

This cross-sectional study was conducted among 7th-8th grade primary school students in Ankara, Turkey between February and March 2006. The schools were randomly selected from two districts with different socioeconomic levels (SEL). Students were visited

at school and their weight and height were measured. Weight was measured with a standard portable scale with children wearing standard school clothes and without shoes. Height was measured with a standard measuring tape without shoes or heels. BMI z-scores were calculated according to the formula ([BMI/M]L-1/LS; L, S, and M as constants defined according to age and sex).[15] Parental weight and height were self reported and parental BMI was calculated.

A self-designed questionnaire, adapted from the questionnaire used in our previous study conducted in the same schools,[16] was filled out by students and their parents. The questionnaire included questions about television viewing and activity durations of the children. Activity durations were asked separately for weekdays and weekends, and then mean durations were calculated by multiplying weekdays by 5, weekends by 2. Vigorous physical activity was defined as activity leading to sweating in the child.[17] The study was approved by Hacettepe University Institute of Child Health and the Ministry of Education and oral informed consent was obtained from all the participants.

The data were analyzed using SPSS 11.0. Comparisons between groups were made by Student's *t* test and one-way ANOVA. Bonferroni's correction was used for post hoc analysis. Correlations were tested by Pearson's product-moment correlation coefficient and spearman's rank-order correlation coefficient test. All parameters that had any significant relation with BMI z-score in the univariate analysis were included into the multilinear analysis of factors associated with BMI z-score. A P value of <0.05 was considered statistically significant.

Results

Characteristics of study participants

All the 850 students (440 female and 420 male) in the 7th and 8th grade were invited to participate in the study, including 462 from low and 398 from high SEL districts. The mean age of the students was 13.5±0.66 years (range: 12-15 years); 443 were in grade 7 and 417 in grade 8. The questionnaire was filled out by the 850 students and 566 parents (314 from low and 252 from high SEL districts; 325 mothers and 241 fathers).

The BMI z-scores of 57 (6.7%) adolescents were below -2SD, 739 (86.9%) between -2 and 2SD, and 54 (6.4%) above 2SD. The mean BMI z-score was 0.10±1.4. The mean daily durations of activities reported by the students and their parents are displayed in Table 1. Studying, reading, watching videos, DVD or television, and computer use were classified as sedentary activities; playing, housework and sports were defined as active activities; watching TV, video or DVD and computer use were defined as media activities. The mean durations of these activities are shown in Table 2. There was a good correlation between students and parents reported durations for all activities (Tables 1 and 2).

Parents reported daily activities

The parents reported duration of daily activities differed significantly according to socioeconomic level, grade, gender or parental education. The mean durations of playing and media activities were statistically longer in low SEL schools. Low SEL students spent more time on media and active activities than high SEL students. The students at the 8th grade spent longer time on studying and shorter time on computer use. As a result, media duration was longer for the 7th grade and sedentary activities duration was longer for the 8th grade students. There were significant difference between male and female students. Girls spent longer time on studying, reading, housework and total sedentary activities. Boys spent longer time on media and active activities. The children of mothers with education less than 8 years spent longer time on active activities. The children of fathers with education less than 8 years spent longer time on active activities.

Self-reported daily activities

According to self report, the time spent on playing, housework, and watching video or DVD and active activities was longer in low SEL schools. Girls reported a longer time on study, reading, doing housework and a shorter time on playing, sports, total media activities and total active activities. The students at the 8th grade reported a longer duration on studying and a shorter duration on reading, playing, sports, media activities and active activities. The children of mothers educated less than 8 years reported a shorter time on study and a longer time on playing and housework. Low paternal education children reported a shorter time on study, and a longer time on housework and active activities.

Factors affecting BMI z-score

The mean BMI z-score was significantly lower in low SEL schools (-0.67±1.4) than in high SEL schools (0.29±1.3, P<0.001). Girls showed a lower mean z-score (-0.23±1.4) than boys (0.23 ±1.4, P=0.007). There was no difference in mean BMI z-scores between grades, maternal and paternal education. A weak statistically significant correlation could be detected between BMI z-score and self-reported duration for sports (r=0.078, P=0.027) and vigorous physical activities per week (r=0.089, P=0.046).

The mean BMI z-score was similar between

Table 1. The mean durations (h/day) of daily activities out of school reported by the students and parents

Report	Studying	Reading	Playing	Sports	Housework	Watching Videos/DVD	Computer	Television
Student (*n*=850)	3.4±1.9	1.1±0.8	0.9±1.1	1.0±1.1	0.7±1.0	0.7±1.1	0.5±1.0	2.1±1.4
Parent (*n*=566)	3.6±3.5	1.0±1.1	0.9±1.4	0.8±1.2	0.6±1.1	0.3±0.8	0.3±0.7	2.3±1.8
Correlation (rho)*	0.617	0.518	0.620	0.568	0.570	0.406	0.492	0.422

*: $P<0.001$ for all correlations.

Table 2. The mean durations (h/day) of daily media, sedentary and active activities reported by students and parents

Report	Media	Sedentary	Active
Students (*n*=850)	3.2±2.4	7.5±3.2	2.5±2.1
Parents (*n*=566)	2.9±2.5	7.6±5.1	2.2±2.5
Correlation (rho)*	0.466	0.489	0.560

*: $P<0.001$ for all correlations.

Table 3. Parent reported duration of television viewing and parental body mass index (BMI) according to BMI z-score groups

BMI z-score	Duration of television viewing	Maternal BMI	Paternal BMI
<-2SD (*n*=40)	1.6±0.8*	23.6±3.7†	25.5±3.4‡
-2SD to 2SD (*n*=492)	2.4±1.8	25.1±3.5†	26.4±3.4‡
>2SD (*n*=34)	2.5±0.9*	27.3±4.5†	28.4±3.6‡

*: $P=0.027$, for the first and third groups; †: $P=0.045$, for the first and second groups; $P<0.0001$, for the first and third groups; $P=0.002$, for the second and third groups; ‡: $P=0.002$, between the first and third group; $P=0.005$, between the second and third groups.

students who had TV sets in their bedrooms and those who did not have. Students having a TV set in their bedroom reported significantly longer time on playing, sports, computer use and total media duration. Their parents reported a longer time on sports and active activities. Students from high SEL schools and boys more commonly had a TV set in their bed room than children from low SEL schools and girls (31% [high SEL] *vs.* 20% [low SEL], $P<0.001$; 29.5% [boys] *vs.* 21% [girls], $P=0.002$).

The relations of the three BMI z-score categories with the time on activities and mean parental education were analyzed by one-way ANOVA according to the reports of parents and students themselves. A significant difference was noted in the parents reported time on television viewing, maternal or paternal BMI (Table 3). Multilinear analysis showed only SEL ($\beta=0.149$, $t=2.579$, $P=0.01$), maternal BMI ($\beta=0.267$, $t=4.561$, $P<0.001$) and paternal BMI ($\beta=0.162$, $t=2.825$, $P=0.005$) were significantly associated with adolescent BMI z-score.

Discussion

Over the past 20 years, studies using different methods to determine the relationship between the time on television viewing and obesity have been reported.[3-11] Meanwhile life style has changed and recently BMI z-score has been recommended for cross-sectional evaluation of obesity.[14]

Univariate analysis in this study showed a weak positive correlation between self-reported time on sports and vigorous physical activities and BMI z-scores. As the time on sports increased, the BMI z-scores increased. Only students with a low BMI z-score (below -2SD) and those with a high BMI z-score have a significantly different television viewing duration.

Reports from more developed countries showed there was a positive relation between obesity and television viewing.[3,5-7] In less developed countries or regions with low economic level in the developed countries no positive relation was found.[4,8] Longitudinal studies[10] and meta-analysis[11] showed there is a causal effect relation between television viewing and BMI, but with small effect.

Many studies indicated that increased television viewing and a decrease in more active activities (i.e., replacement) lead to obesity. However this study, like some other reports,[18,19] found a positive correlation between television viewing and many other sedentary activities (reading, watching CD, computer use). High socioeconomic level and parental BMI as factors may affect BMI z-score in adolescents significantly.

Turkey is a developing country which differs from the western societies regarding family interactions and food culture. It is speculated that television viewing may be an indicator of some not measured family interactions and dynamics that also affect obesity most probably via eating and activity culture. Family control on the children has been shown to be an important factor for the development of obesity.[20] Longer time on television viewing may be an indirect measure of lack of control on children which in turn also leads to obesity. Disruptive behavior disorder has also been demonstrated to be related to higher BMI z-scores.[21] Aggression is also related to television viewing contents and duration.[22] So television, obesity and aggression may be "family dynamics/parenting style" is the missing part of the square. We believe that this hypothesis deserves further research.

One of the limitations of this study is the self-reported parental height and weight. Parent or child reports have been criticized for being subjective[23] for the determination of activity durations as well. However in one of our former studies conducted in the

same schools, we correlated parent reports with diaries and found a good correlation.[24] The good correlation detected between reports of parents and adolescents increases the reliability of the results.

In conclusion, neither television viewing nor other media use could be identified as independent factors related to adolescent BMI z-scores. However, genetic and/or family environment is likely to affect nutrition and activity pattern of adolescents and is significantly related to BMI z-score.

Funding: None.
Ethical approval: Permission was obtained from the Ministry of Education.
Competing interest: None declared.
Contributors: Özmert EN contributed to study design, statistical analysis, and manuscript writing. Özdemir R contributed to study design and data collection. Pektaş A contributed to study design and data collection. Üçkardeş Y contributed to study design and data collection. Yurdakök K contributed to review of the manuscript.

References

1 Anderson PM, Butcher KE. Childhood obesity: trends and potential causes. Future Child 2006;16:19-45.
2 Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. Lancet 2008;371: 243-260.
3 Myers EF. ADA Evidence Analysis Library. J Am Diet Assoc 2005;105:S79.
4 Janssen I, Katzmarzyk PT, Boyce WF, Vereecken C, Mulvihill C, Roberts C, et al. Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. Obes Rev 2005;6:123-132.
5 Eisenmann JC, Bartee RT, Smith DT, Welk GJ, Fu Q. Combined influence of physical activity and television viewing on the risk of overweight in US youth. Int J Obes (Lond) 2008; 32:613-618.
6 Dietz WH Jr, Gortmaker SL. Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. Pediatrics 1985;75:807-812.
7 Gortmaker SL, Must A, Sobol AM, Peterson K, Colditz GA, Dietz WH. Television viewing as a cause of increasing obesity among children in the United States, 1986-1990. Arch Pediatr Adolesc Med 1996;150:356-362.
8 Laurson K, Eisenmann JC, Moore S. Lack of association between television viewing, soft drinks, physical activity and body mass index in children. Acta Paediatr 2008;97:795-800.
9 Must A, Bandini LG, Tybor DJ, Phillips SM, Naumova EN, Dietz WH. Activity, inactivity, and screen time in relation to weight and fatness over adolescence in girls. Obesity (Silver Spring) 2007;15:1774-1781.
10 Hancox RJ, Poulton R. Watching television is associated with childhood obesity: but is it clinically important? Int J Obes (Lond) 2006;30:171-175.
11 Marshall SJ, Biddle SJ, Gorely T, Cameron N, Murdey I. Relationships between media use, body fatness and physical activity in children and youth: a meta-analysis. Int J Obes Relat Metab Disord 2004;28:1238-1246.
12 Vaughan KK, Fouts GT. Changes in television and magazine exposure and eating disorder symptomatology. Sex Roles 2003; 49:313-320.
13 Mei Z, Grummer-Strawn LM. Standard deviation of anthropometric Z-scores as a data quality assessment tool using the 2006 WHO growth standards: a cross country analysis. Bull World Health Organ 2007;85:441-448.
14 Cole TJ, Faith MS, Pietrobelli A, Heo M. What is the best measure of adiposity change in growing children: BMI, BMI %, BMI z-score or BMI centile? Eur J Clin Nutr 2005;59:419-425.
15 Fredriks AM, van Buuren S, Wit JM, Verloove-Vanhorick SP. Body index measurements in 1996-7 compared with 1980. Arch Dis Child 2000;82:107-112.
16 Toyran M, Ozmert E, Yurdakök K. Television viewing and its effect on physical health of schoolage children. Turk J Pediatr 2002;44:194-203.
17 Andersen RE, Crespo CJ, Bartlett SJ, Cheskin LJ, Pratt M. Relationship of physical activity and television watching with body weight and level of fatness among children: results from the Third National Health and Nutrition Examination Survey. JAMA 1998;279:938-942.
18 Feldman DE, Barnett T, Shrier I, Rossignol M, Abenhaim L. Is physical activity differentially associated with different types of sedentary pursuits? Arch Pediatr Adolesc Med 2003;157:797-802.
19 Ekelund U, Brage S, Froberg K, Harro M, Anderssen SA, Sardinha LB, et al. TV viewing and physical activity are independently associated with metabolic risk in children: the European Youth Heart Study. PLoS Med 2006;3:e488.
20 Larios SE, Ayala GX, Arredondo EM, Baquero B, Elder JP. Development and validation of a scale to measure Latino parenting strategies related to children's obesigenic behaviors. The parenting strategies for eating and activity scale (PEAS). Appetite 2009;52:166-172.
21 Anderson SE, Cohen P, Naumova EN, Must A. Relationship of childhood behavior disorders to weight gain from childhood into adulthood. Ambul Pediatr 2006;6:297-301.
22 Huesmann LR, Moise-Titus J, Podolski CL, Eron LD. Longitudinal relations between children's exposure to TV violence and their aggressive and violent behavior in young adulthood: 1977-1992. Dev Psychol 2003;39:201-221.
23 Bryant MJ, Lucove JC, Evenson KR, Marshall S. Measurement of television viewing in children and adolescents: a systematic review. Obesity 2007;8:197-209.
24 Ozmert E, Toyran M, Yurdakök K. Behavioral correlates of television viewing in primary school children evaluated by the child behavior checklist. Arch Pediatr Adolesc Med 2002; 156:910-914.

Received March 23, 2010
Accepted after revision September 2, 2010