Roya Kelishadi, Nafiseh Mozafarian, Mostafa Qorbani[a,*], Mohammad Reza Maracy, Mohammad Esmaeil Motlagh, Saeid Safiri, Gelayol Ardalan, Hamid Asayesh, Fatemeh Rezaei and Ramin Heshmat[a,*]

Association between screen time and snack consumption in children and adolescents: The CASPIAN-IV study

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Abstract

Background: The relationship between screen time (ST) and the frequency of snack consumption in a national sample of Iranian children and adolescents was assessed. The present nationwide survey was conducted on 14,880 school students living in urban and rural areas of 30 provinces in Iran. Trained healthcare providers conducted the physical examination and completed the questionnaire of the World Health Organization – Global School-Based Student Health Survey (WHO-GSHS).

Methods: The association between ST (total time spent watching TV and using a computer in leisure time) and the frequency of snack consumption was determined using ordinal logistic regression analysis. The subjects were 13,486 students out of the 14,880 invited including 50.8% boys. The mean (SD) age of participants was 12.47 (3.36) years.

Results: In multivariate models, for students who had prolonged ST (more than 4 h/day), the odds of daily consumption of sweets (odds ratio, OR 1.25; 95% CI 1.14–1.4), salty snacks (OR 1.6; 95% CI 1.5–1.76), soft drinks (OR 1.52; 95% CI 1.4–1.7), canned fruit juice (OR 1.3; 95% CI 1.2–1.4), and fast food (OR 1.53; 95% CI 1.4–1.7) were higher compared to those with low ST. Furthermore, the odds of daily consumption of milk in students who had prolonged ST (more than 4 h/day) were lower compared to those with low ST (OR 0.9; 95% CI 0.8–0.99).

Conclusions: Prolonged time spent watching TV and using a computer during leisure time might be associated with unhealthy dietary habits. Moreover, inactivity induced by prolonged ST may also lead to unhealthy dietary habits and in turn excess weight in children and adolescents.

Keywords: dietary habit; obesity; screen time (ST); sedentary life style; snack.

[a]**Mostafa Qorbani and Ramin Heshmat:** These authors contributed equally as corresponding authors to this work.
***Corresponding authors: Mostafa Qorbani,** Noncommunicable Diseases Research Center, School of Medicine, Alborz University of Medical Sciences, Baghestan Boulevard, 31485/56, Karaj, Iran, E-mail: mqorbani1379@yahoo.com; and Chronic Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran; and **Ramin Heshmat,** Chronic Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran, E-mail: rheshmat@tums.ac.ir
Roya Kelishadi, Nafiseh Mozafarian and Gelayol Ardalan: Paediatrics Department, Child Growth and Development Research Center, Research Institute for Primordial Prevention of Non-communicable Disease, Isfahan University of Medical Sciences, Isfahan, Iran
Mohammad Reza Maracy: Department of Biostatistics and Epidemiology, School of Public Health, Isfahan University of Medical Sciences, Isfahan, Iran
Mohammad Esmaeil Motlagh: Paediatrics Department, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
Saeid Safiri: Managerial Epidemiology Research Center, Department of Public Health, School of Nursing and Midwifery, Maragheh University of Medical Sciences, Maragheh, Iran
Hamid Asayesh: Department of Medical Emergencies, Qom University of Medical Sciences, Qom, Iran
Fatemeh Rezaei: Department of Social Medicine, Medical School, Jahrom University of Medical Sciences, Jahrom, Iran

Introduction

In recent years, obesity has become an epidemic among children and adolescents [1]. In Iran, the incidence of overweight and obesity in adolescents has also increased [2–4]. The prevalence of obesity among Iranian adolescents has been recently reported to be about 5% [5]. In addition to being linked to childhood diseases (or a child's well-being), obesity in children is related to a higher risk of chronic diseases and reduced life expectancy in adulthood [6]. Some of the factors contributing to obesity include decreased physical activity, genetics, socioeconomic status (SES), increased sedentary lifestyle, and unfavorable dietary habits (e.g. increased consumption

of soft drinks, sweets, and fast food) [7, 8]. Meanwhile, unhealthy dietary habits are one of the most important causes [9]. Human behavior (dietary habits and physical activity) is shaped from childhood [10, 11] and continues to adulthood [12]. Accordingly, many factors such as individual, social, and environmental factors influence adolescents' food habits. Watching TV is also one of the influencing factors [13].

Some behaviors associated with minimum energy consumption, such as lying down or sitting, are called sedentary behaviors [14]. Screen time (ST), which refers to the sum of the time spent watching TV and using a computer, forms a major part of sedentary behaviors. Watching TV is linked to obesity in two ways: one is that physical activity may be replaced by watching TV and the other is that disruption of dietary habits caused by eating junk food and overeating while watching TV can lead to obesity [15, 16].

Extensive research has been done on the relationship between time spent watching TV and dietary habits of children and adolescents. In several review studies, it was revealed that watching TV is related to unhealthy dietary habits in children and adolescents [17–20].

Of the major mechanisms proposed to explain the relationship between watching TV and unhealthy food habits is the impact of food advertisements on preferences, selection, and food consumption [15, 21, 22]. In other words, watching TV is linked to eating more junk food owing to the fact that TV commercials of junk food are aimed at children's programs [23–25]. In some studies, a positive relationship between time spent watching TV and increase in energy intake in children and adolescents has been found [16, 18, 26]. In some studies, watching TV is associated with increased consumption of energy-dense drinks [18, 27, 28], fast food [18, 26, 29–31], soft drinks [29, 32–35], sweets [26, 29, 32, 35], salty snacks [26, 29, 36], and reduced consumption of fruit and vegetables [18, 25, 27–29, 31, 32] in children and adolescents.

Likewise, the relationship between computer use [27, 31, 33] and ST [37, 38] and unhealthy dietary habits in children and adolescents has been recently found in a limited number of studies.

Nowadays, children and adolescents allocate a major part of their leisure time to watch TV and play computer games. Most previous studies focused on the effects of TV watching, and not the total ST, on snack consumption; moreover, they were almost all conducted in Western countries. In spite of the growing problem of childhood obesity in our community and possible cultural differences in the lifestyle patterns, this association has not been examined in Iranian children.

Thus, assessing the association between ST and dietary habits seems essential for designing and implementing intervention programs to reduce the so-called modifiable behaviors in children and adolescents. The current study was designed to determine the association between ST and dietary habits in a nationally representative sample of Iranian pediatric population.

Materials and methods

Participants and study design

Data for this nationwide survey were obtained from the fourth phase of the childhood and adolescence surveillance and prevention of adult non-communicable disease-IV (CASPIAN-IV) study. The details of the study method including data collection and sampling frame have been described elsewhere previously [39]. Briefly, this national cross-sectional multicenter study was conducted on a population of 14,880 Iranian students aged 6–18 years in 2011–2012. Students were selected randomly from elementary, secondary, and high schools by the multi-stage cluster sampling method from urban and rural areas of 30 provinces. All adolescents participating in the CASPIAN-IV study were enrolled, and individuals having incomplete information about dietary habits and time spent watching TV and using computers were excluded. The protocol of study was approved by the Ethics Committee of Tehran and Isfahan University of Medical Sciences, and other relevant national organizations. All participants were briefed about the study, and oral consent from the students and written consent from their parents were obtained.

Measurements

Students' information was collected through questionnaires and conducting physical examinations. Students' healthcare system questionnaires whose validity and reliability had been examined by experts [40] were prepared according to the World Health Organization Global School-based Student Health Survey (WHO-GSHS). Students completed the questionnaires under the supervision of healthcare experts. Information was entered into a checklist by a trained team, and examinations were performed by standard protocols using calibrated devices. The questions included the following items: individual information, family characteristics, and social and psychological environment of schools. It is worth noting that physical activity was assessed by three self-report questions: a) During the past week, on how many days were you physically active for overall 30 min per day? b) Do you have regular sports class at school? c) How much time do you spend on regular sports class at school per week?

Physical activity was evaluated through the principal component analysis (PCA) method [41]. Moreover, some questions concerning the family (parents' education and occupation, having a personal computer, type of student's school (private, public), number of children in the family, birth order and birthweight, and family history of chronic diseases) were answered by the parents [41].

The subjects' dietary habits were investigated through nine food items including sweets (cake, cookies, biscuits, and chocolate), salty snacks (puff, chips, and pretzel), soft drinks, fresh fruit, dried fruit, vegetables (fresh or cooked), canned fruit juice, milk, and fast food (sausage, pizza, and hamburger). Dietary habits were measured by the following question: 'How many times do you eat each of these food groups?' Responses on the Likert scale were transformed to a numerical scale as follows: never = 1, rarely = 2, weekly = 3, and daily = 4.

Anthropometric measurements: Anthropometric measurements including height and weight were done according to a standard program using calibrated devices by a trained team. Weight was measured in light clothing to the nearest 0.1 kg on a digital scale, and height was recorded without shoes to the nearest 0.1 cm. The body mass index (BMI) was calculated by dividing the weight in kilograms by the square of height in meters. The BMI z-score was calculated to control for age and gender differences [42].

Socioeconomic status (SES) definition: The method and variables used for calculating SES were approved previously in the Progress in International Reading Literacy Study (PIRLS) [43]. The SES score was calculated using the PCA method based on parent's education and occupation, type of school (private or public), type of home (rented or private), and family assets (private car and computer).

ST definition: The time spent watching TV and using computers was assessed by the WHO-GSHS questionnaire. Students were asked for time spent in hours per day on weekends and on weekdays for watching TV and working with computers. The weighted average of the time spent watching TV and working with a computer in a day was obtained as the sum of 1/7 × watching TV and working with computers on weekends and 6/7 × watching TV and working with computers on weekdays.

The ST for each student was obtained as the sum of the average time spent watching TV and working with computers in 1 day. Time spent watching TV and working with computers and ST were divided based on quartiles, and the lower limit of the fourth quartile was considered as the cut-off point (the first, second, and third quartiles were considered as low, and the fourth quartile was considered as high).

Statistical analysis

Quantitative and qualitative variables were reported as mean (standard deviations, SD) and number (%), respectively. Independent sample t-test and the χ^2 tests were, respectively, used to compare the quantitative and qualitative variables across ST categories. The ordinal logistic regression (OLR) model was used to assess the association of ST with the frequency of snack consumption in two models (crude and adjusted) for adjusting potential confounders. In the adjusted model, potential confounders including age, sex, living area (urban, rural), physical activity, BMI z-scores, SES, and sleep duration were also taken into account. The data were analyzed by the STATA software version 11.0 (STATA Corp, College Station, TX, USA). All statistical analyses were performed using the survey data analysis method.

Results

Overall, 13,486 students out of the 14,880 invited (90.6% participation rate) participated in this study. Approximately, 50% of the students were boys and 75% were from urban areas. The mean (SD) age of participants was 12.47 (3.36) years.

The mean (SD) h/day spent watching TV, using computers, and ST at leisure time were 2.14 (1.07), 0.86 (0.98), and 2.81 (1.55), respectively. The lower limits of fourth quartiles of watching TV, working with computers, and ST in students obtained were 3, 1, and 4, respectively (Table 1).

Students' characteristics and food habits in terms of watching TV, working with computers, and ST are presented in Table 2. Students who spent more hours per day watching TV, working with computers, and ST had higher weight and BMI, better SES, and less sleep and physical activity.

Moreover, students who worked with computers for more than 1 h/day consumed more fresh fruit, dried fruit, canned fruit juice, and vegetables compared to those who used computers for less than 1 h/day. Students who had ST more than 4 h/day were outlined to consume more sweets, fresh fruit, dried fruit, and canned fruit juice compared to those with less than 4 h ST per day. Moreover, boys spent more time on TV watching and ST compared to girls (Table 2).

Associations between time spending watching TV, working with computers, and ST and students' dietary habits in the OLR model are presented in Table 3. Students who watched TV for more than 3 h/day in comparison with those who watched TV for less than 3 h/day had higher odds of daily consumption (compared to the combined never, rarely, and weekly consumption) of sweets, salty snacks, soft drinks, and fast food and also had lesser odds of consuming milk daily (compared to the combined never, rarely, and weekly consumption). For watching TV for more than 3 h/day, the odds of daily consumption of sweets versus the combined never, rarely, and weekly consumption were 1.30 (OR = 1.30, 95% CI [1.2–1.4],

Table 1: Quartiles of watching TV, working with computers and screen time in Iranian children and adolescents: the CASPIAN IV study.

Quartiles	Watching TV, h/day	Working with computers, h/day	Screen time, h/day
First	1.14 <	0	1.71 <
Second	1.14–2.14	0	1.71–2.43
Third	2.14–3	1 ≤	2.43–4
Fourth	3 >	1 >	4 >

Table 2: Characteristics of participants according to screen time: the CASPIAN-IV study.

Variables		Watching TV per day, h/day			Working with computer, h/day			Screen time, h/day		
		≤3 h	>3 h	p-value	≤1 h	>1 h	p-Value	≤4 h	>4 h	p-Value
Age, year; Mean (SD)		12.26 (3.4)	13.13 (3.2)	<0.001[a]	12.1 (3.4)	13.7 (3.1)	<0.001[a]	12.2 (3.4)	13.9 (3)	<0.001[a]
Sleep duration, h; Mean (SD)		9.04 (1.52)	8.94 (1.56)	0.001[a]	9.1 (1.5)	8.8 (1.58)	<0.001[a]	9.1 (1.51)	8.8 (1.6)	<0.001[a]
Weight, kg; Mean (SD)		41.2 (16.8)	46.1 (17.4)	<0.001[a]	40.3 (16.3)	49.4 (17.8)	<0.001[a]	40.8 (16.5)	50.2 (17.3)	<0.001[a]
BMI, kg/m^2; Mean (SD)		18.4 (4.3)	19.6 (4.7)	<0.001[a]	18.5 (4.3)	20.3 (4.7)	<0.001[a]	18.6 (4.3)	20.2 (4.6)	<0.001[a]
BMI z score		− 0.14 (1.8)	0.03 (1.81)	<0.001[a]	− 0.16 (1.77)	0.09 (1.80)	<0.001[a]	− 0.14 (1.77)	0.096 (1.81)	<0.001[a]
Number of children in the family; Mean (SD)		3.1 (1.75)	3.1 (1.68)	0.42[a]	3.15 (1.8)	3 (1.6)	<0.001[a]	3.13 (1.8)	3.05 (1.6)	0.04[a]
Sex; n (%)	Boy	5063 (50.4)	1697 (51.4)	0.31[b]	4741 (47.4)	1869 (60.9)	<0.001[b]	5192 (48.5)	1388 (59.7)	<0.001[b]
	Girl	4982 (49.6)	1603 (48.6)		5268 (52.6)	1202 (39.1)		5515 (51.5)	937 (40.3)	
SES; Mean (SD)		− 0.02 (1.64)	0.07 (1.55)	0.01[a]	− 0.19 (1.61)	0.67 (1.46)	<0.001[a]	− 0.13 (1.62)	0.66 (1.43)	<0.001[a]
Weight status; n (%)	Underweight	1245 (12.6)	361 (11.05)	<0.001[b]	1253 (12.7)	327 (10.8)	<0.001[b]	1332 (12.6)	240 (10.4)	<0.001[b]
	Normal	6655 (67.1)	2096 (64.2)		6660 (67.3)	1926 (63.5)		7093 (67)	1463 (63.5)	
	Overweight	938 (9.5)	333 (10.2)		911 (9.2)	335 (11.1)		987 (9.3)	255 (11.1)	
	Obese	1084 (10.9)	476 (14.6)		1077 (10.9)	443 (14.6)		1169 (11.1)	345 (15)	
Living area; n (%)	Urban	7483 (74.5)	2616 (79.3)	<0.001[b]	7229 (72.2)	2676 (87.1)	<0.001[b]	7840 (73.2)	2036 (87.6)	<0.001[b]
	Rural	2562 (25.5)	684 (20.7)		2780 (27.8)	395 (12.9)		2867 (26.8)	289 (12.4)	
Physical activity; Mean (SD)		0.02 (0.98)	− 0.05 (1.05)	<0.001[a]	0.02 (0.98)	− 0.061 (1.06)	<0.001[a]	0.012 (0.98)	− 0.06 (1.08)	0.003[a]
Sweets; n (%)	Never	303 (3)	70 (2.13)	<0.001[b]	275 (2.75)	95 (3.1)	0.9[b]	311 (2.9)	58 (2.5)	0.02[b]
	Rarely	2074 (20.7)	710 (21.6)		2059 (20.6)	673 (22)		2196 (20.6)	524 (22.6)	
	Weekly	4396 (43.9)	1223 (37.14)		4304 (43.1)	1210 (39.6)		4639 (43.4)	853 (36.8)	
	Daily	3252 (32.44)	1290 (39.2)		3356 (33.6)	1081 (35.34)		3541 (33.1)	884 (38.1)	
Salty snacks; n (%)	Never	1528 (15.3)	288 (8.8)	<0.001[b]	1445 (14.5)	337 (11)	<0.001[b]	1570 (14.7)	203 (8.8)	<0.001[b]
	Rarely	3796 (37.9)	1179 (35.8)		3724 (37.3)	1153 (37.7)		4023 (37.7)	836 (36.1)	
	Weekly	3567 (35.6)	1229 (37.3)		3601 (36.1)	1116 (36.5)		3817 (35.8)	884 (38.1)	
	Daily	1122 (11.2)	597 (18.1)		1215 (12.2)	454 (14.8)		1268 (11.9)	396 (17.1)	
Soft drinks; n (%)	Never	1954 (19.5)	437 (13.3)	<0.001[b]	1895 (19)	448 (14.7)	<0.001[b]	2060 (19.3)	275 (11.9)	<0.001[b]
	Rarely	4341 (43.4)	1369 (41.6)		4368 (43.8)	1238 (40.5)		4632 (43.4)	955 (42.3)	
	Weekly	3040 (30.4)	1134 (34.5)		3062 (30.7)	1026 (33.6)		3272 (30.7)	802 (34.6)	
	Daily	669 (6.7)	349 (10.6)		649 (6.5)	342 (11.2)		705 (6.6)	283 (12.2)	
Fresh fruit; n (%)	Never	113 (1.15)	46 (1.42)	0.1[b]	112 (1.14)	42 (1.4)	<0.001[b]	119 (1.1)	35 (1.5)	0.02[b]
	Rarely	889 (9)	294 (9.1)		892 (9.1)	270 (9)		943 (9)	211 (9.2)	
	Weekly	3405 (34.5)	1040 (32.1)		3470 (35.2)	902 (30)		3651 (34.7)	697 (30.5)	
	Daily	5459 (55.3)	1861 (57.4)		5381 (54.6)	1800 (60)		5823 (55.3)	1344 (58.8)	
Dried fruit; n (%)	Never	812 (8.9)	280 (9.5)	0.27[b]	877 (9.6)	195 (7)	<0.001[b]	928 (9.5)	142 (6.8)	<0.001[b]
	Rarely	2873 (31.4)	979 (33.1)		2930 (32.1)	879 (31.7)		3103 (31.7)	691 (33)	
	Weekly	3468 (38)	1037 (35)		3434 (37.6)	993 (35.9)		3676 (37.6)	738 (35.2)	
	Daily	1985 (21.7)	666 (22.5)		1901 (20.8)	703 (35.4)		2076 (21.2)	524 (25)	
Canned fruit juice; n (%)	Never	1065 (10.7)	284 (8.7)	0.3[b]	1060 (10.7)	260 (8.5)	<0.001[b]	1141 (10.7)	176 (7.6)	
	Rarely	3366 (33.8)	1185 (36.1)		3483 (35)	982 (32.2)		3650 (34.3)	792 (34.2)	
	Weekly	4047 (40.6)	1300 (39.6)		3980 (40)	1265 (41.5)		4294 (40.4)	938 (40.6)	
	Daily	1489 (15)	514 (15.7)		1420 (14.3)	540 (17.7)		1545 (14.5)	407 (17.6)	

Table 2 (continued)

Variables		Watching TV per day, h/day			Working with computer, h/day			Screen time, h/day		
		≤3 h	>3 h	p-value	≤1 h	>1 h	p-Value	≤4 h	>4 h	p-Value
Vegetables; n (%)	Never	352 (3.5)	142 (4.33)	0.2[b]	352 (3.5)	132 (4.3)	0.014	381 (3.6)	102 (4.4)	0.41[b]
	Rarely	1404 (14)	480 (14.6)		1389 (14)	458 (15)		1484 (13.9)	354 (15.3)	
	Weekly	4649 (46.5)	1490 (45.4)		4772 (47.9)	1258 (41.2)		5035 (47.2)	973 (42)	
	Daily	3600 (36)	1169 (35.6)		3455 (34.7)	1206 (39.5)		3761 (35.3)	887 (38.3)	
Milk; n (%)	Never	644 (6.44)	313 (9.5)	<0.001[b]	702 (7.04)	242 (7.9)	<0.001[b]	755 (7.1)	184 (7.9)	<0.001[b]
	Rarely	1214 (12.1)	599 (18.2)		1290 (12.9)	486 (15.9)		1344 (12.6)	427 (18.4)	
	Weekly	3314 (33.1)	1093 (33.2)		3313 (33.2)	1007 (32.9)		3551 (33.3)	754 (32.5)	
	Daily	4833 (48.3)	1285 (39.1)		4669 (46.8)	1325 (43.3)		5017 (47)	955 (41.2)	
Fast foods; n (%)	Never	2608 (26)	559 (17)	<0.001[b]	2612 (26.2)	490 (16.02)	<0.001[b]	2757 (25.8)	335 (14.4)	<0.001[b]
	Rarely	4867 (48.6)	1683 (51.1)		4942 (49.5)	1478 (48.3)		5252 (49.2)	1142 (49.2)	
	Weekly	2301 (23)	913 (27.7)		2215 (22.2)	939 (30.7)		2418 (22.6)	726 (31.3)	
	Daily	137 (4.2)	242 (2.4)		220 (2.2)	152 (5)		254 (2.4)	117 (5.04)	

[a]p-Values are resulted from t-test. [b]p-Values are resulted from χ^2 test. BMI = Body mass index; SES = Socio-economic status.

p = < 0.001). Nevertheless, no significant association was observed between watching TV and consuming fruits, canned fruit juice, and vegetables.

Furthermore, the results showed that students who used computers for more than 1 h/day compared to those with less than 1 h/day of computer use had higher odds of daily consumption (compared to the combined never, rarely, and weekly consumption) of sweets, salty snacks, soft drinks, dried fruit, canned fruit juice, and fast food. For example, students who used computers for more than 1 h/day had 1.14 times higher odds of daily consumption of sweets than those who used computers for less than 1 h/day (OR = 1.14, 95% CI [1.05–1.24], p = 0.002). Yet, there was no significant relationship between time spent working with computers and consuming fresh fruits, vegetables, and milk.

In students who had prolonged ST (more than 4 h/day), the odds of daily consumption (vs. the combined never, rarely, and weekly consumption) of sweets, salty snacks, soft drinks, canned fruit juice, and fast food were higher compared to those with low ST. Furthermore, the odds of daily consumption of milk in students who had prolonged ST (more than 4 h/day) were lower compared to those with low ST. For example, for students who had prolonged ST (more than 4 h/day), the odds of daily consumption (vs. the combined never, rarely, and weekly consumption) of salty snacks were 1.60 (OR = 1.60, 95% [1.5–1.76], p = < 0.001) compared to those who had less than 4 h/day ST. However, no significant association was found between ST and consumption of fruit and vegetables.

Discussion

The findings of the present study showed that ST, watching TV, and working with computers were associated with increased odds of consumption of sweets, salty snacks, soft drinks, and fast food. Also, there was a significant relationship between the time spent watching TV and ST and reduced consumption of milk. The findings also showed a significant relationship between the time spent working with computers and ST and increased consumption of canned fruit juice. However, no significant relationship was observed between ST, time spent watching TV, and time spent working with computers and consumption of fresh fruit and vegetables.

Nevertheless, in some studies, a significant relationship is reported between watching TV and unhealthy dietary habits, which is consistent with the present study. For example, the findings of a cross-sectional study

Table 3: Association of watching TV, working with computer, and screen time with frequency of snacks consumption in ordinal logistic regression model: the CASPIAN IV study.

		Sweets	Salty snacks	Soft drinks	Fresh fruit	Dried fruit	Canned fruit juice	Vegetables	Milk	Fast foods
Watching TV > 3 h/day	OR (95%CI)[a]	1.21 (1.12–1.29)	1.55 (1.44–1.67)	1.47 (1.4–1.6)	1.07 (0.99–1.15)	0.96 (0.89–1.03)	1.04 (0.96–1.11)	0.95 (0.89–1.03)	0.65 (0.61–0.70)	1.51 (1.41–1.63)
	p-Value[a]	< 0.001	< 0.001	< 0.001	0.09	0.27	0.32	0.23	< 0.001	< 0.001
	OR (95%CI)[b]	1.3 (1.2–1.4)	1.53 (1.4–1.7)	1.43 (1.3–1.54)	1.08 (0.99–1.2)	0.96 (0.9–1.04)	1.06 (0.98–1.15)	0.93 (0.9–1.01)	0.74 (0.7–0.81)	1.4 (1.3–1.5)
	p-Value[b]	< 0.001	< 0.001	< 0.001	0.08	0.30	0.13	0.095	< 0.001	< 0.001
Working with computer > 1 h/day	OR (95%CI)[a]	1.01 (0.93–1.08)	1.19 (1.11–1.29)	1.42 (1.31–1.53)	1.19 (1.10–1.30)	1.21 (1.12–1.31)	1.25 (1.16–1.34)	1.10 (1.02–1.19)	0.85 (0.79–0.91)	1.79 (1.66–1.93)
	p-Value[a]	0.89	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.013	< 0.001	< 0.001
	OR (95%CI)[b]	1.14 (1.05–1.24)	1.31 (1.21–1.42)	1.33 (1.22–1.45)	1.06 (0.97–1.2)	1.15 (1.05–1.25)	1.3 (1.2–1.4)	0.99 (0.9–1.1)	0.99 (0.9–1.1)	1.5 (1.4–1.6)
	p-Value[b]	0.002	< 0.001	< 0.001	0.21	0.002	< 0.001	0.90	0.75	< 0.001
Screen time > 4 h/day	OR (95%CI)[a]	1.11 (1.02–1.20)	1.45 (1.34–1.58)	1.61 (1.48–1.74)	1.12 (1.02–1.22)	1.16 (1.06–1.26)	1.20 (1.11–1.31)	1.04 (0.95–1.13)	0.76 (0.7–0.83)	1.84 (1.69–2)
	p–Value[a]	0.02	< 0.001	< 0.001	0.02	0.001	< 0.001	0.4	< 0.001	< 0.001
	OR (95%CI)[b]	1.25 (1.14–1.4)	1.6 (1.5–1.76)	1.52 (1.4–1.7)	0.97 (0.9–1.1)	1.1 (0.995–1.2)	1.3 (1.2–1.4)	0.93 (0.8–1.01)	0.90 (0.8–0.99)	1.53 (1.4–1.7)
	p-Value[b]	< 0.001	< 0.001	< 0.001	0.6	0.065	< 0.001	0.11	0.027	< 0.001

[a]Without adjusted (crude model). [b]Adjusted for age, sex, living area, physical activity, BMI z score, socioeconomic status and sleep duration.

(2006) across Europe and the North American countries on a population of 162,305 students aged 11–15 years were significantly indicative of an increased consumption of sweets and soft drinks caused by increased time spent watching TV [32]. In 2011, a cross-sectional review of 53 studies revealed that watching TV is associated with increased consumption of energy-dense snacks, drinks, and fast food in children and adolescents [18]. The results of a prospective cohort study conducted on 548 students also proved that increased time spent watching TV is associated with a higher consumption of high-energy foods of low nutritional value advertised on TV, such as sweets, fast food, salty snacks, and sugar-sweetened beverages [26]. In 2014, a cross-sectional study on 9–11 year-old Canadian children conducted by Borghese Michael et al. showed that watching TV has a significant positive relationship with the consumption of some unhealthy food items such as sweets, soft drinks, potato chips, and fast food [29]. Also, a significant relationship was outlined in the present study between the time spent watching TV and reduced daily consumption of milk, which is in line with a study on Belgian adolescents in 2006 [32, 44]. However, such a relationship was not found in a cross-sectional study in Europe [27].

In some studies, the relationship between time spent watching TV and using computers and dietary habits has also been evaluated separately. Moreover, a cohort study on 908 Norwegian children in 2013 unfolded a positive relationship between time spent watching TV and using computers and the consumption of soft drinks, sugar, and unhealthy snacks [33]. Also, the findings of a sectional study in Europe in 2012 conducted on 2202 adolescents aged 12.5–17.5 years revealed a significant association between increased time spent watching TV and computer and Internet use in leisure time with a higher probability of consuming sweetened beverages and reduced consumption of fruit [27]. A cross-sectional study conducted in 2015 on high school students in America showed that increased time spent watching TV and using computers are related to excessive consumption of fast food and sugar-sweetened beverages and reduced consumption of fruit and vegetables [31].

The findings of the present study indicated that ST is related to increased consumption of sweets, salty snacks, soft drinks, canned fruit juice, and fast food as well as reduced consumption of milk. Some other studies have also suggested a positive relationship between ST and unhealthy dietary habits in children and adolescents. A large national survey on Saudi Arabian adolescents in 2013 showed that increased ST was associated with increased consumption of sugar-sweetened

drinks, fast food, cake, and energy drinks [38]. By the same token, in a cross-sectional study conducted on 630 Canadian 8–10-year-old children in 2015, the results showed that increased ST was associated with increased energy intake and reduced consumption of fiber, fruits, and vegetables [37].

Probably, the relationship between watching TV and unhealthy dietary habits is due to the effect of TV ads on preferences, selection, and food consumption [15, 21, 22]. Most of the foods advertised on TV misrepresent nutritionally poor foods containing sugar, salt, and high fat [45, 46]. Children are likely to choose unhealthy foods due to their exposure to food advertising which appears on TV [47]. A study conducted by Wiecha in 2006 showed that foods and drinks usually advertised on TV play an important role in adolescents' nutrition [26]. Exposed to much more food advertising, it is more probable that the person requests for and consumes the advertised food [36].

Probably, the relationship between computer use and dietary habits is due to the effect of advertisements on the Internet and in video games. Considering the fact that recently adolescents spend more time on sedentary activities, which is largely due to the increased use of computers [43, 48–50], it seems necessary to conduct studies on the content of Internet ads and its impact on individuals' food habits.

Some studies have reported that watching TV is associated with reduced consumption of fruit and vegetables in children and adolescents [18, 28, 29, 32]. This relationship, however, was not found in the current study for several reasons, partly due to people's nutritional culture. Moreover, greater parental supervision on children's fruit and vegetable consumption as well as the availability of fruit and vegetables are possibly the contributing factors to such a result. In addition, the level of family income may distort this relationship. As information on families' income was not available, the results may have been influenced by such factors. For other reasons, we can refer to the upper boundary point for watching TV; if the upper limit for watching TV is considered more than 2 h, all the results might be almost the same except that of vegetable consumption for which a significant inverse correlation was found (OR = 0.91, CI 95% [0.85–0.97], p = 0.006). However, no significant relationship was found with regard to fruit consumption.

Much research has been conducted on the relationship between the time spent watching TV and video and working with computers and dietary habits in different populations. However, these studies are different in terms of measurement methods of nutritional factors, type of controlled confounders, use of different statistical methods, sample size as well as the age groups studied.

The main limitation of the study was its cross-sectional design, which precludes causal inference. Moreover, the data collection method for food habits and ST, which was based on self-reporting might have caused a bias in reporting.

As food items' data were collected via qualitative methods, detailed nutrient intake data were not available. Hence, using only four modes (never, rarely, weekly, and daily) as qualitative indicators, people who consumed food several times per day were considered with equal daily consumption that may have led to under-estimation of the results.

Also, despite adjustment for some confounding factors, some confounders may still remain such as family income, maturity status, and environmental factors. It is recommended to consider family income and adolescents' maturity status and their impact as confounding variables in future studies.

The main strength of this study was its large sample size. Also, a validated questionnaire (WHO-GSHS) was used for data collection.

The findings suggest that prolonged time spent watching TV and using computers during leisure time is possibly related to unhealthy dietary habits, and thus obesity in children and adolescents. Therefore, it is possible to prevent obesity and its complications through increasing families' knowledge, modifying behaviors, creating fields for diverse entertainments, and having more control on children's food habits.

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