

Association of Sedentary Leisure Time with School Performance in Children and Adolescents: the CASPIAN-V Study

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Abstract

Background: Leisure time activities might be associated with school performance. This study aimed to investigate the association between leisure time variables, including television and computer using time, homework time and cell phone using time, with children's school performance in a nationally representative sample of Iranian children and adolescents.

Materials and Methods: In this analytical cross-sectional study as the fifth survey of a national school-based surveillance program in Iran, participants were selected by multi-stage sampling approach among 7-18-year-old students from urban and rural areas. In addition to filling questionnaires obtained from World Health Organization Global School Health Survey and conducting physical examinations, the averages of school grades were categorized into "very good" (grade 17-20 out of 20), and "not very good" (under 17 out of 20) as school performance according to qualitative evaluation scales established recently in Iranian schools.

Results: The participation rate was 99%, 14,274 students completed the study. Urban students spent more time doing homework and using screen media, and they had better school performance than rural students ($P < 0.001$). Girls had higher homework time and better school performance than boys ($P < 0.001$). Prolonged screen time, including watching television and computer use increased the odds of lower school performance (Odds ratio = 1.11). No other media type times or homework time had a significant association with school performance.

Conclusion: In this study, prolonged screen time represents an inverse association with school performance. Television viewing time, computer and cell phone using time and homework time might have no separate significant effects on school performance.

Key Words: Adolescents, Academic performance, Children, Sedentary lifestyle, Leisure activities.

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1- INTRODUCTION

Sedentary leisure time has several adverse health effects in children and adolescents (1). Many children and adolescents spend considerable time using screen-based media as an essential part of their sedentary time (2). The adverse effects of prolonged screen time on general health are well-documented. Time spent watching television/video gaming, surfing the internet and using a computer are usually considered as screen time (3). Screen time increases the risk of mental health problems (4), cardiovascular disease (5), and has adverse effects on child's diet (6), sleep (4, 7), and on other health complaints including headache, backache, irritability, and feeling nervous (8). Moreover, screen time might cause positive and negative influences on children's learning (9).

Excessive television viewing is inversely associated with attention and reading time (10, 11). Television viewing has a negative impact on educational achievement as well (12). Despite these findings, a limited number of studies showed that screen time might be associated with better cognitive development (9, 13, 14). Furthermore, excessive playing with video games has been correlated to lower homework time and academic performance (15), although some authors underscore that video games do not impact negatively on academic performance in adolescences (16). Also, the same studies have documented the role of internet overuse or misuse in impairment of academic achievement among students (17, 18). Almost all extensive studies in this field have been conducted in Western countries, and limited experience exists from other populations. Iranian school children spend more time on screen-based activities than the recommended time. For instance, 25% of them watch television for more than 4 hours daily (19). The effects of the screen-based action on the children' health have

been investigated before (20), but research on the impact of screen-based activities on school performance is limited in Iran. This study aimed to examine the associations of sedentary leisure time activities including time used for watching television, using computer, doing homework and cell phone use with school performance in a nationally representative sample of Iranian children and adolescents.

2- MATERIALS AND METHODS

2-1. Study population and sampling method

This study was conducted from 2014 to 2015 as part of the fifth survey of a national school-based surveillance program entitled Childhood and Adolescence Surveillance and Prevention of Adult Non-communicable disease (CASPIAN-V study). It was performed among 14,400 students aged 7-18 years living in urban and rural areas of 30 provinces in Iran. The study population was selected by multi-stage sampling approach consisting of cluster, stratified and random sampling method. The study protocol has been explained in detail (21-23), and here it is presented in brief.

2-2. Procedure and measurements

The questionnaire of this study was mainly based on the questionnaire of the World Health Organization Global School Health Survey (24), which was translated to Persian, and validated in the Iranian population. Content validity was affirmed by getting a score of more than 0.75. Cronbach's alpha coefficient of the questionnaire was 0.97 and Pearson's correlation coefficient was obtained 0.94 in test-retest phase, confirming the reliability of the questionnaire (23). Trained health care providers completed the questionnaire by interviewing students and one of their parents. In the current study, the data about student's school performance as well as sedentary leisure

time, i.e., the time typically spent on watching TV, using a cell phone and computer were used for further statistical analyses. For school performance we categorized the average grades of 17-20 out of 20 as "very good", and under 17 out of 20 as "not very good" with regard to qualitative-descriptive evaluation scales for educational system (very good, good, acceptable, requiring more effort) which has been recently developed in Iranian schools (25, 26).

For the main study variables pertaining to time including television and computer using time, homework time and time spent using cell phone as well as screen time, we considered time ≥ 2 hours/day as high, and < 2 hours/day as low in our analyses according to American Academy of Pediatrics' recommendation and limitation of total screen time for children older than 2 years old (27). In this work, screen time is considered as hours spent on watching television and on leisure time computer use, including video gaming, internet surfing, etc. Also, the parents' educational level was categorized as illiterate, diploma/under diploma and academic in the analyses. Socioeconomic status was classified using principal component analysis with regard to 25%, and 75% percentiles, as low, moderate and high. The variables used in the mentioned analysis were school type (private or public), home type (rented, individual or organizational), parental occupation, parental education, having a private car and having a personal computer. Weekly frequency of past week leisure-time physical activity through the validated questionnaire was collected. Sufficient physical activity was considered as doing exercises at least 30 minutes a day leading to significant increases in breathing or heart rate.

2-3. Statistical analysis

Descriptive statistics and frequencies were determined for continuous and discrete

variables, respectively. The Kolmogorov-Smirnov and Shapiro-Wilk tests were performed to assess the normal distribution of the data. Survey analyses for cross-sectional studies were used to investigate the relations between the variables (Chi-square and independent t-tests). Crude and adjusted models of logistic regression tests (models I and II respectively) were done to examine the relationship of screen media time and homework time with school performance afterwards (age, gender, living area, physical activity, and socioeconomic status were the variables retained to adjusted models, i.e., models II). P-value < 0.05 was considered statistically significant for all tests. Statistical analyses were conducted using STATA package version 11.0 (Stata Statistical Software: Release 11. StataCorp LP. Package, College Station, TX, USA). Statistical analysis was performed using the survey analysis method.

2-4. Ethical statement

Ethical protocols for this study were reviewed and approved by national and regional regulatory ethics committees. It was approved by the Ethics Committee of Isfahan University of Medical Sciences (Project No. 194049). The study was performed after obtaining informed written consent from parents and oral assent from students based on providing sufficient information about the research.

3- RESULTS

The participation rate was 99% ($n=14,400$), 14,274 students (50.64% boys, 71.42% urban inhabitants) completed the study. **Table.1** shows the baseline characteristics of the study participants. The mean (standard deviation [SD]) age of students was 12.28 (3.15) years. Higher physical activity (≥ 2 hours) was more prevalent in rural students in comparison with urban students, and this difference was statistically significant ($P = 0.02$). The same prevalence was higher significantly

in boys than in girls ($P < 0.001$). The educational level of urban parents was statistically higher than this level in rural parents ($P < 0.001$). The paternal education was higher among the group of girls than in boys as well ($P = 0.006$). The mean (SD) of daily homework time was 2.29 (1.08) hours, and this value was statistically significant in rural and urban areas as well as in boys and girls ($P < 0.001$). Mean screen time in all students was 1.27 ± 0.68 hours. This mean was statistically different in urban and rural areas (1.28 ± 0.68 and 1.25 ± 0.67 hours respectively, $P = 0.03$), but not in the boys and girls (1.28 ± 0.69 and 1.26 ± 0.67 hours, respectively, $P = 0.24$). Overall, school performance in 9,667 (69.2%) students was very good, and the corresponding figure was statistically different in the study sample considering student's gender and living area; girls and urban inhabitants had higher school grades

than boys and rural inhabitants (71.2%, 70.3%, 67.2% and 66.5%, respectively, $P < 0.001$). **Table.2** shows the association of screen and homework time with school performance. The differences considering the time spent on television viewing, computer use, screen time, homework and cell phone use were not statically significant among students with better school performance and other students. **Table.3** shows the abovementioned associations based on logistic regression analysis via crude and adjusted models. We found that higher screen time was related to lower school performance (odds ratio [OR] = 1.11, 95% confidence interval [CI] = 1.00-1.24, $P = 0.03$). Other models of logistic regression analysis revealed no further relationship between the times spent using cell phone and watching T.V watching time, personal computer (PC) working time, and homework time with school performance independently.

Table-1: Baseline and anthropometric characteristics of study participants: the CASPIAN-V study.

Variables	Total	Boys	Girls	P-value	Rural area	Urban area	P-value
Age (year) ^a	12.28 (3.15)	12.39 (3.14)	12.17 (3.16)	< 0.001 ^c	11.49 (2.70)	12.59 (3.27)	< 0.001
Paternal education (%) ^b							
Illiterate	1734 (12.6%)	876 (12.5%)	858 (12.6%)	0.006	642 (16.3%)	1092 (11.1%)	< 0.001
Diploma/under diploma	10152 (73.7%)	5211 (74.6%)	4941 (72.7%)		2894 (73.3%)	7258 (73.8%)	
Academic	1892 (13.7%)	895 (12.8%)	997 (14.7%)		410 (10.4%)	1482 (15.1%)	
Maternal education (%) ^b							
Illiterate	2500 (17.7%)	1298 (18.1%)	1202 (17.2%)	0.20	957 (23.6%)	1543 (15.3%)	< 0.001
Diploma/under diploma	10137 (71.6%)	5125 (71.5%)	5012 (71.7%)		2770 (68.4%)	7367 (72.9%)	
Academic	1523 (10.8%)	747 (10.4%)	776 (11.1%)		324 (8.0%)	1199 (11.9%)	
Number of family members (%) ^b							
≤ 4	6735 (47.9%)	3444 (48.3%)	3291 (47.4%)	0.31	1718 (42.9%)	5017 (49.9%)	< 0.001
> 4	7331 (52.1%)	3686 (51.7%)	3645 (52.6%)		2289 (57.1%)	5042 (50.1%)	
Socioeconomic status (%) ^b							
Low	4559 (33.5%)	2325 (33.6%)	2234 (33.3%)	0.07	1657 (42.7%)	2902 (29.8%)	< 0.001
Moderate	4515 (33.1%)	2343 (33.8%)	2172 (32.4%)		1230 (31.7%)	3285 (33.7%)	
High	4552 (33.4%)	2255 (32.6%)	2297 (34.3)		996 (25.7%)	3556 (36.5%)	
Yes	5772 (43.2%)	2932 (43.4%)	2840 (43.1%)		1661 (43.2%)	4111 (43.3%)	
Physical activity (%) ^b							
Low	8235 (58.2%)	4020 (56.2%)	4215 (60.4%)	< 0.001	2301 (56.7%)	5934 (58.8%)	0.02
High	5906 (41.8%)	3138 (43.8%)	2768 (39.6%)		1754 (43.3%)	4152 (41.2%)	
TV watching time per day (hour) ^a	1.97 (1.01)	1.97 (1.01)	1.96 (1.01)	0.51	1.97 (1.01)	1.96 (1.01)	0.56
TV watching time per day (%) ^b							

Low	6506 (45.7%)	3297 (45.8%)	3209 (45.7%)	0.94	1873 (45.9%)	4633 (45.6%)	0.76
High	7721 (54.3%)	3908 (54.2%)	3813 (54.3%)		2205 (54.1%)	5516 (54.4%)	
PC working per day (hour) ^a	0.57 (0.80)	0.57 (0.82)	0.56 (0.79)	0.30	0.52 (0.77)	0.59 (0.81)	< 0.001
PC working per day (%) ^b							
Low	12653 (91.0%)	6367 (90.5%)	6286 (91.5%)	0.052	3673 (92.2%)	8980 (90.5%)	0.001
High	1252 (9.0%)	666 (9.5%)	586 (8.5%)		310 (7.8%)	942 (9.5%)	
Screen time (hour) ^a	1.27 (0.68)	1.28 (0.69)	1.26 (0.67)	0.24	1.25 (0.67)	1.28 (0.68)	0.03
Screen time (%) ^b							
Low	11644(83.8)	5863(83.4%)	5781 (84.3%)	0.18	3370 (84.6)	8274(83.5%)	0.11
High	2243(16.2%)	1164 (16.6%)	1079 (15.7%)		612 (15.4%)	1631(16.5%)	
Homework time per day (hour) ^a	2.29 (1.08)	2.24 (1.07)	2.33 (1.08)	< 0.001	2.20 (1.05)	2.32 (1.08)	< 0.001
Homework time per day (%) ^b							
Low	5308 (37.4%)	2801 (38.9%)	2507 (35.8%)	< 0.001	1641 (40.3%)	3667 (36.2%)	< 0.001
High	8891 (62.6%)	4393 (61.1%)	4498 (64.2%)		2431 (59.7%)	6460 (63.8%)	
Cell phone using time per day (hour) ^a	0.23 (0.57)	0.25 (0.61)	0.20 (0.53)	< 0.001	0.16 (0.50)	0.25 (0.60)	< 0.001
Cell phone using time per day (%) ^b							
Low	13477 (96.8%)	6813 (96.3%)	6664 (97.2%)	0.002	3887 (97.8%)	9590 (96.3%)	< 0.001
High	451 (3.2%)	262 (3.7%)	189 (2.8%)		87 (2.2%)	364 (3.7%)	
Final educational category in the past year (%)							
Very good	9667 (69.2%)	4751 (67.2%)	4916 (71.2%)	< 0.001	2657 (66.5%)	7010 (70.3%)	< 0.001
Not very good	4303 (30.8%)	2318 (32.8%)	1985 (28.8%)		1338 (33.5%)	2965 (29.7%)	

a: Data are presented as mean (standard deviation) and p-values are resulted from T-test

b: Data are presented as n (%) and p-values are resulted from Chi- square test

c: Significant P-values are bolded

TV: television, PC: personal computer.

Table-2: The relationship of screen time and homework time with school performance: the CASPIAN-V study.

Variables	Final educational category in the past year		P-value
	Very good	Not very good	
TV watching time per day (hour) ^a	1.97 (1.01)	1.94 (1.01)	0.15
TV watching time per day (%) ^b			
Low	4430 (69.2%)	1968 (30.8%)	0.98
High	5227 (69.2%)	2324 (30.8%)	
PC working per day (hour) ^a	0.56 (0.77)	0.58 (0.85)	0.27
PC working per day (%) ^b			
Low	8648 (69.6%)	3771 (30.4%)	0.32
High	833 (68.3%)	387 (31.7%)	
Screen time (hour) ^a	1.27 (0.67)	1.26 (0.69)	0.69
Screen time (%) ^b			
Low	7979 (69.8%)	3460 (30.2%)	0.18
High	1494 (68.3%)	693 (31.7%)	
Homework time per day (hour) ^a	2.30 (1.08)	2.28 (1.06)	0.47
Homework time per day (%) ^b			

Low	3630 (70.0%)	1554 (30.0%)	0.13
High	6013 (68.8%)	2727 (31.2%)	
Cell phone using time per day (hour) ^a	0.23 (0.58)	0.22 (0.57)	0.23
Cell phone using time per day (%) ^b			
Low	9137 (69.1%)	4079 (30.9%)	0.56
High	314 (70.4%)	132 (29.6%)	

a: Data are presented as mean (standard deviation) and p-values are resulted from T-test
b: Data are presented as n (%) and p-values are resulted from Chi square test
TV: television, PC: personal computer.

Table-3: Association of screen time and homework time with school performance: the CASPIAN-V study

Variables	Sub-model	Final educational category in the past year (not very good/very good)		
		OR	95% CI	P-value
TV watching time per day (hour) ^a	Model I ^a	0.97	0.94-1.01	0.15
	Model II ^b	0.98	0.94-1.02	0.36
TV watching time per day (high/ low)	Model I ^a	1.001	0.93-1.07	0.98
	Model II ^b	1.01	0.94-1.09	0.68
PC working per day (hour)	Model I ^a	1.02	0.98-1.07	0.26
	Model II ^b	1.04	0.99-1.09	0.07
PC working per day (high/ low)	Model I ^a	1.06	0.93-1.20	0.32
	Model II ^b	1.11	0.97-1.27	0.12
Screen time (hour)	Model I ^a	0.98	0.93-1.04	0.69
	Model II ^b	1.01	0.95-1.07	0.69
Screen time (high/ low)	Model I ^a	1.07	0.96-1.18	0.18
	Model II ^b	1.11	1.00-1.24	0.03
Homework time per day (hour)	Model I ^a	0.98	0.95-1.02	0.47
	Model II ^b	1.00	0.97-1.04	0.78
Homework time per day (high/ low)	Model I ^a	1.05	0.98-1.14	0.13
	Model II ^b	1.04	0.96-1.13	0.24
Cell phone using time per day (hour)	Model I ^a	0.96	0.90-1.02	0.23
	Model II ^b	0.99	0.92-1.06	0.81
Cell phone using time per day (high/ low)	Model I ^a	0.94	0.76-1.15	0.56
	Model II ^b	1.01	0.80-1.26	0.92

a: Crude model
b: Adjusted for age, sex, living area, physical activity, and socioeconomic status
TV: television, PC: personal computer; OR: Odds ratio; 95% CI: 95% confidence interval.

4- DISCUSSION

In the current study, we investigated the relationship between different aspects

of screen time and school performance among a large sample of Iranian children and adolescents. As the first point, we

found that students in the urban area were less physically active than their rural counterparts. This finding may be because of farm-based activities among rural children in comparison with urban residents. Moreover, as we expected, urban students had higher socio-economic families, and their parents were higher educated compared to rural students. We suggest that according to the social welfare condition in Iran, more top educational facilities and recourses in the urban areas can explain such difference (28).

It should be noted that Iranian urban school children use cell phone and personal computer more than rural students. Nevertheless, and interestingly, in our study the urban students had better school performance; this may be because of the more prolonged time they spent on doing their homework or possible appropriate educational content they had watched, although we did not investigate the effects of media content. Our findings showed that boys spend more time on physical activity than girls. Also, boys spend less time doing homework than girls. Similarly, a German cross-sectional survey indicated that boys are at higher risk for presenting lower school performance as much as they increase their media-usage time (29). Gender differences in educational achievement have been reported before in various aspects of schooling (30, 31).

The average of media consumption among children aged 9-16 years old is proposed to be more than 4 hours/day in western industrial countries (32). The adverse effects of television viewing on children's academic performance are well documented worldwide. Different hypotheses are proposed through which watching television might affect school performance. One of these mechanisms is the time displacement hypothesis in which watching television reduces the efficient time that could be spent on studying or

doing homework (33). Similarly, we found that the lower school performance of boys in comparison with girls might be, at least in part, due to the higher time spent on using a cell phone and subsequently lower time spent on doing homework among boys than in girls. In our study screen time was inversely associated with school performance. In other words, the odds of having poor school performance was 1.11 higher given high screen time compared to low screen time. This is consistent with previous research in which the impacts of media time have been investigated (12, 34). However, as we mentioned, nowadays, the effects of media content have received remarkable attention besides the media usage time in the literature.

For instance, watching educational programs was linked with higher grades and higher creativity among boys and girls in previous research (35). Furthermore, we found that homework time, television watching time, computer using time and cell phone using time might not impact separately on school performance. Positive effects of homework time on school performance is well-illustrated (36). There are controversies about the effects of computer game and internet usage on children's academic performance as well (16, 32). It seems that the conflicting results may be related to different types of academic performance assessments in different countries (16).

In a recent study on a representative sample of early Canadian adolescents, the authors demonstrated that screen time affects academic achievement independently. In the mentioned study other health behaviours such as physical activity, diet and sleep were investigated and found to be impressive on academic achievement as well (37). On the other hand, poor academic success may be related to further undesirable consequences for children later in their lives (38). Thus, increasing public awareness about all

known aspects of healthy behaviours and not just focusing on reducing screen time would be necessary to achieve better academic performance and subsequently better health outcomes among children and adolescents (39).

4-1. Limitations of the study

Our study was conducted among a large representative sample of Iranian children all over the country. Many aspects of screen media time were considered to be correlated with school performance. Also, we reported demographic factors of the study population separately according to gender and living area. Despite the mentioned strengths, the nature of our study was cross-sectional. We did not focus on media content as an independent variable.

5- CONCLUSION

In brief, we conclude that in Iran, urban children spend more time doing homework and viewing screen media than rural students. Regarding descriptive evaluation scales which are used in schools (very good, good, acceptable, requiring more effort); urban students are more successful in school performance compared to rural students. Girls have higher homework time and school performance than boys. Leisure activities including television viewing time, computer using time, homework time and cell phone using time might have no separate significant effect on school performance, although prolonged screen time is associated with poor school performance in Iranian children. Further investigation could be held to reinforce the evidence in this field.

6- CONFLICT OF INTEREST: None.

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8- AUTHOR'S CONTRIBUTION

SBM contributed in the conception of the work, manuscript preparation, manuscript revision, final approval of the manuscript and agreed to be accountable for all aspects of the work.

PB contributed in the conception of the work, manuscript preparation, manuscript revision, final approval of the manuscript and agreed to be accountable for all aspects of the work.

MQ contributed in statistical analysis, interpretation of data, manuscript revision, and final approval of the manuscript and agreed to be accountable for all aspects of the work.

MEM contributed in study design, data acquisition, manuscript revision, final approval of the manuscript and agreed to be accountable for all aspects of the work.

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RH contributed in the conception of the work, study design, interpretation of data, manuscript revision, and final approval of the manuscript and agreed to be accountable for all aspects of the work.

RK contributed in the conception of the work, study design, manuscript revision, and final approval of the manuscript and agreed to be accountable for all aspects of the work.

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