The influence of media on the sleep quality in adolescents

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This study was conducted to evaluate the influence of media devices on sleep quality in adolescents. Applying a descriptive design, the study was carried out with 9th, 10th and 11th grade students (N=392, 52.0% female, average age 16.04±0.86) who were attending Konya High School between the dates of January 18 and 22, 2016. Changes were seen to occur in the wake-up times of those who had either a television or a computer in their bedrooms (p<0.005, p<0.05, respectively). Overall, it was determined that the students who participated in the study had poor sleep quality (66.6%). A positive correlation was detected between the amount of time the adolescents spent watching TV, using the internet, and playing games on their mobile phone, and the wake-up times (r=0.154, p<0.005; r=0.152, p<0.005; r=0.258, p<0.001; r=0.232, p<0.001, respectively). A negative correlation was detected between playing computer/console games and listening to music and sleep duration in the adolescents (respectively, r=-0.149, p<0.005; r=-0.107, p<0.05). The results showed that as the adolescents spent more time with their media products (except TV watching), their sleep quality deteriorated. In adolescents, the duration and quality of sleep were found to be affected by certain aspects of media use. It is therefore recommended that families regulate the intended purpose and content of their children's media use and limit the time spent with media. Moreover, media products should be removed from their bedrooms. More training and intervention studies on sleep patterns and media literacy should be conducted with this study group.

Key words: adolescents, media, sleep quality, sleep routines, sleep.

In addition to being a period of relative unconsciousness that can be interrupted, sleep is a regular cycle of a person's life from birth on and functions as a healthy preparation for the following day, enabling a person to rest, grow, develop, and learn.[1] Although the duration of sleep varies from person to person, studies have shown that adolescents need at least 8-10 hours of sleep per night.[2] Adolescence is a period wherein individuals experience significant physical, emotional, and cognitive changes. Sleep, as an essential component of development, can significantly affect the thinking, behavior and emotional well-being of adolescents. Daily activities, individual factors, and environmental changes can have an impact on the sleep patterns of adolescents.[3] For example, television, nicotine, caffeine and the internet are important environmental factors that affect the sleep duration of school-aged children.[4] In today's culture, electronic media has been shown to have a negative effect on the sleep patterns of children and adolescents.[5,6]

The results from a study conducted in the United States to describe the use of technology and sleep quality and to determine the correlation between technology and sleep quality (N=1,508 people, aged 13-64), in contrast to the use of passive technology devices (such as music players), showed that the use of interactive technology tools (computers, mobile phones, video game consoles) made it difficult to go to sleep (β=9.4, p <0.0001) and prevented a refreshing sleep (β=6.4, p

<0.04).[7] From a meta-analysis of forty-one studies published between 2003 and 2014, it was concluded that video game, telephone, computer and internet use delayed the bedtime in adolescents (between 12 and 18 years of age).[8] In a systematic review of sixty-seven studies, conducted between 1999 and 2014, to assess the correlation between sleep and the amount of time spent on screen (TV, video games, mobile devices) in school children and adolescents, it was found in 90% of the studies that the time spent on screen affected sleep negatively (shortening the time and delaying bedtime).[6]

A study evaluating the correlation between specific technology and adolescent sleep quality, the amount of sleep time was determined to have an inverse correlation between the frequent use of all technology types and the duration of weekday sleep.[9] Furthermore, it was found in a study that excessive TV watching and the presence of a TV in the bedroom were associated with short sleep duration in children, and that 1 hour of daily increase in lifetime TV watching time resulted in a 7 minute reduction in daily sleep.[10]

The use of multiple, as opposed to single, electronic media devices is common among young people. In Turkey, there is very little information about the influence of multi-media use on sleep; in fact, we found no studies evaluating the influence of multiple media products on sleep quality in our country. Therefore, there is a need to conduct descriptive research on this subject in Turkey. The aim of this study was to assess sleep quality in adolescents as it relates to the influence of media devices for the purpose of revealing whether or not Turkey faces a problem concerning this subject.

Material and Methods

Participants and procedure

In this study, which was conducted between the dates of January 18 and 22, 2016, a descriptive research design was used to evaluate the sleep quality in adolescents as it relates to the influence of media devices. The population of the study consisted of 9th, 10th, and 11th grade students (N= 982) attending Konya High School in the 2015-2016 academic year. Students with any psychological disorder,

respiratory sleep disorder, or neurological disease were excluded from the study. Data concerning the subject were collected from a total of 392 students who had voluntarily agreed to participate in the study. Before administering the questionnaire, students were informed about the questions. The survey took an average of 20-30 minutes to complete.

Prior to starting the study, permission to perform it was granted with the institutional approval obtained from the Konya Provincial Directorate for National Education and with the ethical approval (decision number 2016/1, dated January 12, 2016) obtained from the Selçuk University Ethics Committee. Informed consent was obtained from all the individual students included in the study and from their parents.

Instruments

Introductory Characteristics of the Students and Status of Media Use Habits Information Form

This form was created by the researcher for the purpose of gathering information related to the variables that had been determined to have an impact, according to a review of the relevant literature, on the children constituting the study sample.[5,6, 11-18] On this form, the amount of time children engaged in watching TV/cinema, playing computer/console games, using internet, listening to music and playing games with mobile phones during the weekdays and at weekends was evaluated separately.

Pittsburgh Sleep Quality Index (PSQI)

The PSQI was developed by Buysse et al.[19] and adapted to Turkish by Ağargün et al.[20] The PSQI is a 19-item self-report index that assesses sleep quality and disturbance over the past month. It consists of 24 questions, including 19 self-report questions and 5 questions that are to be answered by the spouse or roommate. The 19 self-report questions of the index consist of 7 components, namely, subjective sleep quality, sleep latency, sleep duration, usual sleep efficiency, sleep disturbance, use of a sleeping pill and daytime dysfunction. Each component is evaluated on the basis of a 0-3 point system. The total score of the seven components gives the total score of the index, with the total score ranging from between 0 and 21. A total score higher than 5 indicates

Table I. Descriptive Characteristics of the Study Group (n=392).

Gender	N	%
Gender		
Female	204	52.0
Male	188	48.0
Family income state		
Low	16	4.1
Middle	195	49.7
Good	168	42.9
High	13	3.3
Family structure		
Nuclear	346	88.3
Extended	37	9.4
Single parent	9	2.3
Sufficiency of sleep duration		
Sufficient	199	50.8
Insufficient	193	49.2
General status of sleep		
Perfect	139	35.5
Moderate	224	57.1
Poor	29	7.4
Status of waking up at night		
Yes	161	41.1
No	231	58.9
Status of sleep depth		
Perfect	158	40.3
Moderate	211	53.8
Poor	23	6.9

"poor sleep quality". The 5 questions of the index that are supposed to be filled out by the spouse/roommate of the person taking the test was not used since the current study was conducted on adolescents.

Statistical analysis

The data obtained from the study were evaluated in the SPSS 15.0 program. Daily mean time of media usage was found by calculated the following formula: (weekday time x 5 + weekend time x 2)/7. The time spent in front of screens was obtained by totaling the daily mean amount of time spent watching TV/ cinema, playing computer/console games, using the internet and playing games with mobile phones. Frequency and percentage were used to analyze the students' demographic information, sleep routines, media use habits and duration of time; the t test, a test of differences between two independent groups, was used to test the correlation between the presence of a computer and TV in the bedroom and sleep parameters; bivariate Pearson correlation test was used to test the correlation between amount of media use times and sleep parameters; and lastly, Chi-square test was used to test the correlation between the time spent in front of screens (2<, 2 ≥) and PSQI.

Results

The descriptive characteristics of the study group are given in Table I, where it can be seen that 52.0% of the students were female, the mean age was 16.04±0.86 years, 92.6% of the income states were either moderate or

Table II. Sleep Parameters According to the Presence of Computer and TV in the Bedroom.

Sleep parameters	Present	Absent	F*	P value
The presence of computer in the bedroom	226	166		
Usual bedtime	23.32±1.07	23.38±1.13	0.937	0.334
Usual wake up time	7.30±1.44	6.55±1.00	11.153	0.001
Sleep duration (hours)	7.05±1.58	7.03±1.41	0.619	0.432
The presence of TV in the bedroom	48	344		
Usual bedtime	23.14±1.40	22.92±1.01	3.753	0.053
Usual wake up time	6.92±1.71	6.73±1.21	4.078	0.044
Sleep duration (hours)	6.83±1.64	7.07±1.50	1.339	0.248

* Paired sample t test,

Table III. The Distribution of Sleep Routines in the Study Group.

Sleep routines *	Routines performed before going to bed		The reason to delay the bedtime	
	N	%	N	%
Reading book	189	48.2	137	34.9
Listening to music	194	49.5	43	11.0
Playing computer/console games etc.	60	15.3	62	15.8
Internet use	158	40.3	67	17.1
Social network	175	44.6	69	17.6
Watching TV or DVD movie	110	28.1	71	18.1
Spending time on mobile phone (playing game, talking, texting etc.)	167	42.6	73	18.6
Study	180	45.9	290	74.0
Study with computer	33	8.4	47	12.0
Directly going to bed	122	31.1	16	4.1
Other (having bath etc.)	9	2.3	28	7.1

* Multiple options were checked.

good, and 88.3% of the students had a nuclear family structure. Furthermore, the table shows that 41.1% of the students woke up at night and that the sleep duration of 50.8% of the students was not sufficient. The sleep depth of 60.7% and the general sleep status of 64.5% were evaluated as moderate and poor, respectively (Table I). Finally, the students were found to have a usual bedtime at the hour of 23.34±1.07, a wake-up time at the hour of 6.75±1.29 and a sleep duration of 7.04±1.51 hours.

A comparison of the presence of a computer and TV in the bedroom with sleep parameters is shown in Table II. The usual bedtime of the adolescents who had a computer in their bedroom was found to be at the hours of 23.32±1.07, while the usual bedtime of the adolescents who did not have a computer in their bedroom was found to be at the hour of 23.38±1.13; the usual bedtime of the adolescents who had TV in their bedroom was found to be at the hour of 23.14±1.40, while the usual bedtime of the adolescents who did not have a TV in their bedroom was found to be at the hour of 22.92±1.01. Regarding the usual wake-up times, the adolescents who had a computer in their bedroom were found to have wake-up times at the hour of 7.30±1.44, while those who did not have a computer in their bedroom had wake-up times at the hour of 6.55±1.00; the usual

wake-up time of the adolescents who had TV in their bedroom was found to be at the hour of 6.92±1.71, while the usual wake-up time of the adolescents who did not have a TV in their bedroom was found to be at the hour of 6.73±1.21. This difference was found to be statistically significant (respectively, p<0.005, p <0.05). The sleep duration of those who had a computer in their bedroom was found to be 7.05±1.58 hours, while the sleep duration of those who did not have a computer in their bedroom was found to be 7.03±1.41 hours; the sleep duration of those who had a TV in their bedroom was found to be 6.83±1.64, while the sleep duration of those who did not have a TV in their bedroom was found to be 7.07±1.50 hours (Table II). The usual wake-up time of the adolescents was at the hour of 6.48±0.79 for females and 7.05±1.62 for males. This difference was found to be statistically significant (p<0.001). The mean score of the answers on the PSQI total was calculated to be 6.83±3.49 for females and 7.34±3.12 for males (p>0.05).

Table III shows the distribution of the sleep routines of the study group. The adolescents in the study group specified their routines before going to bed as follows: 49.5% listened to music, 48.2% read a book, 45.9% studied, 44.6% spent time on a social network site, 42.6% spent time on a mobile phone, 43.4% played computer/console games and watched TV/DVD, 40.3% used the internet. Bedtime was delayed in 74.0% of the adolescents who studied, in 34.9% who read a book and in 87.2% of those who spent time with any media product (social network, internet, computer games, TV, mobile phone) (Table III).

As Table IV shows, the mean scores of the adolescents on the subcomponents of the PSQI were calculated to be as follows: subjective sleep quality component 1.06±1.09; sleep latency component 1.36±1.42; sleep duration component 1.36±0.83; usual sleep efficiency component 0.63±1.02; sleep disturbance/ disorder component 0.71±0.45; the use of sleep pill component 0.93±0.86; and the daytime dysfunction component 1.02±0.47. The mean score for the PSQI total was determined to be 7.07±3.32. According to the PSQI scores, 66.6% of the adolescents participating in the study had poor sleep quality (Table IV).

The correlations between the sleep parameters of the study group and the mean media interaction times are shown in Table V. It was found that the mean TV/cinema watching time of the study participants was 1.66±1.60 hours during the day, the mean computer/console playing time was 0.90±1.51 hours, the mean internet use time was 3.43±3.39 hours, the mean time spent listening to music was 2.32±2.90 hours, the mean playing time on mobile phone was 0.79±1.31 hours and the time spent in front of screens was 6.78±5.10 hours. There was a positive correlation (respectively r=0.154, r=0.152, r=0.258, r=0.232) between watching TV/cinema, the use of internet, playing games with their mobile phones, the length of time spent in front of screens and the wake-up time in adolescents (p<0.01, p<0.01, p<0.01, p<0.01, respectively). There was a negative correlation between playing computer/console game and listening to music (r=-0.149, r=-

Table IV. Pittsburgh Sleep Quality Index Scores of the Study Group.

PSQI scores	Results
Subjective sleep quality	1.06±1.09 (0-3)
Sleep latency	1.36±1.42 (0-5)
Sleep duration	1.36±0.83 (0-3)
Usual sleep efficiency	0.63±1.02 (0-3)
Sleep disturbance/disorder	0.71±0.45 (0-1)
Use of sleeping pills	0.93±0.86 (0-3)
Daytime dysfunction	1.02±0.47 (0-2)
Total PSQI	7.07±3.32 (1-18)
Poor sleep quality*, N (%)	261 (66.6)

*PSQI ≥5; Data is presented as mean±standard deviation (minimum-maximum)

Table V. The Correlations between the Sleep Parameters and the Mean Media Interaction Times.

Mean media interaction time (hours/day)		Mean±SD	Usual bedtime		Usual wake up time		Sleep duration		Total PSQI	
			r	p	r	p	r	p	r	p
Watching TV/cinema	Weekday	1.46±1.71								
	Weekend	2.18±1.72								
	Mean daily	1.66±1.60	-0.078	0.122	0.154	0.002	0.092	0.069	0.002	0.972
Playing computer/ console game	Weekday	0.65±1.37								
	Weekend	1.53±2.34								
	Mean daily	0.90±1.51	0.049	0.337	0.054	0.289	-0.149	0.003	0.144	0.040
Internet use	Weekday	3.13±3.30								
	Weekend	4.18±3.83								
	Mean daily	3.43±3.39	-0.013	0.792	0.152	0.002	-0.041	0.417	0.234	<0.001
Listening to music	Weekday	2.23±2.88								
	Weekend	2.55±3.29								
	Mean daily	2.32±2.90	0.037	0.463	-0.001	0.985	-0.107	0.034	0.122	0.016
Playing games with mobile phone	Weekday	0.69±1.21								
	Weekend	1.01±1.74								
	Mean daily	0.79±1.31	0.024	0.637	0.258	<0.001	0.025	0.617	0.136	0.007
The mean time spent in front of screens		6.78±5.10	-0.013	0.800	0.232	<0.001	-0.036	0.472	0.233	<0.001

0.107, respectively), and sleep duration in the adolescents ($p<0.01$, $p<0.05$, respectively), whereas there was a positive correlation between playing computer/console games, internet use, listening to music, playing games on mobile phones, and the length of time spent in front of screens (r=0.144, r=0.234, r=0.122, r=0.136, r=0.233, respectively), and the PSQI total score in the adolescents ($p<0.01$, $p<0.01$, $p<0.05$, $p<0.01$, $p<0.01$, respectively) (Table V). No correlation was found between age and the wake-up time, the usual bedtime, the sleep duration and PSQI total score in the adolescents (respectively r=0.009, r =-0.028, r =-0.058; $p>0.05$).

Discussion

In this study, the usual bedtime of the students was at the hour of 23.34±1.07, the usual wake-up time was at the hour of 6.75±1.29 and the average sleep duration was 7.04±1.51 hours per night (Table I). A study conducted by Mak et al.[14] on adolescents (mean age of 15.27) in Hong Kong showed that the participants slept an average of 7.74±1.46 hours per night. It

was found in another study conducted on adolescents (mean age 15.2±1.4) that the mean weekday sleep duration was 08.06 hours, the mean weekend sleep duration was 09.30 hours, and the mean bedtime was at the hour of 23.50 on the weekdays and 00.39 at the weekends; the mean wake-up time was reported to be at the hour of 07.55 o'clock on weekdays and at the hour of 10.03 on weekends.[15] It is recommended that adolescents get no more than 11 hours nor less than 7 hours of sleep.[2] The average sleep duration of the study group youth in the present study fell nearer to the lower limit value. For future studies, it would be useful to conduct training and intervention research on sleep patterns and media literacy in an adolescent study group that includes the participation of family members and school personnel.

It was found in the study that when the adolescents had either a TV or computer in their bedrooms, this caused changes in their wake-up time (respectively p <0.01, p <0.05) (Table II). In a study conducted on Swedish children (N= 616), a correlation was found

between sleep deprivation and the presence of a TV in the bedroom or spending more than 2 hours in front of a TV or computer.[12] Watching too much TV has been found to be associated with sleep disorders in adolescence, and the presence of a TV or a computer in the child's room has been shown to cause changes in sleep parameters, especially in bed times and sleep duration.[21] Moreover, the presence of a TV in the bedroom is associated with shorter durations of sleep.[10] In one study, the presence of media products in bedrooms was reported to have a positive correlation with sleep delays, both on weekdays and weekends, late wake up, and shortened sleep duration.[11] The sleep pattern changes observed in our study were similar to those reported in other studies. To address these negative effects of media on sleep, first and foremost, all media products should be removed from the bedrooms and adolescents should reduce their use of media just before going to bed. It is important that families, children and school personnel receive training in the use of media so as to become more aware of the risks it poses to sleep patterns. Lastly, families should regulate their children's intended use of media and its content and limit the time they spend on media devices.

The adolescents in our study reported that the reasons for delaying bedtime were related to their routine of using media products (online social networks, internet, computer games, TV, mobile phones) before going to bed (Table III). In a study conducted on this matter, it was shown that, unlike the use of passive technological devices (such as music players), the use of interactive technological devices (such as computers/laptops, mobile phones, video game consoles) made the onset of sleep difficult ($\beta=9.4$, p <0.0001) and had a hindering effect on refreshing sleep ($\beta=6.4$, p<0.04).[7] A meta-analysis of forty-one studies showed that video game, telephone, computer and internet use delayed the bed time of adolescents (aged between 12-18).[8] Similarly, in a systematic review of sixty-seven studies, it was shown in 90% of those studies that large amounts of time spent in front of screens affected sleep negatively (shortening sleep duration and delaying bedtime).[6] Zimmerman[22] reported in his study that in adolescents for every hour spent using a media device, the

time spent in some other more constructive daily activity is lost or compromised, such as the amount and quality of sleep. It was found in a study conducted by Johansson et al.[17] that 97% of adolescents used some form of technological products before bedtime, and that this negatively affected their nighttime sleep and daytime functions. In another study conducted on the same subject matter, it was reported that one hour or more spent in front of a screen in the evening is associated with increased sleep problems, particularly problems related to bed time and wake-up time.[23] A review of 36 studies, conducted on adolescents, from around the world revealed that media use before sleep was associated with delayed bedtime and shortened total sleep duration.[5]

Our study found that because adolescents spent much of their time with media products, and thereby a large amount of time in front of screens, either watching TV, using the internet, or playing games on their mobile phones, their wake up times were delayed, and moreover, it was found that as a result of large amounts of time spent playing computer/console games or listening to music, sleep duration was shortened; in other words, the increase in students' playing time on computer/console games and listening to music negatively affected sleep durations (Table V). In one study, it was determined that the use of media had a positive correlation with delaying bedtime, waking up late, and shortened sleep duration, both on weekdays and weekends.[11] A study conducted by Arora et al.[9] reported that listening to music and playing video games often prolonged the onset of sleep; it was further revealed that the correlation between the frequent use of all types of technology and the frequency of early wake up was statistically significant. It was found in a study conducted by Orzech et al.[18] that the use of digital media for long durations of time was associated with a decrease in total sleep duration and a delay in going to bed. In another study, it was shown that the use of media led to going to bed late and waking up late in the morning.[16] Furthermore, in a study conducted on children who were 10 and 11 years of age (N= 353, 51% girls) in 27 schools in Finland, it was statistically determined that watching TV and using the computer reduced sleep duration and caused the children to go to bed late.[13] Our study found

that the adolescents strongly attributed the routines they had before going to bed, which included using media products, to their habit of delaying bedtime. It can be argued that because of the increased amount of time they spent in front of screens watching TV, using the internet, and playing games on mobile phones, their wake-up times were delayed. It could be argued that the children of today are consumed by their media devices, spending more time using various media tools than the amount of time they spend at school.[24] Nowadays adolescents are surrounded by media products, both electronic (TVs, computers, electronic games and/or internet, mobile phones and music players) and non-electronic (journals, magazines, newspapers, books), and they have easy access to these products. Children do not only watch TV at home but also spend significant amounts of time with electronic media products, like the ones named above. Consequently, the total amount of time they spend in front of screens increases and their sleep patterns (bedtime, wake up time, sleep duration) vary. In addition, the young population tends to forge social relations with peers through technological tools. Due to the influence of all these factors, it can be said that the adolescents in the study group used media products almost unconsciously. Given this situation, it is important that adolescents make lifestyle changes to regulate their sleep patterns, such as removing media products from their bedrooms, not using media products two hours before bedtime and participating in more constructive activities that utilize their time in a higher quality manner.

More than half of the students (66.6%) in this study were found to have poor sleep quality (Table IV). As adolescents spent more time with their media products (except TV watching), their sleep quality deteriorated (Table V). A study conducted on Japanese school children (N=261, mean age 12.8 years) revealed that sleepiness was associated with sleep disturbances/disorders and amount of media use time.[25] Watching too much TV has been found to be associated with short sleeping cycles in children, and furthermore, it has been determined that a daily increase of 1 hour in lifetime TV watching time resulted in a 7 minute reduction in daily sleep.[10] A study evaluating the correlation between specific

technology and adolescent sleep quality, amount of sleep and parasomnia (N= 738; 54.5% male) found there to be an inverse correlation between the frequent use of any technological devices and weekday sleep duration (hour).[9] In our study, it was determined that sleep quality was adversely affected when the sleep quality was reported to be poor and the amount of time spent with media products increased (except for watching TV). Good sleep quality is described as sleep that results in an individual feeling energetic, fit and ready for a new day after she/he wakes up. Sleep quality is affected by many factors, such as lifestyle, environment, work, social life, economic status, general health condition and stress.[20] It is not possible to link the impaired sleep quality of the adolescents in the study group to the time they spent in front of screens alone; nonetheless, it could be argued that the time spent in front of the screen is a strong determinant. Today, it has been emphasized by experts that children over the age of two should be limited to a maximum of two hours in front of the screen (watching TV/videos, playing computer/video games).[26-28] Students in the study group first need to make changes in their habits. Families should regulate how their children use media and the content and should limit the amount of time spent on them. Moreover, media products should be removed from the rooms of adolescents. In future studies, it is suggested that training and intervention studies be conducted on sleep pattern and media literacy using an adolescent study group that includes family members and school personnel.

This study did involve certain limitations, including the fact that the study was conducted only on 9th, 10th, 11th grade students who were attending Konya High School, and that media use habits were evaluated according to the statements of the students rather than according to reports taken from a more objective source. However, we believe that the results of the study are important in terms of raising awareness, considering that in Turkey there is no other study that has been conducted on this subject.

To conclude, the sleep quality and sleep duration of the adolescents were affected due to the influence of media devices. The length of time that adolescents spend with media

products is a matter of concern, especially considering the lasting effects incurred from the amount of the time spent in front of screens. It is recommended that researchers interested in this topic perform their studies using a randomized controlled experimental design and expanding the sample group.

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