

The Relationship Between Digital Game Addiction and Sleepiness in Adolescents: A Cross-Sectional Study

Adölesanlarda Dijital Oyun Bağımlılığı ile Uykululuk Durumları Arasındaki İlişki: Kesitsel Bir Araştırma

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ABSTRACT

Introduction: The uncontrolled use of digital games for long periods of time may lead to changes in sleep patterns in children and adolescents. This study was conducted to examine the relationship between digital game addiction and sleepiness in adolescents.

Materials and Methods: This cross-sectional study was conducted with 263 adolescents aged 12-18 years who were studying in three high schools in a district center in the Western Black Sea Region and who agreed to participate in the study. The study data were collected between March and May 2024 using the "Introductory Information Form", "Digital Game Addiction Scale (DGAS)" and "Epworth Sleepiness Scale".

Results: The mean total score on the Digital Game Addiction Scale was 15.39 ± 6.10 , while the mean total score on the Epworth Sleepiness Scale was 7.37 ± 4.42 . As indicated by the Epworth Sleepiness Scale, 30.0% of the adolescents exhibited symptoms of daytime sleepiness. A moderate positive correlation was observed between the Digital Game Addiction Scale and Epworth Sleepiness Scale scores of adolescents ($r = 0.400$, $p < 0.001$). The odds of adolescents exhibiting daytime sleepiness were 51 times higher for those with higher mean total scores on the Digital Gaming Addiction Scale. The prevalence of daytime sleepiness was found to be 32 times higher in individuals who were sleep deprived due to digital gaming.

Conclusion: It was determined that sleepiness was high in adolescents with high digital game addiction. Adolescents and parents should be informed about the negative effects of uncontrolled and excessive digital game playing on sleepiness in adolescents.

Keywords: Addiction, digital gaming, adolescents, sleepiness

ÖZ

Giriş: Dijital oyunların sıklıkla kontrolsüz bir şekilde uzun süre kullanılması, çocuklarda ve ergenlerde uyku düzeninde değişikliklere yol açabilmektedir. Bu çalışma adölesanlarda dijital oyun bağımlılığı ile uykulu olma hali arasındaki ilişkinin incelenmesi amacıyla yapıldı.

Materyal ve Metotlar: Bu kesitsel çalışma, Batı Karadeniz Bölgesi'nde bir ilçe merkezinde bulunan üç lisede öğrenim gören ve araştırmayı kabul eden 12-18 yaş arası 263 adölesan ile yapıldı. Çalışma verileri Mart-Mayıs 2024 tarihleri arasında "Tanıtıcı bilgi formu", "Dijital Oyun Bağımlılığı Ölçeği" ve "Epworth Uykululuk Ölçeği" ile toplandı.

Bulgular: Adölesanların Dijital Oyun Bağımlılığı Ölçeği toplam puan ortalaması 15.39 ± 6.10 ve Epworth Uykululuk Ölçeği toplam puan ortalaması 7.37 ± 4.42 'ydi. Epworth Uykululuk Ölçeği'ne göre adölesanların %30.0'u gündüz uykulu olma problemi yaşıyordu. Adölesanların Dijital Oyun Bağımlılığı Ölçeği ve Epworth Uykululuk Ölçeği puanları arasında pozitif yönde orta derecede bir korelasyon vardı ($r=0.400$, $p<0.001$). Dijital Oyun Bağımlılığı Ölçeği toplam puan ortalaması daha yüksek olan adölesanların gündüz uykulu olma olasılığı 51 kat daha fazlaydı. Dijital oyun oynama nedeniyle uykusuz kalmak adölesanların gündüz uykulu olma durumunun oluşmasını 32 kat arttırmaktadır.

Sonuç: Dijital oyun bağımlılığı yüksek olan adölesanlarda uykulu olma durumunu yüksek olduğu belirlendi. Adölesanlarda uykulu olma üzerinde kontrolsüz ve aşırı dijital oyun oynamanın oluşturduğu olumsuz etkiler konusunda adölesanlar ve ebeveynleri bilgilendirmelidir.

Anahtar Sözcükler: Bağımlılık, dijital oyun, adölesan, uykululuk

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Introduction

The term “addiction” is defined as the inability to cease the use of or control over a substance or behavior. The most common substance addictions that are discussed in the literature are smoking, alcohol, and drug addiction. However, in recent years, there has been an increase in the number of studies on behavior-based addictions that are not based on a physical substance. These include computer, television, digital game, and internet addiction, which cause significant harm or distress with uncontrollable, repeated behaviors (1–3). Digital game addiction, one of the behavior-based addictions, is defined as “excessive use of computer or video games resulting in social and/or emotional problems and the player’s inability to control this excessive use despite these problems.” (4). In the Diagnostic and Statistical Manual of Mental Disorders-5, developed by the American Psychiatric Association and published in 2013, digital gaming addiction is considered as “Internet Gaming Disorder.” (5). The effects of digital gaming addiction on individuals are determined according to the level of game playing. It has been presumed that individuals with elevated levels of internet gaming disorder devote excessive time to technological devices, which in turn negatively impacts their interpersonal communication and academic performance (6). The term “game addiction” is defined as an individual’s inability to detach from the game, characterized by constant preoccupation with it and a sustained interest in the game (5). Playing digital games in moderation is regarded as normal and can be beneficial, especially when games that are appropriate for the individual’s age group are chosen (7). However, when the desire to play digital games becomes uncontrollable and causes changes in the individual’s emotions, thoughts, and social life, addiction is diagnosed (8).

Digital game addiction is one of the behavioral addictions that has emerged with the advancement of technology. Its prevalence is increasing daily. It is defined as children associating the game with real life, neglecting their responsibilities in real life, and seeing the game as a priority to be done (9). The prevalence of game addiction among adolescents can vary between 2-15% (10,11). In Türkiye, the prevalence of game addiction among adolescents was found to be 25-40% (12,13). Its prevalence is increasing daily (14).

Excessive and often uncontrolled use of digital games has been shown to result in alterations in sleep patterns and the development of negative habits in children and adolescents. (15). Environmental factors, including the use of digital games, computers, smartphones, tablets, and television, may play a significant role in the inability of adolescents to meet their sleep needs in an adequate and satisfactory manner (16). In children and adolescents, digital screen exposure before falling asleep has been shown to result in less sleep and a deterioration in sleep quality (17). Inadequate and poor-quality sleep has been linked to a range of adverse effects on

the physical, psychological, social, and cognitive development of children and adolescents (18). Sleep is a crucial factor in enhancing physical and academic performance during adolescence, a period marked by accelerated physical growth (19).

Considering the conditions discussed above, digital game addiction and sleepiness are significant concerns for children’s health. These two issues, which have such a significant impact on children’s health, should be investigated by pediatric nurses, who play an important role in improving and promoting health. In this way, pediatric nurses can identify and care for children at risk for digital gaming addiction and sleepiness (20). The aim of this study is to investigate the relationship between digital game addiction and sleepiness in adolescents. In line with the aforementioned general purpose, the research questions are as follows: (1) What is the prevalence of digital game addiction among adolescents? (2) What is the level of sleepiness in adolescents? (3) What is the relationship between digital game addiction and sleepiness in adolescents?

Material and Methods

Design and participants

The study employs a descriptive and cross-sectional methodology. The study population consisted of high school students ($n=1274$) in a district center affiliated with the Directorate of National Education in the Eastern Black Sea Region in Türkiye. As the outcome measure was categorical in this study, the formula $n = \frac{N \cdot t^2 \cdot p \cdot q}{[d^2 \cdot (N-1) + t^2 \cdot p \cdot q]}$ was employed to calculate the sample size. The formula yields the following values: $n=1274$, $p=0.5$, $q=0.5$, $t=1.96$, $d=0.05$. This results in a minimum sample size of 251 individuals. The data collection process was completed with 263 participants. To gather the necessary data, a simple random method was employed within the scope of a probability sampling method among eight high schools in the district. The participants were selected from three chosen high schools. The selected schools included those with students between the ages of 12 and 18. To be eligible, students had to be free of chronic, neurological, and psychiatric diseases; able to speak and understand Turkish; without communication barriers; and willing to participate in the study, with parental consent obtained.

Data Collection

The data for the study were collected between March and May of 2024. Students who met the inclusion criteria were informed about the study and their written and verbal consent was obtained. The questionnaire forms were administered in the classroom 15 minutes before the lesson began. The data were collected using the Descriptive Information Form, the Digital Game Addiction Scale (DGAS), and the Epworth Sleepiness Scale (ESS).

Descriptive Information Form: The introductory information form is designed to elicit basic demographic data from the participants. This form was developed by the researchers in accordance with the extant literature (12,13) and includes inquiries pertaining to the child's age, gender, socioeconomic status, technological device utilized, daily playtime, rationale for technological device usage, and insomnia.

Digital Game Addiction Scale (DGAS): The DGAS is a self-report instrument designed to assess the severity of digital game addiction. The DGAS was developed by Lemmens et al. (21) with the objective of identifying problematic digital game playing behaviors among adolescents aged 12 to 18 years. The scale is a 7-item short form of the DOB-21 scale, which consists of 21 items and 7 sub-dimensions. The scale employs a 5-point Likert-type, single-factor structure, with scores ranging from 1 to 5 (1 = never, 5 = always). Scores are recorded on a scale from 7 to 35, with a minimum score of 7 and a maximum score of 35. The scale was adapted into Turkish by Irmak and Erdoğan (22). The Cronbach's alpha coefficient for this scale is 0.72. The DGAS has a maximum attainable score of 35, while a minimum score is 7, based on 7 items and a 5-point scale. In this study, the internal consistency coefficient and correlation coefficient of the scale were determined to be 0.869.

Epworth Sleepiness Scale (ESS): The instrument was developed by M.W. Johns (23) to assess daytime sleepiness in adolescents. The Cronbach's alpha coefficient of the scale, which was adapted into Turkish and its validity and reliability were evaluated by Ağargün et al. (24), and the value was found to be 0.80. The scale, consisting of eight questions, is designed to determine whether individuals experience periods of sleep or drowsiness during their daily activities. The responses to the questions are graded on a scale of 0 to 3. The scoring method for all questions is uniform. The participant who is unlikely to fall asleep receives a score of 0 points, while those with a low, medium, or high probability of falling asleep receive 1, 2, or 3 points, respectively. The scale provides a score for each participant in the range of 0 to 24. For those with a score of 10 and above, the issue of "increased daytime sleepiness" can be addressed. The study determined that students who scored 10 or higher exhibited issues with daytime sleepiness, whereas those who scored 9 and lower did not. In this study, the Cronbach's alpha coefficient of the scale was found to be 0.783.

Analysis

The data obtained in the study was evaluated using the Statistical Package for the Social Sciences (SPSS 22.0, IBM SPSS, Türkiye) for Windows Statistical Package Programs. Descriptive statistics were presented as mean, standard deviation, median, minimum, and maximum values, as well as percentages. The normality of the data was analyzed using the Kolmogorov-Smirnov test. The Student t test was employed for pairwise comparisons when the data exhibited a normal distribution. The relationship between continuous variables

(such as age and scale scores) was analyzed using the Pearson correlation test. A logistic regression model was constructed that identified the most predictive variables for sleepiness. The significance level of $p < 0.05$ was accepted.

Ethics

Permission (Protocol no: 2024-SBB-0190, Date: 14.03.2024) was obtained from a university social and human sciences ethics committee to conduct the research and collect the data. The study was conducted in compliance with the guidelines established by the Provincial Directorate of National Education, which provided the required institutional approval. The authors of the scales utilized in the study were contacted via email to request permission for their inclusion. Participants were informed about the nature and purpose of the study, and written and verbal consent was obtained.

Results

The mean age of the adolescents was 15.98 ± 1.33 years. Of the participants, 55.1% were female, and 31.2% were 12th grade students. The mean total score of the DGAS was found to be higher in boys (7.93 ± 4.37) than in girls (6.69 ± 4.40) ($t = -2.271$, $p = 0.024$). The mean total scores of the DGAS and ESS did not differ according to age and grade variables (Table 1).

The mean total score of the DGAS was 15.39 ± 6.10 , while the mean total score of the ESS was 7.37 ± 4.42 . The ESS indicated that 30% of adolescents exhibited daytime sleepiness issues. A moderate positive correlation was observed between the DGAS and ESS scores ($r = 0.400$, $p < 0.001$; Table 2).

A total of 95.1% of adolescents reported having a technological device at home for playing games. The most common device was the cell phone, with 52.9% of adolescents reporting that they played games on their cell phones. Additionally, 51.0% of adolescents reported playing games for 1-3 hours daily. A total of 45.2% of adolescents shortened their sleep time and engaged in gaming activities at night, while 63.5% of them played games for 1-3 hours after 22:00. Forty-three percent of adolescents reported staying awake to play games, while 23.6% indicated that they slept in front of a computer while playing games. The rate of computer use for purposes other than gaming was 88.2%. Significant differences ($p < 0.05$) were observed in the mean total scores of the DGAS and ESS according to the presence of a gaming device at home, daily gaming time, playing games by shortening sleep time at night (Table 3).

Table 4 presents the coefficients, standard errors, Wald statistics, degrees of freedom, significance levels, and odds ratios of the independent variables in the model. Adolescents with a higher mean total score on the DGAS were 51% more likely to experience daytime sleepiness. The occurrence of daytime

Table 1. The difference in the mean total scores of the Digital Game Addiction Scale and Epworth Sleepiness Scale according to the characteristics of adolescents (n=263)

Characteristics	Mean±SD	Digital Game Addiction Scale	Epworth Sleepiness Scale
		r, p	r, p
Age	15.98±1.33 (12-18)	-0.078, 0.208	-0.038, 0.541
	n (%)	Mean±SD	Mean±SD
Gender			
Girl	145 (55.1)	6.69±4.40	14.89±5.61
Male	118 (44.9)	7.93±4.37	16.00±6.63
Significance		t=-2.271, p=0.024	t=-1.447, p=0.149
Classroom			
9	46 (17.5)	15.50±6.64	4.13±0.60
10	79 (30.0)	15.63±0.63	4.47±0.50
11	56 (21.3)	16.21±6.46	4.79±0.64
12	82 (31.2)	14.54±5.95	4.32±0.47
Significance		F=0.904, p=0.440	F=0.311, p=0.818

r= Pearson correlation test, Significant p values were highlighted in bold.

Table 2. Distribution and relationship between the mean total scores of the Digital Game Addiction Scale and Epworth Sleepiness Scale of adolescents (n=263)

	Mean±SD	Range	Relationship [†]
Digital Game Addiction Scale	15.39±6.10	7-35	r=0.400 p<0.001
Epworth Sleepiness Scale	7.37±4.42	0-24	
Problems with daytime sleepiness, n (%)	79	30.0	
No daytime sleepiness problems, n (%)	184	70.0	

[†]Pearson correlation test, Significant p values were highlighted in bold.

sleepiness was found to be 32% higher in individuals who were sleep deprived due to playing digital games (Table 4).

Discussion

The present study aimed to examine the relationship between digital game addiction and sleepiness in adolescents. The study revealed that 30.0% of adolescents exhibited daytime sleepiness issues. Adolescents may experience poor sleep quality at rates ranging from 37% to 55% (19, 25). The mean total score of the DGAS was 15.39 ± 6.10, while the mean total score of the ESS was 7.37 ± 4.42. Consequently, it is assumed that adolescents demonstrate a lower prevalence of daytime sleepiness problems compared to what has been observed in other studies (17, 19). The present study found that as digital game addiction increased among adolescents, so did the levels of sleepiness.

The results demonstrated a significant correlation between digital game addiction and daytime sleepiness. It has been suggested that digital game addiction may have a deleterious impact on sleep (17).

The study found no significant differences in digital game addiction and sleepiness levels among adolescents, regardless of age, gender, or socioeconomic status. Despite the absence of age, gender, and class variables influencing digital game addiction, these factors may nevertheless impact sleep quality (19). As age increases, the quality of sleep may decline. A decline in well-being may be observed (and endured) due to the accelerated pace of life and the accumulation of responsibilities associated with advancing age, which may contribute to an increase in sleepiness (26). Moreover, it is observed that a greater proportion of girls than boys experience

Table 3. The difference in the mean total scores of the Digital Game Addiction Scale and Epworth Sleepiness Scale according to the game playing behaviors of adolescents (n=263)

Game playing behaviors	n (%)	Digital Game Addiction Scale	Epworth Sleepiness Scale
		Mean±SD	Mean±SD
Presence of technological devices to play games at home			
Yes	250 (95.1)	15.54±6.13	7.50±4.44
No	13 (4.9)	12.53±4.87	5.00±3.26
Significance		t=3.136, p < 0.05	t=2.636, p < 0.05
Technological device used for gaming			
Computer	82 (31.2)	7.13±0.78	5.27±0.58
Tablet	42 (16.0)	5.22±0.80	6.88±3.67
Telephone	139 (52.9)	5.67±0.48	7.39±4.08
Significance		F=1.016, p=0.364	F=0.366, p=0.694
Game playing time (per day)			
1-3 hours	134 (51.0)	13.35±5.07	6.35±4.13
More than 3 hours	129 (49.0)	17.51±6.37	8.43±4.48
Significance		t=-5.851, p<0.001	t=-3.901, p<0.001
Shortening sleep time at night and playing games			
Yes	119 (45.2)	18.47±6.47	8.56±4.64
No	144 (54.8)	12.84±4.39	6.39±3.98
Significance		t=8.075, p<0.001	t=4.012, p<0.001
Playtime after 22.00 p.m.			
1-3 hours	167 (63.5)	14.41±5.46	7.00±4.26
More than 3 hours	96 (36.5)	17.09±6.78	8.03±4.63
Significance		t=-3.295, p<0.001	t=-3.787, p<0.001
Sleep deprivation due to gaming			
Yes	113 (43.0)	18.80±6.20	9.01±4.66
No	150 (57.0)	12.82±4.60	6.14±3.79
Significance		t=8.612, p<0.001	t=5.352, p<0.001
Sleeping on the computer while playing games			
Yes	62 (23.6)	19.77±6.93	8.20±4.78
No	201 (76.4)	14.04±5.14	7.11±4.28
Significance		t=6.014, p<0.001	t=1.607, p=0.111
Using the computer for other than gaming			
Yes	232 (88.2)	15.24±5.87	7.56±4.27
No	31 (11.8)	16.54±7.65	5.96±5.26
Significance		t=-1.120, p=0.366	t=1.618, p=0.115

t: Student t test, Significant p values were highlighted in bold.

Table 4. Logistic regression model with best predictors for sleepiness (n=263)

Effect	B	S.E.	Wald	df	p	Exp(B)
Constant	-3.644	1.111	10.765	1	0.001	0.026
Digital Game Addiction Scale	0.087	0.028	9.989	1	0.002	51.091
Presence of technological devices to play games at home †	1.319	1.066	1.532	1	0.216	3.739
Game playing time (per day) ‡	0.821	0.361	0.160	1	0.023	8.824
Shortening sleep time at night to play games a	-0.507	0.360	1.987	1	0.159	0.602
Play time after 22.00 ‡	0.042	0.077	8.593	1	0.003	12.043
Lack of sleep due to gaming †	0.766	0.352	4.741	1	0.029	32.152

† Yes=0 No=1, ‡ 1-3 hours=0 More than 3 hours =1, Significant p values were highlighted in bold.

suboptimal sleep quality during adolescence (27). This may be attributed to the earlier onset of puberty in girls. Additionally, girls tend to exhibit less optimism about life and may be more prone to experience worry about a range of issues, including life in general, academic challenges, familial concerns, and interpersonal difficulties. These issues are interrelated and contribute to feelings of sleepiness (28).

The study revealed a moderate positive correlation between digital game addiction and sleepiness in adolescents ($r=0.400$, $p<0.001$). Likewise, the majority of studies have reported a statistically significant correlation between digital game addiction and sleep quality scores in adolescents (19, 29, 30). However, these studies evaluated sleepiness as a component of overall sleep quality. A review of the literature revealed a lack of studies exploring the relationship between sleepiness and digital game addiction. One study was identified that explored the relationship between digital media use and other variables. A systematic review of the literature revealed that in 90% of studies, digital media use among children and adolescents was associated with sleepiness (31).

The study revealed that the majority of adolescents shortened their sleep duration at night and engaged in gaming for 1-3 hours after 22:00. This also affected their daytime sleepiness. In the study by Marufoğlu and Seval Kutlutürk (32), it was demonstrated that digital game playing habits did not alter sleep habits or sleep-wake cycles in children. Furthermore, the study highlights that digital game addiction does not pose a risk to children's sleep habits (32). Children with high levels of game addiction tend to go to sleep later at night, take longer to fall asleep, and wake up more frequently at night (17). This can lead to sleep problems and fatigue symptoms (18, 33).

The study found that adolescents who had a device to play digital games at home and used the internet for three or more hours daily exhibited higher levels of digital game addiction. Adolescents who have their own computer, cell phone, and internet access at home and use the internet for more than two hours a day may have higher levels of digital game addiction (19). There may be significant differences in addiction levels according to the daily computer game playing time of adolescents. Those with high levels of digital game addiction may engage in computer gaming for more than four hours per day (34). It can be assumed that an increase in the time spent on mobile and digital devices is associated with a corresponding rise in addiction (35).

The study found that adolescents with higher total scores on the DGAS were 51% more likely to experience daytime sleepiness. Furthermore, the risk of daytime sleepiness was found to be 32% higher in adolescents who were sleep deprived due to gaming. Sleepiness and sleep quality can be affected by a variety of factors, including physical activity, anxiety, depression, internet and smartphone use, and environmental factors (36). As digital game addiction increases among adolescents, sleep

quality scores also increase, and this increase indicates poor sleep quality

(19). Consistent with previous research, the findings of this study support the hypothesis that sleep disturbances and problematic digital game use are common issues among adolescents. (37,38).

Limitations

As the data were collected from students in a single district center, the results can be generalized to the study group. However, it should be noted that numerous factors may affect sleepiness in adolescents, and only a limited number of factors were investigated in this study. In particular, the influence of having a device to play digital games at home was examined, but the impact of playing digital games outside the home was not assessed. It is therefore recommended that the study be repeated with the inclusion of other factors that may affect sleepiness in adolescents. Conclusion

The study found a positive correlation between high levels of digital game addiction and increased sleepiness among adolescents. It is recommended that adolescents and their parents be informed about the negative effects of uncontrolled and excessive digital game playing on adolescent sleepiness. It is recommended that digital game playing be monitored and limited by parents. It is therefore suggested that by monitoring adolescents' gaming and sleep habits, action can be taken before the problem reaches harmful levels.

Ethics Committee Approval: Permission (Protocol no: 2024-SBB-0190, Date: 14.03.2024) was obtained from Bartın University Social and Human Sciences Ethics Committee in order to conduct the research and collect the data.

Informed Consent: Written consent was obtained from all the participants in the study.

Authorship Contributions

Concept: A.K., İ.B.U., İ.Y., O.B., E.P., Design: A.K., İ.B.U., İ.Y., O.B., E.P., Data Collection or Processing: A.K., İ.B.U., İ.Y., O.B., E.P., Analysis or Interpretation: A.K., İ.B.U., İ.Y., O.B., E.P., Literature Search: A.K., İ.B.U., İ.Y., O.B., E.P., Writing: A.K., İ.B.U., İ.Y., O.B., E.P.

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