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Examining the relationship between digital addiction and daytime sleepiness in secondary school-age children

Ortaokul öğrencilerinde dijital bağımlılık ve gündüz uykululuk ilişkisinin incelenmesi

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ABSTRACT

Aim: This study was conducted to determine the relationship between digital addiction and daytime sleepiness and the level of prediction of daytime sleepiness of digital addiction in secondary school-age children.
Method: Our study is descriptive, cross-sectional and comparative. The sample consisted of 422 children studying in 5th, 6th, 7th, 8th, grades. Data were collected using Child Information Form, Digital Addiction Scale for Teenagers, Pediatric Daytime Sleepiness Scale. The data were obtained by the researchers in the classroom environment via face-to-face data collection method. The relationship between digital addiction and daytime sleepiness was evaluated with Pearson correlation analysis. The predictive level of digital addiction on daytime sleepiness was examined with linear regression analysis
Result: The average age of the participants was 12.25±1.19, 54.7% were girl (n=231), 31.3% (n=132) were in the 8th grade, 34.7% of the mothers were high school graduates and 36.7% of the fathers were high school graduates. 89.8% of children have their own mobile phones. 94.5% reported having an internet connection at home. 41.5% of children use their mobile phones most frequently for social media and internet usage 3.70±2.73 hours daily.
Conclusion: A strong, positive and significant relationship was found between children's digital addiction average scores and daytime sleepiness scores.

Keywords: Internet addiction; daytime sleepiness; school-age child; technology addiction

ÖZET

Amaç: Bu çalışma, ortaokul çağındaki çocuklarda dijital bağımlılık ile gündüz uykululuğu arasındaki ilişkiyi ve dijital bağımlılığın gündüz uykululuğunu tahmin etme düzeyini belirlemek amacıyla yürütülmüştür.
Yöntem: Çalışmamız tanımlayıcı, kesitsel ve karşılaştırmalı bir çalışmadır. Örneklem, 5., 6., 7., 8. sınıflarda öğrenim gören 422 çocuktan oluşmuştur. Veriler Çocuk Bilgi Formu, Ergenler İçin Dijital Bağımlılık Ölçeği, Pediatrik Gündüz Uykululuğu Ölçeği kullanılarak toplanmıştır. Veriler araştırmacılar tarafından sınıf ortamında yüz yüze veri toplama yöntemi ile elde edilmiştir. Dijital bağımlılık ile gündüz uykululuğu arasındaki ilişki Pearson korelasyon analizi ile değerlendirilmiştir. Dijital bağımlılığın gündüz uykululuğu üzerindeki öngörü düzeyi doğrusal regresyon analizi ile incelendi
Bulgular: Çocukların yaş ortalaması 12,25±1,19, %54,7'si kız (n=231), %31,3'ü (n=132) 8. sınıf, annelerin %34,7'si lise mezunu ve babaların %36,7'si lise mezunuydu. Çocukların %89,8'inin kendisine ait cep telefonu bulunmaktadır. %94,5'i evde internet bağlantısı olduğunu bildirmiştir. Çocukların %41,5'i cep telefonlarıyla en sık sosyal medya ve internete girmek için günde ortalama 3,70±2,73 saat vakit geçirdiğini bildirmiştir.
Sonuç: Çocukların dijital bağımlılık puan ortalamaları ile gündüz uykululuk puanları arasında güçlü, pozitif ve anlamlı bir ilişki bulunmuştur.

Anahtar Kelimeler: İnternet bağımlılığı; gündüz uykululuk; okul çağı çocuğu; teknoloji bağımlılığı

Introduction

Digital devices are widely used by children and adolescents for education, social communication, and entertainment. The COVID-19 pandemic led to school closures and reduced social interactions, increasing children's screen time as they spent more time at home (Sülün, Yayan & Düken, 2021). As a result, children's overall screen time significantly increased (Eyimaya & Irmak, 2021). Children's frequent use of

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digital technology has paved the way for them to own digital devices such as mobile phones, tablets, computers and game consoles (Elkin & Soydan, 2024).

School-aged children and young people; by creating an account on Instagram, Facebook, Twitter/X and Tiktok, people can easily access posts in the digital environment, share from their accounts and increase their interactions with other people (Lozano-Blasco, Mira-Aladrén & Gil-Lamata, 2023). Being present in the digital environment, receiving likes and comments on content, sharing instant statuses, and constantly using messaging applications are part of children and adolescents' daily routines (Jeri-Yabar, Sanchez-Carbonel, Tito, Ramirez-delCastillo, Torres-Alcantara, Denegri & Carreazo, 2019). Digital addiction is characterised not only by the excessive use of technological devices such as phones, tablets, computers or game consoles, but also by the negative situations that arise from the unconscious and uncontrolled use of digital devices (Ciminli, 2024; Ektiricioğlu, Arslantaş & Yüksel, 2020). The World Health Organisation defines digital addiction as intense online presence, inability to manage.

Digital devices are defined as the area where children and adolescents spend the longest time outside of school, with their immersive effect, screen brightness and tactile, auditory and visual stimulation effects (Schulz van Endert, 2021). Digital addiction, which occurs with excessive use of digital devices, affects children's physiological sleep time with changes in daily routines and disrupts sleep quality (Chen, & Gau, 2016). For school-aged children, whose growth and development process is still ongoing, a healthy sleep period is an important area for maintaining physical and psychosocial health (Mustafaoğlu, Zirek, Yasacı & Özdinçler, 2018).

Extending the use of digital devices until late at night disrupts children's sleep-wake cycle and daytime sleepiness. Sleep problems in children are associated with physical, behavioural, psychosocial, somatic and medical problems (Sawa et al., 2021; Simola, Liukkonen, Pitkaranta, Pirinen & Aronen, 2014). Mobile phones, tablets, computers and game consoles increase the child's interaction with and time spent on the programmes used via digital devices. Smartphone use before and during sleep increases social media use (Lemola, Perkinson-Gloor, Brand, Dewald-Kaufmann & Grob, 2015). Sharing digital content via social media increases the expectation of receiving comments and likes from people associated with those shares, which increases the time that adolescents spend online. Similarly, internet/digital game addicted adolescents are unable to control their digital device use time by forming close friend groups and interacting with other internet/digital game addicted friends (Günüç, 2017).

Excessive screen exposure, difficulty disengaging from digital activities, and the stimulating effects of screen light and sound contribute to sleep difficulties in children (Cajochen et al., 2011). After waking up from sleep, the child is expected to be happy, rested, and active. However, using digital devices for a long time before going to bed is among the causes of insufficient sleep amount, poor sleep quality and excessive daytime sleepiness (Bener et al., 2019; Carter, Rees, Hale, Bhattacharjee & Paradkar, 2016). A cross-national comparative study found that mobile device use was associated with delayed bedtimes and reduced sleep duration in children and adolescents (Bartel et al., 2016). Children at school and during the day; The ability to achieve desired academic, social and cognitive performance and to continue the normal physiological process of growth and development is closely related to sleep quality (Acikgoz, Acikgoz & Acikgoz, 2022). One of the factors affecting sleep that can be controlled is the use of digital devices for longer than usual, which can affect sleep at night. This study aims to examine the relationship between digital addiction and daytime sleepiness in secondary school children and to assess how well digital addiction predicts daytime sleepiness.

Research Questions

Is there a relationship between digital addiction and daytime sleepiness in secondary school-aged children?

What is the predictive value of digital dependence scores for daytime sleepiness scores in secondary school-aged children?

To what extent do characteristics of secondary school-aged children predict daytime sleepiness scores?

Methods

Study design and Sample

Our study is descriptive, cross-sectional and comparative. The data of the study were collected from secondary school-aged children studying in a city centre in the western region of Turkey. All public schools in Turkey receive equal financial support from the state. The children participating in the study represent a socio-economically homogeneous region in a province in the western region of Turkey. Five secondary schools located in the city centre were included in the sample. The schools included in the sample were determined by the provincial national directorate and sent to us. In this regard, random selected five secondary schools located in the city center were included in the sample. A total of 600 students were invited to participate in the study, and 422 students who had parental consent and agreed to participate in the study were included in the study. The sampling access rate was 70.3%.

Data Collection Tools

Child Information Form: This form was developed by researchers in line with the literatüre (Kaynak). This form consists of questions about the age, gender, grade level of the children participating in the study, number of siblings, parents' education level, mobile phone ownership, Internet access and purpose of use, and duration of daily Internet use. These questions were drawn from studies investigating the digital addiction status of children and adolescents.

Digital Addiction Scale for Teenagers: The Digital Addiction Scale for Teenagers was developed by Seema, Heidmets, Konstabel and Varik-Maasik (2022). The scale has a 5-point Likert type (never-always) scoring. This measurement tool is a valid and reliable measurement tool to determine the digital addiction levels of young people aged 11-19 or in secondary and high school. Cronbach's alpha value was calculated as 0.85 for its application during the pandemic and 0.83 after the pandemic. Turkish validity and reliability study by Çelik, Tunç, et al. Made by (2023). As a result of the CFA analysis, the scale had model fit (χ^2/Sd= 128.614/28=4.59; $p<.05$, CFI=.96; TLI=.95; GFI=.95; SRMR=.036; RMSEA=.079). has been seen. It was concluded that factor load values varied between .56 and .79, and item-total test correlations varied between .62 and .79. Cronbach's alpha reliability coefficient was calculated as .90.(Çelik, Tunç, Candemir, Kapkın & Açar, 2023) The Croncach alpha value of this study is 0.82.

Pediatric Daytime Sleepiness Scale: The Pediatric Daytime Sleepiness Scale was developed by Drake et al. (2003) and is a special scale that enables the evaluation of daytime sleepiness in children and adolescents between the ages of 12-18. The scale consists of eight items describing sleep-related behaviors. Total Cronbach's alpha was found to be .80 (Drake, Nickel, Burduvali, Roth, Jefferson & Badia 2003). In the In the scale prepared according to the five-point Likert system, the answers are 0 = never, 4 = always. In scoring the scale, the lowest score is "0" and the highest score is "32". As the score obtained from the scale increases, daytime sleepiness increases. Turkish version, the validity and reliability of which was determined by Bektaş et al. (2016), Cronbach's alpha coefficient; .79, Kaiser-Meyer-Olkin (KMO) value is .78, and item-total correlation varies between .53 and .73. (Bektas, Bektas, Ayar, Selekoglu, Ayar, Kudubes, Sal, & Armstrong, 2016).The Croncach alpha value of this study is 0.76.

Data Collection

After obtaining the necessary permissions during the data collection process of the study, planning was done with the school administrators of the sampled schools. In the schools where the research data were collected, appropriate teaching hours were determined so as not to disrupt education and training. In the first stage, the children's parents were sent a detailed parental consent form about the purpose of the research and the research data collection forms. Parents were informed and written permission was obtained through school administrators. In the second stage, children with parental consent were identified. Children with parental consent were included in the study if they agreed to participate in the research. Data were collected using a face-to-face data collection method in the classroom. The children were informed that they could withdraw from the study at any time and that the study data would only be used for scientific purposes. Data collection took about 15 minutes.

Data Analysis

Numbers, percentages and means were used in the analysis of descriptive data. The normal distribution of continuous data was assessed using skewness and kurtosis and it was found that all data were normally distributed between +2. In the evaluation of normality, in addition to skewness and kurtosis, the Kolmogrow Smirnow test was also used because the sample size was greater than 50. The P value was found to be greater than 0.05 and it was determined that the data were normally distributed. The relationship between digital addiction and daytime sleepiness was assessed using Pearson correlation analysis. The predictive value of digital addiction for daytime sleepiness was assessed using linear regression analysis. For regression, multicollinearity was examined using VIF and tolerance values, and it was determined that VIF values were less than 10 and tolerance values were greater than 0.2 and that there was no multicollinearity. The significance level was set at 0.05.

Ethical Consideration

Prior to starting the data collection process, the researchers obtained ethical approval from the University's Non-Interventional Ethics Committee with IRB No: 1368 dated 20.12.2023. Permission was obtained from the Provincial Directorate of National Education to collect data in the schools included in the research. Informed consent was obtained from the parents of the children participating in the study and permission was given for their children to participate in the study. In addition, the authors of the measurement tools used in the research were contacted and asked for their permission to use the measurement tools.

Limitation

This study has several limitations. First, our study used a convencience sampling method. The second limitation of our study is that the data were collected based on children's self-reports.

Results

This section includes the study findings.

Table 1. Participants' descriptive characteristics

Descriptive characteristics	**M±SD**	
Age	12.25±1.19	
Internet Usage (hours)	3.70±2.73	
	n	**%**
Gender		
Girl	231	54.7
Boy	191	45.3
Grade level		
5. th	112	26.5
6. th	62	14.7
7. th	132	31.3
8. th	116	27.5
Number of siblings		
None	76	18.1
One	219	51.9
Two	85	20.1
Three	25	5.8
Four and up	17	4.1
Mother Education		
Primary school	63	14.9
Middle school	80	19.1
High school	147	34.7
University and above	132	31.3
Father Education		
Primary school	52	12.3
Middle school	80	19.0
High school	155	36.7
University and above	135	32.0
Mobile phone		
Have	378	89.8
None	44	10.2
Internet at home		
There is	399	94.5
None	23	5.5
Purpose of mobile phone use		
Homework-Lesson	95	22.5
Social media	175	41.5
Game	152	36.0

M= Mean, SD: Standart Deviation

The average age of the participants was 12.25±1.19, 54.7% were girl (n=231), %45.3 were boy (n=191). 26.5% (n=112) of the children were in the 5th grade, 14.7% (n=62) were in the 6th grade, 31.3% (n=132) were in the 7th grade, and 31.3% (n=132) were in the 8th grade. 51.9% had only one sibling, 34.7% of the mothers were high school graduates, 36.7% of the fathers were 89.8% of high school graduates have a mobile phone, 94.5% have an internet connection at home and 41.5% of the participants use their mobile phones for social media. Children's daily internet use was 3.70+2.73 hours on average.

Table 2. Relationship between children's digital addiction scores and daytime sleepiness scores

	Daytime Sleepiness Scores	
	r	**p**
Digital Addiction Scores	0.540	<0.01

A strong, positive and significant relationship was found between children's digital addiction average scores and daytime sleepiness scores ($p<0.01$).

Table 3. The predictive level of children's digital addiction scores on daytime sleepiness scores

Variables	**Daytime Sleepiness**						
	B	**SE**	**β**	**t**	**Sig.**	**95 %CI**	
Constant	5.210	.726		7.176	.000*	3.783	6.637
Digital Addiction	.387	.029	.540	13.144	.000*	.329	.445
R	**0.540**						
R^2	**0.292**						
F	**172.763**						
p	**<0.001**						
DW (1.5-2.5)	**1.855**						

***** Significant at 0.01 level, β= Standardized Beta

It was determined that addiction levels of adolescents significantly explained 29.2% of daytime sleepiness.

Table 4. The predictive level of children's characteristics on daytime sleepiness scores

Variables	**Daytime Sleepiness**						
	B	**SE**	**β**	**t**	**Sig.**	**95 %CI**	
Constant	5.901	3.354		1.760	.079	-.691	12.493
Age	.182	.413	.039	.440	.660	-.630	.993
Gender	-.897	.526	-.079	-1.706	.089	-1.931	.137
Grade Level	.542	.415	.114	1.307	.192	-.273	1.358
Number of Siblings	.136	.268	.026	.506	.613	-.392	.663
Mother Education	-.108	.313	-.020	-.344	.731	-.722	.507
Father Education	.202	.322	.036	.626	.531	-.432	.836
Having Mobile Phone	.341	1.023	.018	.333	.739	-1.670	2.352
Internet at Home	-.093	1.304	-.004	-.071	.943	-2.656	2.471
Internet Usage Time	.643	.099	.313	6.475	.000	.448	.838
R	**0.373**						
R^2	**0.139**						
F	**7.348**						
p	**<0.001**						
DW (1.5-2.5)	**1.894**						

* Significant at 0.01 level, β= Standardized Beta

It was determined that the characteristics of adolescents significantly explained 13.9% of daytime sleepiness ($p<0.05$). When the variables were examined one by one, it was determined that only the duration of internet use significantly affected the level of daytime sleepiness.

Discussion

Increasing digital addiction in children affects the physiological sleep period and increases daytime sleepiness. Daytime sleepiness negatively affects school-aged children and adolescents in terms of healthy growth development, expected school performances, and peer relationships. Our study reveals the relationship between secondary school-age children's daytime sleepiness and digital addiction and other child variables.The average age of the children in our study is 12.25±1.19, most of them have their own mobile phone and internet connection at home, and their daily internet usage time is 3.70±2.73 hours. In addition, children use their mobile phones most frequently for social media use and games. It is not possible for children to stay away from digital devices in the digital age. Children are introduced to social media and

digital games at an early age, which increases their use of digital devices and screen time (Üstündağ, 2022). Increasing screen time, with the immersive effect of digital devices, causes the child to not be able to control the use of digital devices and to spend a large part of the day with digital devices. One of the most common negative consequences of this condition is sleep problems. Studies have shown that children's excessive use of digital devices and their addiction level negatively affect the sleep period (Bener, et al., 2019; Carter, et al., 2016; Sülün, et al., 2021). Children can easily access videos, TV series and movies on the internet through digital devices. Most of this content contains violence, fear and age-inappropriate figures, and children's prolonged screen time makes it difficult for them to fall asleep. In addition, blue light emitted from the screen prevents the release of melatonin, causing children to sleep less (Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). Prolonged use of digital devices during the day shortens sleep duration and delays falling asleep (Sümen, & Evgin, 2021). Hysing et al. found in their study that there is a dose-response relationship between digital device use and sleep duration (2015). As a child's exposure to digital devices increases, sleep duration decreases. Mobile phones are one of the most accessible digital devices for children.

Our study found a strong, positive and significant relationship between children's average digital dependency scores and daytime sleepiness scores. In our country, children attend school for an average of 6-7 hours during secondary school. The fact that classes and school activities start early in the morning requires children to wake up early. A child's prolonged screen time on digital devices is strongly correlated with sleep duration, sleep quality and daytime sleepiness (Sakamoto, Kabaya, & Nakayama; 2022, Touitou, Touitou, & Reinberg, 2016). Daytime sleepiness is related to the child's nighttime sleep duration and sleep quality. After the sleep period, the child should be able to wake up with a simple stimulus and start his or her daily routine. Sleep and wakefulness follow each other regularly. Disruption of the nighttime sleep period also causes sleep to shift to daytime hours, resulting in the child spending sleepy hours during school hours when they should be active and performing academically (Ludwig, Smith, & Heussler, 2019). In our study, children's level of digital dependence was found to significantly explain 29.2% of daytime sleepiness. Our findings are similar to previous studies.

Children's addiction to digital devices has been shown as a behavioural factor that causes them to spend long periods of inactivity in front of the screen and contributes to obesity by affecting their eating habits (Eliacik, Bolat, Koçyiğit, Kanik, Selkie, Yilmaz, Çatlı, Olgaç, & Dundar, 2016; Uysal, & Çalışır, 2024). Obesity is a condition that negatively affects the child's relationship with his or her friends in school life and reduces social acceptance among children. The child becomes more dependent by building relationships with digital devices that they cannot build with their own friends (Hu, Wang, Lin, & Tang, 2021). Children who spend long periods of time playing games in the digital environment, either alone or in groups, cannot develop social relationships with their peers and prefer to communicate less (Şensoy & Ayar, 2022). This whole process increases daytime sleepiness by increasing children's interaction and screen time with digital devices such as mobile phones, computers, tablets, and game consoles (Kim, Han, Park, Yoo, Park, Suh, & Shin, 2020).

In our study, some characteristics of the children were found to significantly explain 13.9% of the daytime sleepiness (p<0.05). When the variables were examined one by one, it was found that only the duration of internet use had a significant effect on the level of daytime sleepiness. This shows that children are using digital devices to access the internet. Children spend a lot of time on social media, digital games and messaging programmes and this time is considered a leisure activity (Nasirudeen, Lee Chin Adeline, Wat Neo Josephine, Lay Seng, & Wenjie, 2017). Anxiety about missing developments on social media, liking digital content added to a social media account, replying to messages, watching videos, the next level of the game and the desire to earn points are indicators of addiction. These are some of the most common

activities that children and adolescents do with their digital devices. Children perform these behaviours automatically without being aware of their digital addiction. Secondary school is a time when children's physical growth rate.

Conclusions

Sleep problems and daytime sleepiness in children are detrimental to healthy growth and development. Therefore, children need to get enough and good quality sleep at night. This study found that digital addiction and duration of internet use were significant determinants of daytime sleepiness. In order for children to grow up healthy and improve their school performance, daytime sleepiness needs to be reduced. To do this, paediatric nurses need to identify children at risk by assessing their level of digital addiction, internet time and daytime sleepiness both in school and in the clinical setting. It is recommended to regulate internet time for children at risk and to develop strategies to raise awareness of digital addiction among children and parents. Identified children at risk can be referred to professional support systems and receive the necessary support. It is recommended that school- and community-based intervention studies be conducted to reduce digital addiction and daytime sleepiness. In our study, digital addiction was found to be an important variable affecting daytime sleepiness in children. It was found that there is a significant relationship between children's internet use time and daytime sleepiness.

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