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Original Article

The Effect of Technological Device Usage Time on the Physical Activity Level of Secondary School Children: A Rural Example

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What is already known on this topic?

- *The use of technological devices can lead to a sedentary lifestyle by reducing children's physical activity levels.*
- *Long-term screen use is associated with musculoskeletal pain, sleep disorders, and psychological disorders.*
- *Digital addiction can have negative effects on physical and mental health, especially in adolescents.*

What this study adds on this topic?

- *This study shows that excessive use of phones and computers is linked to reduced physical activity and increased musculoskeletal complaints in children.*
- *It provides important data from a rural region, highlighting that the negative effects of screen time are not limited to urban areas.*
- *With a large sample, the study emphasizes the need for awareness and strategies to balance technology use and healthy habits in school-aged children.*

ABSTRACT

Objective: The aim of this study was to examine the relationship between the duration of technological device usage and the physical activity levels of secondary school students in Akyazı, a rural area in north-west Türkiye. Given the increasing integration of digital devices into daily life, understanding their impact on children's health and activity levels is crucial.

Methods: This cross-sectional study was conducted with 1,000 secondary school students. The Baecke Physical Activity Questionnaire was used to assess physical activity levels, and a structured survey was administered to collect data on technological device usage and health-related symptoms. The data were analyzed using Statistical Package for Social Sciences version 26.0 software, and associations between variables were determined with Spearman's correlation analysis.

Results: The most commonly used technological device was the mobile phone, with 44.2% of students using it for 1-2 hours per day. A significant relationship was found between mobile phone use and neck pain ($r = 0.094$, $P = .002$), and between computer use and back pain ($r = 0.112$, $P = .002$). Increased mobile phone usage was associated with a decrease in physical activity levels ($r = 0.043$, $P = .008$). Excessive screen time was also linked to sleep disturbances, fatigue, and psychological effects such as stress.

Conclusion: Excessive use of technological devices negatively affects secondary school students' physical activity levels and overall health. Encouraging balanced screen time and promoting physical activity are essential to mitigate these adverse effects. Further research and public health interventions are needed to address this growing concern.

Keywords: Technological device usage, physical activity, secondary school children, musculoskeletal health, screen time

Introduction

Recent advances in the field of technology have radically transformed our daily lives. The increasing daily use of technological devices such as mobile phones, computers, televisions, and tablets has become an indispensable part of modern life. The majority of children and young people now spend their lives intertwined with technology. However, excessive use of technological devices such as phones, game consoles, and computers poses a significant danger to the mental and physical health of children and adolescents. Studies of children's use of digital technology and the internet from many countries have comprehensively addressed children's interactions with technology and the opportunities and risks of these

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interactions. UNICEF's "Kids Online" and "Global Kids Online" projects have analyzed children's use of digital media in different countries. These reports have shown that approximately 71% of children use the internet on a daily basis, most frequently engaging in activities such as watching videos, playing games, and using social media platforms. While internet access exceeds 90% in developed countries, it varies between 30-50% in low-income countries. The greatest motivation for children to use the internet is for educational and entertainment purposes.[1] The Information Technology Usage (ITU) report from the United Nations has emphasized that young people (aged 15-24 years) constitute 71% of internet users and that the ownership of digital devices varies according to income level. The report also emphasized that children face risks such as cyberbullying and privacy violations in the digital environment and the importance of digital literacy training to protect them against these risks.[1] According to the 2024 report of the Survey on the Use of Information Technologies among Children, the rate of internet use among children aged 6-15 years increased to 91.3%. The rate of those who stated that they use the internet regularly was 97.4% and the most common purposes of use were watching videos (83.9%), homework/study work (75.0%), and playing games (72.7%). The proportion of children using social media was recorded at 66.1%, and the most preferred platform was YouTube (96.3%). In addition, the proportion of children using mobile phones or smartphones reached 76.1%, with these devices mostly used for surfing the internet (77.9%) and communicating (77.3%). While 74.0% of children played digital games, 40.1% of regular gamers reported spending more time than planned. Among children who spent more time in front of the screen, 34.4% stated that they read fewer books. That research revealed the impact of children's increasing interaction with information technologies on their daily lives and habits.[2]

Internet addiction is defined as the unconscious and uncontrolled use of the internet for a long period of time at a level that will be harmful to the person.[3] According to 2024 data, it is estimated that 35% of the global population shows signs of internet addiction. Young people, especially those aged 13-24 years, have the highest addiction rates, with 73% of this age group being addicted to digital devices. It has also been reported that 14% of young people in the USA are addicted to social media, while 60% are overly dependent on their phones.[4] Health problems caused by excessive internet use include social withdrawal due to a sedentary lifestyle, sleep irregularities, musculoskeletal system problems, visual problems, and obesity as a result of unbalanced eating habits.[5]

The physical activity level during adolescence is very important for establishing lifelong health behaviors and preventing chronic diseases. This period of life is characterized by significant physical, emotional, and social changes and requires the promotion of active lifestyles. Physical activity plays an important role in preventing chronic diseases, reducing the economic burden of disease, increasing the individual's self-esteem and sense of well-being, and increasing social interaction. As a result of all these positive effects, the World Health Organization (WHO) recommends that children and adolescents between the ages of 5 and 17 years perform moderate to vigorous physical activity for at least 60 minutes a day.[6] When the current conditions and statistics in the literature are evaluated, it can be seen that the use of technological infrastructure has become extremely important. It is obvious that it should be examined in every dimension in terms of a healthy life and society. There is no study in the literature that has evaluated the usage rates of technological devices and the physical activity level of young people in Akyazı, a rural region in Türkiye. The aim of this study was to examine the relationships between the duration of use of technological devices and the physical activity levels of secondary school children in this geographical area.

Research Questions

1. What are the daily usage patterns of technological devices (e.g., mobile phones, computers, tablets, televisions, and game consoles) among secondary school students living in a rural area?
2. Is there a relationship between the duration of technological device usage and the physical activity levels of secondary school students as measured by the Baecke Physical Activity Questionnaire?
3. What is the association between screen time and self-reported health complaints such as musculoskeletal pain, fatigue, sleep disturbances, and psychological symptoms in this population?
4. Do different types of technological devices have varying impacts on students' physical activity levels and health-related outcomes?

Methods

The sample group of this cross-sectional study consisted of secondary school students in the Akyazı district of Sakarya province (north-west Türkiye). The study was conducted on 1,000 students randomly selected from secondary schools in the designated population. Permission to conduct the study was obtained from the Akyazı District Governorship (decision no: E-98849436-604.01.01.01-99478, dated: 03.01.2023). Ethical approval of the study was granted by the Ethics Committee of Sakarya University of Applied Sciences University (decision no: E.83xx., dated: 12.05.20). Written informed consent was provided by all the participants and their parents.

Inclusion and Exclusion Criteria

Inclusion Criteria: Secondary school students who were students in state secondary schools in Akyazı District and who volunteered to participate in the study were included.

Exclusion Criteria: Students who were not willing to participate or who did not use any technological device were not included in the study.

Data Collection Tools

Baecke Physical Activity Questionnaire (BPAQ): This scale was developed by Baecke, Burema, and Frijters in 1982 to assess the physical activity levels of individuals in work, sports, and leisure time. The BPAQ is divided into 3 main sections: the first part includes the activities that students perform at school during their educational process; the second part includes sports-related activities; and the third part includes non-sports leisure time activities. Previous research has shown that the questionnaire accurately distinguishes between different activity levels in both males and females and reliably measures physical activity habits. The Turkish validity and reliability study was conducted by Yazıcı et al.[7]According to the analysis, ICC varied from 0.98 to 0.99 in all of the BHPAQ sub-scores. BHPAQ total score was found moderately related to IPAQ total score (rho: 0.47 $P < 0.001$).

Technological device usage form: This questionnaire, developed by Doruk et al,[8] consists of 3 parts. In the first part, the number of technological devices in the student's home, the availability of his/her own room, the technological devices in the room, and the daily usage time of these devices are investigated. In the second part, the student's health-related symptoms such as sleep, musculoskeletal pain (Numerical Rating Scale), eye health, concentration, headache, fatigue, stress, nutrition, etc., are examined. In the third section, the sociodemographic characteristics of the student and parents such as educational level, age, gender, height, weight, education, and employment status of parents, etc., are analyzed.

Statistical Analysis

Data obtained in the study were analyzed statistically using the Statistical Package for Social Sciences (SPSS) Version 26.0 software (SPSS Inc., Chicago, IL, USA). Spearman's correlation test was used to

Table 1. Characteristics of the Study Participants

	(N=)	%		(N=)	%
Gender			Chronic illness		
Female	537	53.7	No	862	86.2
Male	463	46.3	Yes	138	13.8
Age			Duration of sleep		
11 years	274	27.4	6 hours	149	14.9
12 years	216	21.6	6-7 hours	268	26.8
13 years	232	23.2	7-8 hours	462	46.2
14 years	276	27.6	8 hours and over	121	12.1
Class			Sleep latency		
5. Class	267	26.7	< 5 minutes	184	18.4
6. Class	155	15.5	5-10 minutes	261	26.1
7. Class	294	29.4	10-20 minutes	287	28.7
8. Class	284	28.4	≥20 minutes	268	26.8
Type of education					
Morning student	624	62.4			
Afternoon student	42	4.2			
All day	334	33.4			

determine the relationship between the findings obtained, and the correlation coefficient (*r*) was accepted as a weak relationship when *r* was 0.00-0.24, a moderate relationship when 0.25-0.49, a strong relationship when 0.50-0.74, and a very strong relationship when 0.75-1.00.

Results

Evaluations were made of the demographic characteristics, sleep patterns, technological device usage habits, health status, musculoskeletal complaints, and daily living activities of the students. The mean weight of the participants was 46.78 ± 13.14 kg, height was 151.23 ± 11.05 cm, and body mass index (BMI) 20.04 ± 3.60. The sample comprised 53.7% females and 46.3% males, and 13.8% of the participants had chronic diseases. In age distribution, the groups aged 11 and 14 years constituted the highest groups at 27.4% and 27.6%, respectively. In terms of sleep duration, 46.2% of the students stated sleeping for 7-8 hours, and the highest rate of sleep latency was 28.7% for 10-20 minutes (see Table 1).

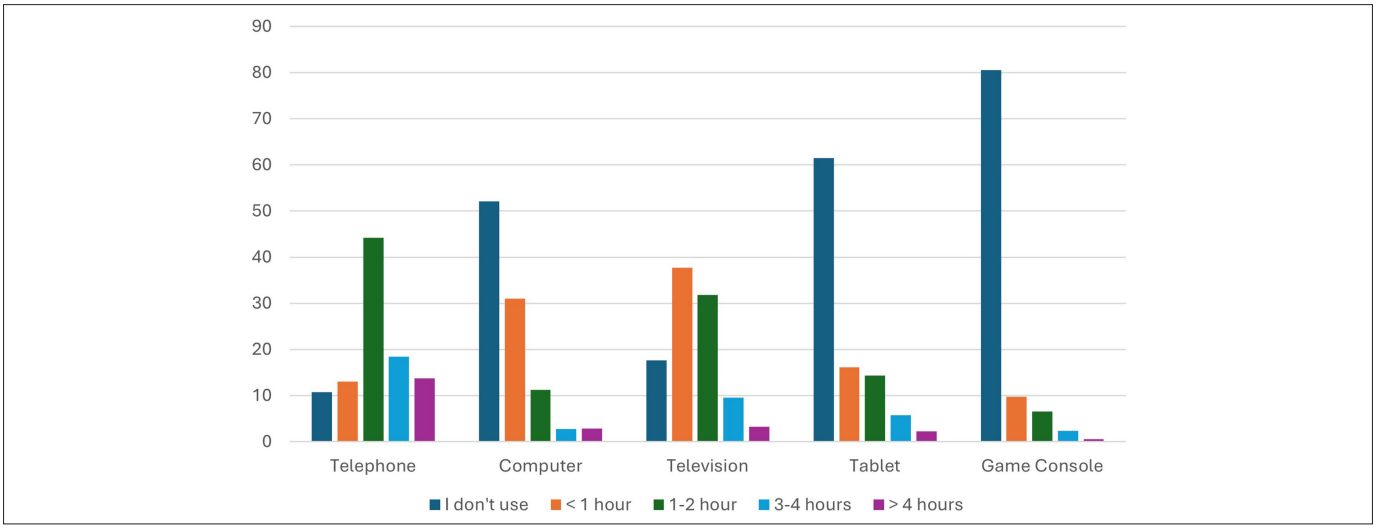

Figure 1. Distribution of the average daily duration of use of technological devices by the students.

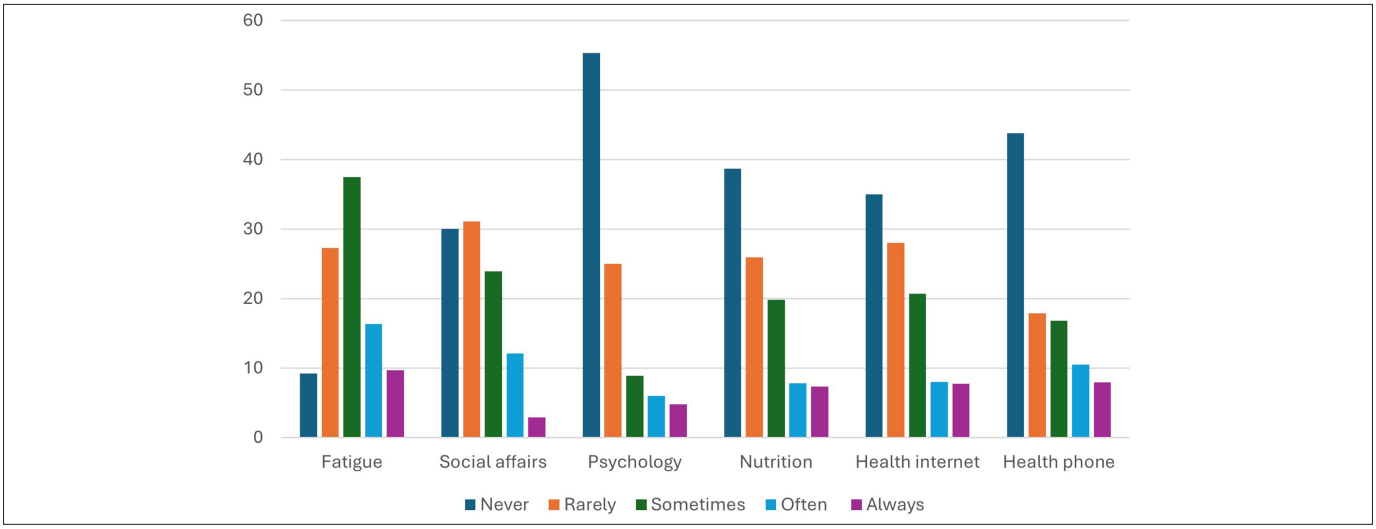

Figure 2. Distribution of the levels of addiction to technological devices and frequency of use of technological devices for health-exercise purposes.

Table 2. Relationships between the Frequency of Technological Device Use and Complaints of Musculoskeletal Pain

	Back		Lower back		Neck		Hand		Wrist		Shoulder	
	r	*P*	*r*	*P*	*r*	*P*	*r*	*P*	*r*	*P*	*r*	*P*
Telephone	0.057	.060	0.051	.120	0.094	**.002***	0.056	.050	0.079	**.008***	0.012	**.020***
Computer	0.112	**.002***	0.067	**.010***	0.004	.890	0.020	.500	0.026	.210	0.062	**.040***
Television	−0.018	.550	0.019	.760	−0.069	**.040***	0.019	.340	0.025	.140	−0.003	.845
Tablet	0.018	.600	0.012	.700	0.005	.810	0.065	**.030***	0.127	**.040***	0.038	.200
Game console	−0.014	.560	0.004	.980	0.015	.670	0.035	.550	−0.013	.810	−0.001	.870

*Spearman, $P < .05$

When the technological device usage habits were examined, the telephone was the most frequently used device, and it was determined that 44.2% used it for 1-2 hours a day. According to the statements of the students, computers were not used by 52.1% of the participants, television was watched for less than 1 hour per day by 37.7%, tablets were not used by 61.5%, and the use of game consoles remained at a very low level, with 80.6% stating that they did not use game consoles (see Figure 1).

When the effects of the use of technological devices on health were evaluated, the main complaints were determined to be headaches at the rate of 27.4%, dizziness at 15.3%, nausea at 8.4%, and fatigue complaints. In respect of fatigue, 37.5% reported having complaints "sometimes", while psychological effects were seen "always" by 4.8% (see Figure 2). When the musculoskeletal system pains related to the use of technological devices were examined, significant relationships were found between the use of mobile phones and neck pain ($r = 0.094$, $P = .002$), and between computer use and back pain ($r = 0.112$, $P = .002$) (see Table 2). The relationship between the use of television, tablet and game console, and musculoskeletal complaints did not show statistical significance. The effect of technological device use on physical activity levels was evaluated, and significant relationships were found between the use of mobile phones and a decrease in leisure time activities ($r = 0.056$, $P = .002$) and a decrease in physical activities for health purposes ($r = 0.043$, $P = .008$). A statistically significant relationship was found between computer use and leisure time physical activities ($r = 0.020$, $P = .04$). Although the findings obtained in the study were statistically significant, the correlation coefficients were found to be small (see Table 3).

Discussion

The aim of this study was to understand the effects of the duration of technological device use on the health and physical activity levels of secondary school students. According to the findings obtained, excessive use of technological devices may lead to significant changes in children's daily life habits. The use of phones and computers in particular was found to be associated with a decrease in physical activity levels, an increase in musculoskeletal complaints, and disturbances in sleep patterns. Excessive use of technological devices among secondary school students poses several significant health risks. One major concern is sleep deprivation, as the blue light emitted from screens disrupts the natural sleep-wake cycle, leading to fatigue and decreased cognitive function.[9] Moreover, prolonged screen time can result in digital eye strain, characterized by discomfort and vision problems, which is particularly prevalent among students who engage in extended digital activities.[10] Mental health issues are also exacerbated by excessive device use, with increased rates of anxiety, depression, and low self-esteem linked to constant social media comparisons.[11] Furthermore, increased screen time can lead to a greater risk of cyberbullying, contributing to feelings of vulnerability and further mental health deterioration.[12] Finally, over-reliance on technology can result in social isolation, reducing face-to-face interactions, and increasing the likelihood of depression and anxiety.[13] These interconnected risks highlight the urgent need for balanced technology use among students.

The relationship between technological device use and physical and sedentary activity levels of secondary school students is complex and multifaceted. Research has shown that increased screen time is often associated with decreased physical activity and leads to poorer physical fitness outcomes.[14,15] This relationship is influenced by a variety of factors, including the type of technology used and the context of use. Prokoso et al[16] found that students with higher screen time exhibited lower levels of physical activity, with 43.18% of participants reporting low activity levels and an average screen time of 3.03 hours per day. Hantal et al. reported a significant association between increased digital device use and low levels of physical activity among adolescents. It was noted that higher screen time was associated with a sedentary lifestyle, potentially leading to disc degeneration and herniation.[17] Similarly, in another study, increased screen time among adolescents was seen to be significantly linked to decreased levels of physical activity. In that study, 76.01% of participants exceeded the recommended screen time, and this was associated with a decline in physical activity and academic performance.[18] Another study of adolescents also found that excessive smartphone use was associated with shorter sleep duration, increased fatigue, and musculoskeletal pain, which in turn had a negative relationship with physical activity levels and encouraged sedentary behavior due to prolonged device use.[8]

The use of technological devices among secondary school students significantly affects their psychological health and sleep quality. Research

Table 3. Correlations between the Duration of Technological Device Use and Physical Activity Level in Students

	BPAQ-Total		BPAQ-Work		BPAQ-Sport		BPAQ-Leisure Time	
	r	P	*r*	*P*	*r*	P	*r*	*P*
Telephone	0.058	.060	0.043	**.008***	0.094	**.005***	0.056	**.002***
Computer	0.890	**.001***	0.073	**.001***	0.004	**.001***	0.020	**.004***
Television	−0.018	.550	0.009	**.002***	−0.059	**.004***	0.029	.33
Tablet	0.018	.600	0.011	.74	0.006	**.002***	0.045	**.003***
Game console	−0.018	.590	0.004	.96	0.015	.64	0.018	**.003***

*Spearman, $P < .05$
BPAQ, Baecke Physical Activity Questionnaire.

has shown that excessive screen time, particularly from smartphones and other electronic devices, is associated with poor sleep outcomes and increased psychological distress. This relationship is complex and involves several factors such as device type, duration of use, and interpersonal differences. In studies examining the impact of technological device use on sleep quality, the long-term use of electronic devices, especially before bedtime, has been found to disrupt sleep patterns, leading to decreased sleep quality and duration.[19,20] Another study found that 28.4% of adolescents who used smartphones for more than 2 hours per day reported decreased sleep duration and increased fatigue.[8] In addition, larger screens such as laptops were associated with more significant sleep disruptions compared to smaller devices.[20] It has been reported that 72% of all children and 89% of adolescents have at least 1 device in their sleep environment, and most are used close to bedtime.[21] In the current study, significant relationships were found between students' frequency of phone, computer, television, tablet and game console use and fatigue, stress, disruption in social behaviors, and internet use for health purposes. When the effects of the duration of technological device use on psychological health are examined, high use of electronic devices has been seen to be linked to increased levels of stress, anxiety, and depression among adolescents.[22] A significant proportion of adolescents have reported severe psychological distress, and those with high levels of device use experienced worse mental health outcomes.[22] The association between device use and mental health is often mediated by sleep quality, indicating that poor sleep exacerbates psychological problems.[19] Conversely, some argue that technology can provide positive social interactions and educational benefits, potentially mitigating some of the negative effects on mental health and sleep. However, current studies suggest that the risks associated with excessive device use outweigh these benefits and require interventions to promote healthier patterns of use among adolescents.

The association between the duration of technological device use and musculoskeletal complaints among secondary school students is important as evidence has shown that prolonged use is associated with increased pain and discomfort. Several studies have emphasized that excessive screen time leads to poor posture, thereby exacerbating musculoskeletal problems.[9,23] One study found that students who used electronic devices for more than 2 hours per day reported higher prevalence and severity of musculoskeletal symptoms, particularly in the neck and back.[9,24] Secondary school students exhibited greater device use and associated symptoms compared to their younger peers, indicating a trend toward increasing discomfort with age.[9] Regarding the posture effect, poor posture, such as bent positions during device use, has been linked to musculoskeletal discomfort, with reports of students with forward head posture experiencing significant pain levels.[25] Correct posture and physical activity are known to be mitigating factors against pain, suggesting that awareness and education on ergonomics may be beneficial.[23] In a review article published by Bilgin and Kutsal, it was also stated that the possibility of discomfort in the neck, shoulders, back, and hands increased with increased computer use, and excessive daily computer use may increase musculoskeletal symptoms from moderate to severe.[26] The current study results showed a relationship between computer usage time and back, lower back, and shoulder pain, television watching time and neck pain, tablet usage time and hand and wrist pain, and phone usage time and back and shoulder pain. However, no significant relationship was found between the duration of game console use and musculoskeletal pain.

Limitations and Strengths

This study is one of the few that have comprehensively examined the effects of technological device usage time on physical activity levels and health in secondary school students living in a rural area.

There were some limitations, primarily the cross-sectional design, which prevented the establishment of a cause-and-effect relationship. In addition, since the data were based on self-reporting, the possibility of bias in the answers of the participants should be taken into consideration. The fact that the study was limited to a specific region may also limit the generalizability of the findings. It can be recommended that this issue be examined in more depth with future longitudinal studies and studies covering different socio-economic groups.

Conclusion

The results of this study demonstrated the effects of technological device use on the physical activity levels and general health of secondary school students. In particular, excessive use of devices such as mobile phones and computers leads to a decrease in physical activity, an increase in sedentary lifestyle, and various health problems. Students who use technological devices for a long time experience musculoskeletal disorders, fatigue, disturbances in sleep patterns, and decreased social interaction. Therefore, it is important that screen time is managed in a balanced way while ensuring that children lead an active life. Encouraging outdoor activities, increasing digital literacy, and raising awareness among both students and parents can help reduce these negative effects. Future research should focus on examining the impact of intervention programs that promote long-term behavioral changes and healthy technology use.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Sakarya University of Applied Sciences (Date: 03.01.2023, Number: E-98849436-604.01.01.01-99478).

Informed Consent: Written informed consent was obtained from participants and their parents who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – A.Y., S.N.D., İ.Ç., P.İ., A.T., B.T.; Design – S.N.D., İ.Ç., P.İ., A.T., B.T.; Supervision – A.Y.; Resources – S.N.D., İ.Ç., P.İ., A.T., B.T.; Materials – S.N.D., İ.Ç., P.İ., A.T., B.T.; Data Collection and/or Processing – S.N.D., İ.Ç., P.İ., A.T., B.T.; Analysis and/or Interpretation – A.Y.; Literature Search – A.Y., S.N.D., İ.Ç., P.İ., A.T., B.T.; Writing Manuscript – A.Y., S.N.D., İ.Ç., P.İ., A.T., B.T.; Critical Review – A.Y.; Other – A.Y., S.N.D., İ.Ç., P.İ., A.T., B.T.

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