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THE RELATIONSHIP OF SCREEN ADDICTION WITH PHYSICAL ACTIVITY, PHYSICAL PERFORMANCE, BALANCE, CIRCADIAN RHYTHM, AND QUALITY OF LIFE IN CHILDREN
ÇOCUKLARDA EKRAN BAĞIMLILIĞININ FİZİKSEL AKTİVİTE, FİZİKSEL PERFORMANS, DENGE, SİRKADİYEN RİTİM VE YAŞAM KALİTESİ İLE İLİŞKİSİ

Beyza KOYUNCU[1], Büşra KEPENEK VAROL[2]

[1]Üsküdar University, Health Sciences Intstitute, Department of Physiotherapy and Rehabilitation, İstanbul
[2]Nuh Naci Yazgan University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Kayseri

ABSTRACT

The aim of this study is to examine the relationship between screen addiction and physical activity, physical performance, balance, circadian rhythm, and quality of life (QoL) in children. Sixty-eight children who were aged 8-12 years included in the study was assessed with the Screen Addiction Problematic Media Use Scale, the Physical Activity Questionnaire, the Six-Minute Walk Test, the 5 Repetition Sit to Stand Test, the Sit and Reach Test, the Vertical Jump Test, the Flamingo Balance Test, the Tandem Walking Test, the Daily Rhythm Scale for Children, and the Children's QoL Scale. There was no significant relationship between screen addiction and physical activity, physical performance, balance, circadian rhythm and QoL. While there is a positive statistically significant relationship (r_s=0.350; p<0.01 and r_s=294; p<0.05, respectively) between screen time and problematic media use, there is a negative statistical correlation between screen addiction and physical activity and circadian rhythm (r_s=-0.281; p<0.05 and r_s=-272; p<0.05, respectively). The functional muscle strength of the lower extremities decrease with the increase in screen addiction (p<0.05). In conclusion, physical activity levels decrease as the duration of digital screen usage increases. Considering that screen addiction reduces lower extremity functional muscle strength, it is important to encourage children to physical activity. In addition, the increase in the QoL as the screen usage time increases, and the fact that the average daily device usage time is low in the children included in the study, suggests that the children use technological devices efficiently. The increase in QoL may have positively affected the circadian rhythm.

Keywords: screen addiction, physical activity, physical performance, circadian rhythm, quality of life

ÖZ

Çalışmanın amacı; çocuklardaki ekran bağımlılığı ile fiziksel aktivite, fiziksel performans, denge, sirkadiyen ritim ve yaşam kalitesi arasındaki ilişkiyi incelemektir. Çalışmaya dahil edilen 8-12 yaş arası 68 çocuk, Problemli Medya Kullanım Ölçeği, Fiziksel Aktivite Soru Formu, Altı Dakika Yürüme Testi, Otur Kalk Testi, Otur-Uzan Testi, Dikey Sıçrama Testi, Flamingo Denge Testi, Tandem Yürüyüş Testi, Çocuklara Yönelik Günlük Ritim Ölçeği ve Çocuklar için Yaşam Kalitesi Ölçeği ile değerlendirildi. Ekran bağımlılığıyla fiziksel aktivite, fiziksel performans, denge, sirkadiyen ritim ve yaşam kalitesi parametreleri arasında anlamlı ilişki saptanmadı. Ekran başında geçirilen süreyle problemli medya kullanımı ve yaşam kalitesi arasında pozitif yönlü istatistiksel anlamlı ilişki (sırasıyla r_s=0.350; p<0.01 ve r_s=294; p<0.05); fiziksel aktivite ve sirkadiyen ritim arasında negatif yönlü istatistiksel anlamlı ilişki vardı (sırasıyla r_s=-0.281; p<0.05 ve r_s=-272; p<0.05). Ekran bağımlılığının artmasıyla alt ekstremite fonksiyonel kas kuvvetinin azaldığı görüldü (p<0.05). Sonuç olarak, dijital ekranlarla geçirilen süre arttıkça fiziksel aktivite düzeyleri azalmaktadır. Ekran bağımlılığının alt ekstremite fonksiyonel kas kuvvetini azalttığı düşünüldüğünde çocukların fiziksel aktiviteye teşvik edilmesi önemlidir. Bununla birlikte ekran kullanım süresi arttıkça yaşam kalitesini artması, çalışmaya dahil edilen çocuklarda günlük ortalama cihaz kullanım sürelerinin az olduğu göz önünde bulundurulduğunda, çocukların teknolojik cihazları verimli kullandığını düşündürmektedir. Yaşam kalitesindeki artış, sirkadiyen ritmi olumlu etkilemiş olabilir.

Anahtar kelimeler: Ekran bağımlılığı, fiziksel aktivite, fiziksel performans, sirkadiyen ritim, yaşam kalitesi

Corresponding Author: Asst. Prof. Büşra KEPENEK VAROL, Nuh Naci Yazgan Üniversitesi Kuzey Çevreyolu Erkiletdere Mah. Kocasinan/Kayseri, busrakepenek@gmail.com, ORCID: 0000-0001-5488-5316
PT. MSc. Beyza KOYUNCU, beyzagulkoyuncu@hotmail.com, 0000-0003-4949-4665

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INTRODUCTION

Nowadays, many digital devices such as televisions, computers, smart phones have become indispensable for people of all ages in daily life with rapidly developing technology. While these devices provide convenience in every aspect of our lives, they also bring many damages due to incorrect and/or excessive use (1). The increasing use of technological devices not only helps children with their homework, but also causes them to meet their game and social activity needs with these devices, and directs children to the digital world by distracting them from the habits of playing traditional games or communicating side by side (2).

The time spent by children in front of the screen and the use of technological devices are increasing (3). The use of devices by sitting for a long time, mostly due to the habit of playing games, causes children to adopt a sedentary lifestyle which increase the risk of obesity. It has been reported that secondary to this situation, children can postpone their humanitarian needs such as sleep, to use the toilet and nutrition and they also experience sleep problems (4).Long-term use of smart phones can cause kyphotic posture, damage to the ligaments as well as the structure of the cervical and lumbar spine, and these structural problems caused by postural distortion may lead to systemic disorders (5).

The circadian rhythm is a 24-hour cycle that encompasses psychological, physiological, and behavioral processes and is formed by endogenous biological clocks (6). There are various opinions in the literature explaining the effect of technological device use on children's circadian rhythm. Chang et al. (7) reported that short-wavelength light emitted from devices delays the circadian rhythm by suppressing melatonin release. Turner et al. (8) stated that the light transmission of the crystal lens in children is faster than in adults, and therefore children are more affected by technological devices. In another study performed by Arora et al. (9), it has been suggested that the circadian rhythm is affected because the electromagnetic radiation emitted from the devices changes the sleep architecture and delays the production of melatonin. In the light of this information, it is clear that the use of digital devices in children has positive aspects as well as some negative aspects. So, we aimed in this study to examine the relationship of screen addiction in children with physical activity, physical performance, balance, circadian rhythm, and quality of life.

MATHERIAL AND METHODS

Study Design and Participants

Between May 2021 and November 2021, 68 children aged between eight and 12 years were included in the study. Children aged between eight-12 years, using technological devices, and who were allowed to participate in the study by their families were included in the study. Children with a diagnosis of psychological illness, acute or chronic illness that would prevent participation in the study, physically disabled, and not having adequate communication skills were excluded from the study. After the demographic information of all children participating in the study were recorded, their screen addictions, physical activity levels, physical performances, static and dynamic balances, circadian rhythms, and quality of life were evaluated. The study was approved by the Ethics Committee of Üsküdar University in accordance with the Helsinki Declaration (Protocol Number: 61351342/Nisan 2021-102). Written informed consents were received from all children and their parents.

Problematic Media Use Measure (PMUM): The scale, which was developed to detect problematic media use in children aged 4-11, generally evaluates the problematic use of visual media tools (television, computer, tablet, smart phone, etc.), in other words, screen addiction. PMUM is filled by the mother or father, considering the child's perceptions and behaviors. The short form consists of a total of nine items and the items are scored between one (never) and five (always) according to the Likert scale. The total score is obtained by averaging the scores from nine items, and high scores indicate problematic use of visual tools (10). The Turkish validity and reliability study was performed by Furuncu et al. (11). In our study, the short form of PMUM was applied face-to-face to evaluate screen addiction in children.

Physical Activity Questionnaire (PAC): PAC is a scale used to evaluate the physical activity of children during the last seven days of the school term. The scale consists of 10 items, but the 10th item is not included in the total scoring. The last item was created to question whether there was an obstacle to physical activity during the past week. The answers are scored between one and five, "one" represents low-intensity physical activity, and “five” points represents high-intensity physical activity. The total score is obtained by calculating the average score of the first nine questions. The lowest score that can be obtained from the scale is nine, and the highest score is 45 (12). Turkish validity and reliability study was conducted by Sert et al. (13). PAC was used to evaluate the physical activity levels of children in this study. In accordance with the scale scoring, the 10th question was not included in the total score calculation.

The Six-Minute Walk Test (6MWT): The 6MWT is a field test that is easy to apply and does not require complex equipment, used to determine functional capacity and aerobic performance. It is one of the most widely used field tests reflects daily life activities (14). The test was performed in a 30 m long corridor marked at three m intervals in accordance with the American Thoracic Society/European Thoracic Society criteria (14). Before the test, individuals were rested for 10 minutes, heart rate, blood pressure and oxygen saturation were measured before and immediately after the test, and dyspnea and fatigue levels were determined with the Borg Scale (15). At the end of the test, the distance that children walked for six minutes was recorded in meters.

The Sit-to-Stand Test (STS): STS is used to evaluate lower extremity functional strength. The individual is asked to perform the activity of standing up from a sitting position five times in a row as quickly as possible from a standard chair while the hands are in a crossed position on his chest. The time during which the five sit-to-stand activities are performed is recorded in seconds with a stopwatch. The test is performed in three replicates and the average value of the recorded times is calculated (16). In our study, STS was applied in three repetitions to evaluate the functional strength of the lower extremity, and the average value of the tests ap-

plied was calculated and recorded in seconds.

The Sit and Reach Test (SRT): The SRT is used to evaluate the flexibility of the hamstring and trunk flexion muscles. The individual is asked to sit with his feet on the test bench with both knees in extension and reach towards his feet. The flexion movement should not occur on the knees during the test. The distance between the tips of the fingers and the test bench is measured. The test is repeated three times and the average score is recorded (17). In this study, the children were asked to rest their feet on the test bench and reach towards their feet, paying attention to the extension movement of the knee, and the mean value of the tests repeated three times was calculated and recorded in centimeters.

Vertical Jump Test (VJT): The VJT is used to measure the sudden explosive force of muscles such as the quadriceps femoris, gastrocnemius, and gluteus maximus. The individual is asked to extend the arm up by touching the ground near the wall and the end point that can be reached is marked on the wall. Afterwards, it is requested to move 25 cm away from the wall and to jump from the ground with the help of the arms and touch the highest point that can be touched. The difference between the first reaching point and the jump is recorded in centimeter (18). In our study, the VJT was used to determine anaerobic power, and the difference between the children's first reaching point and the point reached after jumping was recorded in centimeter.

Flamingo Balance Test (FBT): In the FBT, individuals are standing on his non-dominant foot on a board (50 cm in length, 4 cm in height and three cm a wide board), bends the free leg backwards and grips the back of the foot. If the balance is disturbed, the time is stopped, and the number of falls is noted. If individuals make 15 mistakes in the first 30 seconds, the test is terminated. The application is made twice, and the best result is recorded (19,20). In the present study, static balance was evaluated with the FBT, and the number of falls within one minute was recorded.

Tandem Walking (TW): The test is started in a standing position with the hands on the waist, and the feet on a line. Afterwards, the individual is asked to take ten steps forward by looking forward with his/her preferred foot along the line drawn on the ground as heel-toe (20). In our study, dynamic balance was evaluated with the TW, and the walking time was recorded.

The Morningness Eveningness Scale for Children (MESC): The scale consists of 10 items with four options for some items and five options for the other items. Each item is given a score between one and five, and the total score range varies between 10 and 43. The scale can be used to classify circadian rhythm in children as morning, evening, and intermediate types. A score of 23 and below is considered morning type, a score between 24-32 is considered intermediate type, and a score of 33 and higher is considered evening type (21). Children's circadian rhythm was evaluated using MESC in this study. In addition, children were grouped as morning, intermediate and evening types according to the total score.

The Pediatric Quality of Life Inventory (PedsQL): The PedsQL is a health-related quality of life scale used in children and adolescents between the ages of two-18.A five-choice Likert-type scale was used (0=never, 1=rarely, 2=sometimes, 3=often, 4=always). In the assessment of the scale, there is a Total Physical Health Score (TPHS) and a Psychosocial Health Total Score (PHTS), which is the sum of emotional, social, and school-related functionality. The total score of the PedsQL consist of TPHS and PHTS. An increase in the total score of the scale is an indicator of better quality of life (22). A Turkish validity and reliability study was conducted by Çakın-Memik et al. (23). The scale, which has both parent and child/adolescent forms, was used only in the child form for eight-12 years of age to evaluate the quality of life in our study.

Statistical Analysis

IBM SPSS 20 package program was used to evaluate the data. Kolmogorov Smirnov test, which is one of the normality tests, was used to test whether the data showed a normal distribution. ANOVA Test was used to compare the values of the three dependent groups. The relationship between the variables was evaluated with the Spearman Correlation Test. Regression analysis was performed to show the relationship between the dependent variable and the independent variable.

In the literature, there is a relationship with a correlation coefficient of 0.335 between smart phone addiction and physical activity (24). In our study, it was predicted that a relationship with a correlation coefficient of at least 0.350 could be detected between screen addiction and physical activity, similar to the literature, and in order to detect this relationship with a confidence level of 95% and a power of 80%, 61 cases were calculated, but this rate has been increased by 10% considering possible missing data and a total of 68 cases were included in the study (25).

RESULTS

The demographic characteristics of the children included in the study are presented in Table I. When the age distribution of children is examined, 23 children (33.8%) are 8 years old, 14 children (20.6%) are 9 years old, 7 children (10.3%) are 10 years old, 6 children (8.8%) are 11 years old, and 18 children (26.5%) was 12 years old. Eighteen children had their own phone, 31 had their own tablet, 24 had their own computer, and 5 children had more than one device. While the average daily time spent with digital devices was 2.33 ± 1.66 hours, there were 23 children (33.9%) with 1 hour or less daily screen exposure, 22 children (32.4%) 2 hours,14 children (20,6%) with 3-4 hours, and 9 children (13.2%) with 5 hours or more. When the daily period of time spent with the digital device was questioned, it was observed that 4 children (5.9%) had more screen exposure in the morning, 13 children (19.1%) at noon, 36 children (52.9%) in the evening, and 15 children (22.1%) just before going to bed.

The relationship between PMUM and physical activity, circadian rhythm and quality of life is given in Table II, and the relationship between time spent with a digital device and problematic media use, physical activity, circadian rhythm, and quality of life is given in Table III. While there was no statistically significant correlation between screen addiction and physical activity, circadian rhythm, and quality of life ($p>0.05$), there was a statistically significant positive and moderate correla-

Table I. Demographic characteristics of the children

	n	%
Gender		
Female	29	42.6
Male	39	57.4
Body massindex		
Underweight	28	41.2
Normal	35	51.5
Overweight	5	7.4
Number of siblings		
0	4	5.9
1	23	33.8
2	21	30.9
≤ 3	20	29.4
Child'sownroom		
Yes	24	35.3
No	44	64.7

	$\bar{X}$ ± SS	min.	max.
Age (years)	9.68 ± 1.72	8	12
Height (cm)	135.65 ± 15.84	110	160
Weight (kg)	36.09 ± 10.73	19	67
Duration of digital deviceuse (h)	2.33 ± 1.66	0.3	8

$\bar{X}$ ± SS: mean ± standart deviation; min: minimum; max: maximum

Table II. The correlation between problematic media use, physical activity, circadian rhythm and quality of life

	PMUM	PAC	MESC	PedsQL	*TPHS*	*PHTS*
PMUM	1					
PAC	-.036	1				
MESC	-.105	-.036	1			
PedsQL	.35	-.111	-.127	1		
TPHS	-.119	-.169	-.104	.717**	1	
PHTS	.107	-0.95	-.127	.925**	.444**	1

** p<0.05 **p<.01 ***Spearman Corelation Test*

PMUM: Problematic Media Use Measure; PAC: Physical Activity Questionnaire; MESC: The Morningness Eveningness Scale for Children; PedsQL: The Pediatric Quality of Life Inventory; TPHS: Total Physical Health Score; PHTS:Psychosocial Health Total Score

Table III. The relationship between duration of digital device use and problematic media use, physical activity, circadian rhythm and quality of life

	Duration of digital device	PMUM	PAC	MESC	PedsQL	*PedsQL TPHS*	*PedsQL PHTS*
Duration of digital device	1						
PMUM	.350**	1					
PAC	-.281*	-.036	1				
MESC	-.272	-.105	.373**	1			
PedsQL	.294*	.035	-.111	-.127	1		
TPHS	.312*	-.119	-.169	-.104	.717**	1	
PHTS	.221	.107	-.095	-.127	.925**	.444**	1

** p<0.05 **p<.01 ***Spearman Correlation Test*

PMUM: Problematic Media Use Measure; PAC: Physical Activity Questionnaire; MESC: The Morningness Eveningness Scale for Children; PedsQL: The Pediatric Quality of Life Inventory; TPHS: Total Physical Health Score; PHTS: Psychosocial Health Total Score

tion between physical health and psychosocial health subgroups of PedsQL (r_s=0.444; p<0.05). There was a low negative correlation between the time children spend with digital devices and physical activity (r_s=-0.281; p<0.05); A positive low-level significant correlation with physical health functionality, one of the subgroups of PedsQL, (r_s=0.312; p<0.05); While there was a low and positive significant correlation with the total score of PedsQL (r_s=0.294; p<0.05), and a significant positive correlation between the duration of digital device use and PMUM (r_s=0.350; p<0.01); there was a low and significant negative correlation with MESC (r_s=-0.272; p<0.05).

There was no statistically significant relationship between the participants' duration of use of technological devices and 6MWT distance, STS, SRT, VJT, static and dynamic balance test results (p>0.05). While there was no significant difference between PMUM and 6MWT distance, VJT, SRT, static and dynamic balance test results (p>0.05); it was concluded that there was a significant negative correlation with the STS (r_s=-0.264; p<0.05). A significant positive correlation was found between PAC and 6MWT distance (r_s=0.257; p<0.05). There was no statistically significant correlation between MESC, PedsQL, TPHS, PHTS and 6MWT, VJT, STS, SRT, static and dynamic balance results (p>0.05).

In the comparison of morning, intermediate and evening groups according to MESC, no statistically significant difference was found in the parameters of problematic media use, physical activity, physical performance, balance, quality of life and duration of digital device use (p>0.05) (Table IV). There is a positive and significant relationship between time spent with digital devices and problematic media use (β: 15.39; p<0.05), a negative significant relationship with PAC (β: 68.52; p<0.05), and PedsQL there was a significant positive correlation (β: 39.40; p<0.05), and a negative significant relationship with MESC (β: 28.02; p<0.05). (Table V). There was no significant relationship between the ages of the children and their PMUM, MESC and PedsQL scores (p>0.05). There was a significant negative correlation between the age variable and PAC scores (β: 83.38; p<0.05) (Table VI).

DISCUSSION

This study was conducted to investigate the effects of screen addiction in children on physical performance, physical activity, balance, circadian rhythm, and quality of life. In this study, which included 68 children, no significant relationship was found between screen addiction and physical activity, physical performance, balance, circadian rhythm, and quality of life parameters. While there was a positive statistically significant relationship between screen time, problematic media use and quality of life, there was a negative statistically significant relationship between physical activity and circadian rhythm. The decreased functional muscle strength of the lower extremities was observed with the increase in screen addiction.

The term screen addiction is excessive and problematically used for screen use through technological devices. The individual loses his will over the use of the device in addiction and spends a lot of time in the created virtual world. As a result, social, psychological, and physical activities are delayed and/or neglected (26). Nowadays, children spend a lot of time on digital screens, especially in games played in front of the screen, which leads to a decrease the physical activity level by moving away

Table IV: Comparison of problematic media use, physical activity, physical performance, balance, quality of life and duration of digital device use according to circadian rhythm preference

	Morning type (n=14)	Intermediate type (n=30)	Evening type (n=24)	*p**
	X̄ ± SS	X̄ ± SS	X̄ ± SS	
PMUM	21.3 ± 8.83	19.3 ± 8.5	17.49 ± 7.06	.365
PAC	59.5 ± 10.1	64 ± 12.1	61.9 ± 15.85	.566
6MWT	518.6 ± 59.3	533.6 ± 40.8	514.54 ± 70.31	.440
STS	8.4 ± 2.09	8.12 ± 2.72	8.27 ± 1.88	.928
STR	-4.36 ± 9.8	-3.77 ± 8,3	-3.88 ±9.18	.979
VJT	16.7 ± 4.99	15.6 ± 4.83	15.96 ± 4.7	.776
FBT	6.64 ± 4.62	6.03 ± 5.03	4.92 ± 3.99	.494
TW	10.5 ± 3.71	9.54 ± 2.23	10.03 ± 2.03	.484
PedsQL	43.6 ± 9.84	45.59 ± 9.03	41.59 ± 10.8	.339
Duration of digital device use (h)	2.96 ± 1.89	2.42 ± 1.65	1.85 ± 1.31	.116

**ANOVA Test*

X̄ ± SS: mean ± standart deviation; PMUM: Problematic Media Use Measure; PAC: Physical Activity Questionnaire; 6MWT: The Six-Minute Walk Test; SRT: The Sit and Reach Test; STS: The Sit-to-Stand Test; VJT: Vertical Jump Test; FBT: Flamingo Balance Test; TW: Tandem Walking; PedsQL: The Pediatric Quality of Life Inventory

Table V. The regression analysis between duration of digital device use and problematic media use, physical activity, circadian rhythm, and quality of life

	PMUM			PAC			MESC			PedsQL		
	B	SE	P	B	SE	P	B	SE	P	B	SE	P
Sabit	15.39*	1.63	.000	68.52*	2.551	.000	28.02*	.865	.000	39.4	2.00	.000
Media use	1.66	.574	.005	-2.33	.893	.011	-.987	.303	.002	1.99	.701	.006
F		8.38			6.81			10.62			8.06	
P		.005			.011			.002			.006	
R2		.116			.310			.142			.112	
R2 exchange		.102			0.82			.129			.098	

**Regression analysis*

PMUM: Problematic Media Use Measure; PAC: Physical Activity Questionnaire; MESC: The Morningness Eveningness Scale for Children; PedsQL: The Pediatric Quality of Life Inventory

Table VI. The regression analysis between children's age and problematic media use, physical activity, circadian rhythm and quality of life

	PMUM			PAC			MESC			PedsQL		
	B	**SE**	**P**	**B**	**SE**	**P**	**B**	**SE**	**P**	**B**	**SE**	**P**
Sabit	15.67	5.66	.007	83.38*	8.83	.000	30.4	2.95	.000	39.02	6.90	.000
Age	.351	.577	.554	-2.17	.899	.018	-.481	.301	.115	.491	.702	.487
F		.371			5.85			2.54			.489	
P		.544			.018			.115			.487	
R2		.006			.081			.037			.007	
R2 exchange		-.009			.068			.023			-.008	

**Regression analysis*
PMUM: Problematic Media Use Measure; PAC: Physical Activity Questionnaire; MESC: The Morningness Eveningness Scale for Children; PedsQL: ThePediatric Quality of Life Inventory

from traditional games that emphasize physical activity and socialization in open-air spaces (27). Delfino et al. (28) reported that individuals who spend more than 2 hours with a smartphone have lower physical activity levels than other individuals. In a study conducted with secondary school students, no significant relationship was found between digital game addiction and physical activity level and sleep habits, but an increase in the addiction level of students who spent 3 hours or more with games was reported (4). In our study, no correlation was found between screen addiction and physical activity. However, when the time spent with digital screen devices was questioned during the day, physical activity decreased as the time spent with the screen increased. The fact that the total screen exposure (television, tablet, computer, smartphone) was two hours or less, a level that cannot be considered addictive, in more than half of the cases (n=45, 66%) included in our study may have caused the lack of correlation. In our study, it was also observed that physical activity levels of children decreased with age.The reason for the decrease in physical activity according to the age may be due to lifestyle changes caused by interests.

Physical activity affects motor skills and physical performance parameters (29). The fact that screen addiction reduces physical activity also leads to deterioration in physical performance (30,31). Delebe et al. (30) reported that digital game addiction in children reduces aerobic performance and decreases physical endurance in the extremities. In another study, a negative correlation was found between long-term mobile phone use and aerobic performance, and this was associated with long-term use of mobile phones leading to physical inactivity (31). Conversely, smartphone addiction was not associated with physical activity and physical performance in youth (32). The time spent with the screen, leisure activities, exercise history, or sociocultural reasons may have affected these different results in the literature, and further studies are needed considering these differences to investigate the relationship between screen addiction and physical performance.

Digital game addiction reduces muscle strength in the extremities due to prolonged sitting position (30). In addition, it has been reported that when using a smartphone while walking, less muscle activity occurs in the gluteus maximus and medius, biceps femoris, rectus femoris, gastrocnemius and tibialis anterior muscles compared to walking without using a smartphone (33). While there was no significant relationship between screen addiction and vertical jump performance in this study, the low negative correlation between screen addiction and lower extremity functional muscle strength suggested that screen addiction negatively affects the functional use of lower extremity muscles in children. The short average time spent in front of the screen by children (2.33 ± 1.66 hours daily) may not have affected the vertical jump performance.

The increase in the time spent with technological devices leads to decreases in body flexibility due to sedentary life (34). In addition, weight gain as a result of a sedentary life increases the adipose tissue around the joint and decreases the range of motion and flexibility (35). No relationship was found between physical activity level, screen addiction and flexibility in the present study. Screen addiction may not have affected flexibility, since flexibility decreases with age and the younger age group is higher in children included in our study. Another reason for decreased flexibility has been reported as excessive weight gain due to a sedentary life, but the fact that only five children in our sample group had a BMI above normal may be another reason for the lack of flexibility in children. However, it should be kept in mind that taking frequent breaks and applying stretching exercises while using a digital device will be beneficial for the protection of the musculoskeletal system in the future.

The use of digital devices in long-term incorrect body posture, especially in the cervical region, causes pain and pathology in the vestibulospinal system, which leads to disruption of the balance (36). In individuals who use computers for a long time, posture deteriorates, and the center of gravity shifts forward, reducing the ability to balance (37). There was no correlation between screen addiction and static/dynamic balance in this study. We think that the total screen usage time of the children included in our study, and even more than half of them being two hours or less, does not affect the posture, and this is not reflected in the balance scores.

Circadian disruption is known as the misalignment between the endogenous circadian rhythm and environmental conditions (38). Light exposure at night, espe-

cially blue light, can cause a phase shift in the circadian rhythm depending on the duration, wavelength, and intensity of the light. While short-wavelength light affects circadian rhythm and nighttime sleep, it also has negative effects on sleep physiology and morning wakefulness (39). The total daily usage time of the smartphone, especially the last time before sleep, delays the onset of sleep and reduces the sleep time (40,41). Lin et al. (40) reported that 1-hour daily increase in smartphone use delays circadian rhythm by 3.5 minutes and reduces total sleep time by 5.5 minutes, and concluded that pre-sleep smartphone use delays circadian rhythm and reduces total sleep time. As a result of this study, there was no statistically significant relationship between screen addiction and circadian rhythm. However, there was a low negative correlation between the time spent with digital devices and the circadian rhythm. It is known that exposure to light at night causes a phase shift in the circadian rhythm by suppressing melatonin secretion (41), while exposure to blue light, especially before bedtime and during the night, disrupts the circadian rhythm and causes chronic health problems (38). In the sample group of our study, when the time of the day was questioned, it was found that only 15 children (22.1%) spent time with the digital screen just before going to bed. The absence of digital screen exposure before bedtime in the vast majority of children may have prevented the phase shift in the circadian rhythm. In addition, the increase in the quality of life with the increase in screen time in our study suggested that the children spend quality time with the screen, which may have a positive effect on the circadian rhythm.

The problem that occurs in the circadian rhythm directly affects the muscle strength, motor control and flexibility parameters (42). Sensory processing disorder accompanied by visual disturbances due to sleep problems can cause balance problems (43). In this study, no statistically significant correlation was found between circadian rhythm and functional capacity, flexibility, lower extremity muscle strength and balance. The low digital screen exposure of the children included in this study, and the screen exposure during the day (n = 53) rather than just before going to bed (n = 15) can be interpreted as not affecting the circadian rhythm, and the physical condition may not be affected.

The use of digital devices can have positive and negative effects on quality of life. In a study conducted with high school students, it was reported that the use of social media significantly affects happiness and life satisfaction (44). While digital devices provide many conveniences when used consciously, their excessive use outside of their purpose affects the quality of life negatively. Digital games used as a leisure activity reduce fatigue and stress, allow people to have fun by taking them away from city life and stress, help to cope with problems, increase self-confidence and ultimately increase the quality of life (45). It was concluded that as the duration of use of technological devices increases the quality of life also increases in the present study. Appropriate use of digital devices without overdoing it improves the quality of life by making life easier. In addition, as we mentioned above, the increase in quality of life may have had a positive effect on health in parameters such as circadian rhythm. This result supports that the children included in the study use the devices in a controlled manner before they reach the level of addiction, and that they benefit from technology to facilitate their daily life.

The large number of younger children and the small number of older children are the limitations of the study. Another limitation is that the majority of the children in the sample (66.2%) spend time with the digital screen for an average of 30 minutes to 2 hours per day, and the number of children who spend more time in front of the screen is low.

CONCLUSION

In conclusion, no statistically significant relationship was found between screen addiction and physical activity, functional capacity, lower extremity explosive muscle strength, flexibility, static and dynamic balance, circadian rhythm, and quality of life. The most important factor affecting this result is that most of the children included in the study spend less time per day with the digital screen. However, as a result of the study, the fact that physical activity levels decrease as the time spent with the digital screen increases may lead children to a sedentary life by taking them away from the activity of daily life with the increase in the time spent in front of the screen. The negative relationship between the usage time of digital devices and the circadian rhythm and the increase in the quality of life as the screen usage time increases, suggests that it may have a positive effect on the circadian rhythm. However, it should be kept in mind that the children in our study had little screen time, and more research on screen addiction and circadian rhythm in children is needed.

Conflict of interest

The authors declared no conflict of interest.

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