ORIGINAL ARTICLE

# Deconstruction of the Relationship Between Physical Activity Level, Body Mass Index and Multi-Screen Addiction in Middle School Students

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ABSTRACT

Nowadays, technology provides convenience in many areas, but it also brings negative effects, especially inactivity. Particularly, screen addiction of children and young people is gradually increasing and physical activity levels are decreasing. In this context, this study aimed to examine the relationship between multiple screen addictions of secondary school students, their physical activity level and body mass index. A total of 74 secondary school students participated in the study. Demographic Information questionnaire, International Physical Activity Questionnaire-Short Form and Multiple Screen Addic-tion scale were used as data collection tools. The data collected in the study were analyzed in Jamovi 2.0.0.0.21. statistical program at a 95% confidence interval and 0.05 significance level. Independent sample T-test, One Way ANOVA and Pearson's correlation analysis were used in the research. According to the results of the study, it was determined that the MET levels of the participants who do sports outside of school were higher and the multi-screen addiction levels of those who did not use smartphones were lower. Moreover, it was determined that the body mass index and multi-screen addiction levels of the participants who did not use social media were lower. As the MET levels of the participants increased, their multi-screen addiction levels decreased significantly. As a result, physical activities can be recommended to reduce the multi-screen addiction levels of secondary school children.

Keywords: Physical inactivity, Technology, Body composition

## INTRODUCTION

In this world of technology, it is not possible to keep individuals completely away from social media and communication tools, which are the benefits of technology. The use of technological tools in all areas, including education, both facilitates life and makes social life difficult. These tools are used by individuals both to save time in accessing information and to spend leisure in a entertaining way. The American Academy of Paediatrics recommends that infants should not be introduced to the screen before 18 months, children between the ages of 2-5 should have less than 1 hour of screen time per day, and children over the age of 6 should have controlled screen time in terms of quality and quantity (American Academy of Paediatrics, 2016). Current reports indicated that children between the ages of 8 and 12 had screen time between 4-6 hours a day and adolescents up to 9 hours a day (American Academy of Child and Adolescent Psychiatry, 2021).

The continuous development, change and accessibility of technological devices make the use of technological devices widespread and can lead to high levels of stress, anxiety and even addiction in children and adolescents (Aragay et al., 2023). Today, addiction is defined as a public health problem and screen (internet) addiction (WHO, 2018), smartphone addiction (Loleska & Pop-Jordanova, 2021) and digital game addiction (Men et al., 2022) are among the common addictions. Studies have shown that screen addiction has increased in the last 15 years, video game addiction is more than internet/social network addiction, and internet and video game addicts are at younger ages (Aragay et al., 2023). Of course, it should not be forgotten that the attitude of families, rules at home and being a role model are also effective in screen addictions at a young age. In a study conducted in Canada, when the screen time of parents with young children was examined, it was found that the phone came in first place with an average of 3 hours a day, and television came in second place with 2 hours of screen time (Dennis et al., 2022). These results suggest that families may also be effective as role models in screen addictions of children and adolescents.

Developments in social media tools in recent years increase the screen use of children and adolescents, and unhealthy screen use paves the way for 'screen addiction' over time (Xu et al., 2023). It is said that today's Alpha generation is addicted to screens such as tablets, smartphones and computers rather than television, and they use these tools mostly to play games (Güzel, 2021). In a study, the result that all children in the sample group used smartphones, played online games and used any social media application shows the seriousness of the situation (Üstündağ, 2022). Especially after the Covid-19 pandemic, it is recommended that screen time has increased and that initiatives should be taken on how to reduce the harms of excessive screen time rather than stopping screen usage (Xu et al., 2023). At this point, determining the situations that may affect children's screen addiction (Bekar & Efe, 2024) is critical in terms of taking necessary measures to reduce

children's screen addiction. Moreover, there is a relationship between screen addiction and healthy life behaviours, raising awareness of children and adolescents on this issue and increasing physical activity among healthy life behaviours can be encouraged (Çokkeser & Kızıltan, 2023).

It is recommended to use physical activity and sports as a tool in to balance the use of technological tools by today's children (Coşkuntürk et al., 2023). It is known that educational games in children both increase children's physical activity levels and contribute to areas of development (Akpınar, 2023). Although the development of technology and the popularity of digital games are seen as a reason that reduces physical activities and this situation is common all over the world (Esen et al., 2023). Studies conducted in European and Asian countries show that internet usage is associated with overweight/obesity (Tsitsika et al., 2016; Park & Lee, 2017). In a study, a relationship was found between the duration of internet use and sedentary behaviour and obesity in children (Novaković et al., 2023). The Covid-19 pandemic experienced all over the world is one of the factors that reduce the physical activity level of children, and the distance education process in the pandemic has made children even more screen-addicted (Li et al., 2021). Besides, it is known that the level of digital game addiction of adolescents is related to physical activity attitudes, and physical activity attitudes are negatively affected as digital game addiction increases (Gülbetekin et al., 2021). Meanwhile, in a study conducted in university students other than children and adolescents, it was concluded that there was no relationship between digital game addiction level and physical activity level (Esen et al., 2023). These results suggest that screen addiction may have different results in different populations.

As a result of the bibliometric analysis of postgraduate theses on screen addiction in Türkiye, it was concluded that screen addiction is the subject of research in different disciplinary fields, and that physical and mental health, Covid-19 pandemic, solution suggestions and the concept of family are concepts related to the subject in terms of how the subject is addressed in theses (Candan et al., 2023). This result shows that screen addiction can cause both physical and mental health problems in children and adolescents. Physical activity can help reduce addictive behaviours; it is said to increase dopamine levels in the body (Roberts et al., 2012). Considering the effect of physical activity, it is important to investigate whether there is any relationship between screen addiction and physical activity level in children and adolescents. In this context, this study aimed to investigate the relationship between multiple screen addiction level, physical activity level and body mass index of secondary school students.

## MATERIALS AND METHODS
### Participants and Protocol

**Research Model:** The research was a descriptive relational survey modelresearch. Descriptive relational survey model 'an event or situation is described as it is and the relationship, effect and degree of the va-riables that cause this situation are tried to be determined' (Kaya et al., 2012).

**Participants:** The sample of the research was determined by random sampling method. The sample consisted of 74 (girl: 36, boy: 38) secondary school students studying in Bodrum district of Muğla pro-vince. The mean age of the participants was (12,19 ·1,0), the mean height was (156,7 ·11,9) and the mean weight was (50,7 ·13,8). The demographic characteristics of the participants were given below (Table 1).

### Data Collection Tools

The demographic information form prepared by the researchers, Multiple Screen Addiction Scale and International Physical Activity Questionnaire-Short Form were used as data collection tools in the study. The data in the study were collected face-to-face using the questionnaire form.

**Demographic Information Scale:** The form created by the researchers includes questions such as gen-der, age, height, weight, class, smartphone usage status, social media tools used by the participants.

Table 1. Demographic characteristics of the participants

| Variable | Group | F | % |
|---|---|---|---|
| **Gender** | *Female* | 36 | 49 |
| | *Male* | 38 | 51 |
| **Class** | *5.class* | 16 | 22 |
| | *6.class* | 17 | 23 |
| | *7.class* | 20 | 27 |
| | *8.class* | 21 | 28 |
| **Sports outside of school?** | *Yes* | 16 | 22 |
| | *No* | 58 | 78 |
| **Use smart phone?** | *Yes* | 60 | 81 |
| | *No* | 14 | 19 |
| **Use tablet?** | *Yes* | 44 | 59 |
| | *No* | 30 | 41 |
| **Use social media?** | *Yes* | 49 | 66 |
| | *No* | 25 | 34 |
| **What social media?** | *İnstagram* | 45 | 92 |
| | *Tik Tok* | 3 | 6 |
| | *You Tube* | 1 | 2 |

International Physical Activity Questionnaire-Short Form (IPAQ-SF): The physical activity level of the participants was evaluated with the IPAQ-SF. In 1996, Australian researcher Dr. Micheal Booth de-signed a reliable and valid questionnaire to examine the health and physical activity levels of the popu-lation and the relationship between them. Subsequently, the International Physical Activity Assessment Group developed the IPAQ based on this questionnaire. The Turkish validity and reliability study of the scale was conducted by Öztürk in 2005 (Öztürk, 2005). The IPAQ was designed as a short and long form to

determine the physical activity and sedentary lifestyles of adults. The short form, consisting of seven questions, provides information about the time spent in walking, moderate-to-vigorous and vigorous ac-tivities (Özer & Şentürk, 2018). Basically, it includes questions about FA done for at least 10 minutes in the last 7 days. The time spent sitting was analysed as a separate question. Scoring of the questionnaire includes the sum of walking, moderate and vigorous activity in duration (minutes) and frequency (days) (Sağlam et al., 2010). One MET-minute was calculated by multiplying the minutes of activity by the MET score. A person at rest consumes 3.5 ml of oxygen per kg of weight in one minute. Total, MET-min/week = (walking + moderate intense + intense + sitting) MET-min/week (Özer and Şentürk, 2018).

Multiple Screen Commitment (MSC) Scale: The multiscreen addiction scale was developed by utilising the criteria for Internet gaming disorder and the scales used in studies on Internet addiction, mobile ga-me addiction and problematic social media use (Sarıtepeci, 2021). The scale consisted of 15 items in to-tal and 3 sub-dimensions. Excessive screen time sub-dimension (item: 1,2,3,4), compulsive behaviour sub-dimension (item: 5,6,7,8,910,11,12) and loss of control (item: 13,14,15) are in 5-point Likert type (1=never, 2=once, 3=once or twice, 4=most of the time, 5=every day). The item mean of 3 and above means that addiction is possible. Internal reliability coefficients of the sub-dimensions of the scale vary between 0,71-0,92. In this study, excessive screen time sub-dimension ($\cdot$=,76), compulsive behaviour sub-dimension ($\cdot$=,85), loss of control sub-dimension ($\cdot$=,82) and multiple screen addiction scale inter-nal consistency coefficient ($\cdot$=,91).

Body Mass Index Calculation: After the height and weight values were determined, the body mass in-dex (BMI) of the students was calculated according to the data obtained. The Quetelet index (Body Mass Index (BMI)), first defined in 1835 by Lambert Adolphe Jacques Quetelet, a statistician, astronomer, epidemiologist and anthropologist from Antwerp, Belgium, has been used to determine body composi-tion for more than a century. BMI index: measured weight (kg) divided by the square of height (metres (m)) (BMI = weight ((kg)/height (m2)). According to the World Health Organisation (WHO), these va-lues; (<18.5 kg/m2) is considered underweight, (18.5 $\leqslant$ BMI <25 kg/m2) is considered normal weight, (25 kg/m2 $\leqslant$ BMI > 30 kg/m2) is considered overweight and (30 kg/m2 $\leqslant$ BMI) is considered glandular.

Data Analysis: It was determined whether the data in the study had a normal distribution by looking at the kurtosis and skewness (-1, +1) values (Tabachnick & Fidell, 1996). BMI values were (skewness=0,64, kurtosis=0,03), MET values were (skewness=0,79, kurtosis=-0,39) and multiple screen dependency scale values were (skewness=0,49, kurtosis=-0,64). In the descriptive analyses of the data in the study, frequency (N),

percentage (%), mean ($\bar{X}$) and standard deviation values (SS) were determined. Man independent sample t test was used for pairwise group comparisons and One-Way ANOVA test was used for more than two group comparisons. Pearson's correlation analysis was used for correlational comparisons. All analyses of the data were performed in Jamovi 2.3.21.0 statistical programme at 95% confidence interval and 0.05 significance level.

## RESULTS

The mean BMI, multi-screen commitment and physical activity levels of the participants in the study were presented below (Table 2).

**Table 2.** BMI, MET, multiscreen addiction mean scores of the participants

| Variable | N | $\bar{X}$ | SS |
|---|---|---|---|
| Body Mass Index (kg/m$^2$) | 74 | 20,37 | 3,47 |
| Metabolic Equivalent (minute/week) | 74 | 2859,5 | 2329,8 |
| Excessive Screen Time Sub-Dimension (point) | 74 | 10,58 | 3,26 |
| Compulsive Behavior Sub-Dimension (point) | 74 | 23,96 | 6,76 |
| Loss of Control Sub-Dimension (point) | 74 | 8,07 | 3,27 |
| Multiple Screen Commitment (point) | 74 | 42,61 | 12,05 |

When Table 2 was analyzed, the mean scores of the participants were BMI (20,37±3,47), MET (2859,5±2329,8), excessive screen time sub-dimension mean score (10,58 ±3,26), compulsive behavior sub-dimension mean score (23,96±6,76), loss of control sub-dimension mean score (8,07±3,27) and multiple screen addiction mean score (42,61±12,05). The item means of the participants' multiple screen addiction scale and sub-dimensions were presented below (Table 3).

**Table 3.** Item means of participants' multiple screen commitment level

| Variable | N | Min. | Max. | $\bar{X}$ | SS |
|---|---|---|---|---|---|
| Excessive Screen Time Sub-Dimension (point) | 74 | 4 | 19 | 2,65 | 0,82 |
| Compulsive Behavior Sub-Dimension (point) | 74 | 12 | 38 | 2,99 | 0,84 |
| Loss of Control Sub-Dimension (point) | 74 | 3 | 14 | 2,69 | 1,09 |
| Multiple Screen Commitment (point) | 74 | 25 | 70 | 2,84 | 0,80 |

*Min: Minimum, Max: Maximum*

When Table 3 was examined, it was seen that the participants' excessive screen time sub-dimension item mean was (2,65±0,82), compulsive behavior sub-dimension item mean was (2,99±0,84), loss of control sub-dimension item mean was (2,69±1,09) and multiple screen addiction scale total item sub-dimension was (2,84±0,80). The t-test results according to the participants' use of sports, smartphones and social media outside of school are presented below (Table 4).

**Table 4.** T test results according to the participants' use of smart phones and social media and doing sports outside of school

| Variable | | Group | N | X̄±SS | T | P | Effect Size |
|---|---|---|---|---|---|---|---|
| Sports outside of school? | MET | Yes | 16 | 4750,1±2130,8 | 4,03 | <0,001*** | 1,14 |
| | | No | 58 | 2338,0±2115,8 | | | |
| Use smart phone? | Multiple Screen Commitment | Yes | 60 | 43,97±12,48 | 2,05 | 0,044* | 0,61 |
| | | No | 14 | 36,79±7,96 | | | |
| Use social media? | BMI | Yes | 49 | 21,14±3,77 | 2,81 | 0,006** | 0,69 |
| | | No | 25 | 18,86±2,12 | | | |
| Use social media? | Multiple Screen Commitment | Yes | 49 | 45,92±12,41 | 3,56 | <0,001*** | 0,88 |
| | | No | 25 | 36,12±8,19 | | | |

*p<0,05, **p<0,01, ***p<0,001

When Table 4 was examined, the mean MET of the participants who do sports outside of school (4750,1 ±2130,8) was significantly higher than the mean of the participants who do not do sports (2338,0 ±2115,8) (t=4,04, p<0,001). The mean multi-screen addiction level of the participants who use smartphones (43,97 ±12,48) was significantly higher than the mean of the participants who do not use smartphones (36,79 ±7,96) (t=2,05, p<0,05). The mean BMI of the participants who use social media (21,14 ±3,77) was significantly higher than the mean BMI of the participants who do not use social media (18,86 ±2,12) (t=2,81, p<0,01).

**Table 5.** ANOVA results of multiple screen addiction levels of participants according to MET and BMI mean scores

| Variable | | Group | N | X̄±SS | F | P | Tukey |
|---|---|---|---|---|---|---|---|
| MET classification | Multiple Screen Commitment | 1.İnactive | 10 | 37,30±8,19 | 3,81 | 0,035* | ---- |
| | | 2.Active | 18 | 47,83±11,66 | | | |
| | | 3.Very Active | 46 | 41,72±12,36 | | | |
| MET classification | Compulsive Behavior Sub-Dimension | 1.İnactive | 10 | 21,60±3,27 | 5,52 | 0,009** | ---- |
| | | 2.Active | 18 | 27,44±6,00 | | | |
| | | 3.Very Active | 46 | 23,11±7,17 | | | |
| MET classification | Excessive Screen Time Sub-Dimension | 1.İnactive | 10 | 8,20±2,53 | 5,90 | 0,008** | 2>1 |
| | | 2.Active | 18 | 12,11±3,41 | | | |
| | | 3.Very Active | 46 | 10,50±3,06 | | | |
| BMI classification | Loss of Control Sub-Dimension | 1.Weak | 24 | 7,79±3,35 | 8,72 | <0,001*** | 3>2 |
| | | 2.Normal | 41 | 7,68±3,31 | | | |
| | | 3.Overweight | 9 | 10,56±1,59 | | | |

*p<0,05, **p<0,01, ***p<0,001

When Table 5 was analyzed, a significant difference was found in the multiple screen addiction scores of the participants according to the MET level (F=3,81, p<0,05). When the post hoc results were examined, no significant effect that could cause a difference between the groups was found (p>0,05). According to the MET level of the participants, a significant difference was found in the challenging behavior sub-dimension scores (F=5,52, p<0,01). When the post hoc results were analyzed, no significant effect was found between the groups (p>0,05). According to the MET level of the participants, a significant difference was found in the excessive screen time subscale scores (active>inactive) (F=5,90, p<0,01). A significant difference was found in the loss of control sub-dimension scores (Overweight > Normal weight) according to the participants' BMI levels (F=8,72, p<0,001). The correlation analysis of the participants' BMI, MET level and multiple screen addiction level scores are presented below (Table 6).

**Table 6.** Pearson's correlation analysis results of participants' BMI, MET and multiscreen addiction levels

| Variable | N | Body Mass Index | Metabolic Equivalent |
|---|---|---|---|
| Multiple Screen Commitment (point) | 74 | 0,11 | -0,23* |
| *p<0,05 | | | |

When Table 6 was examined, a low level significant negative relationship was found between MET scores and multi-screen addiction level scores (r=-0,23, p<0,05). As the participants' multi-screen addiction level scores increase, their MET scores decrease.
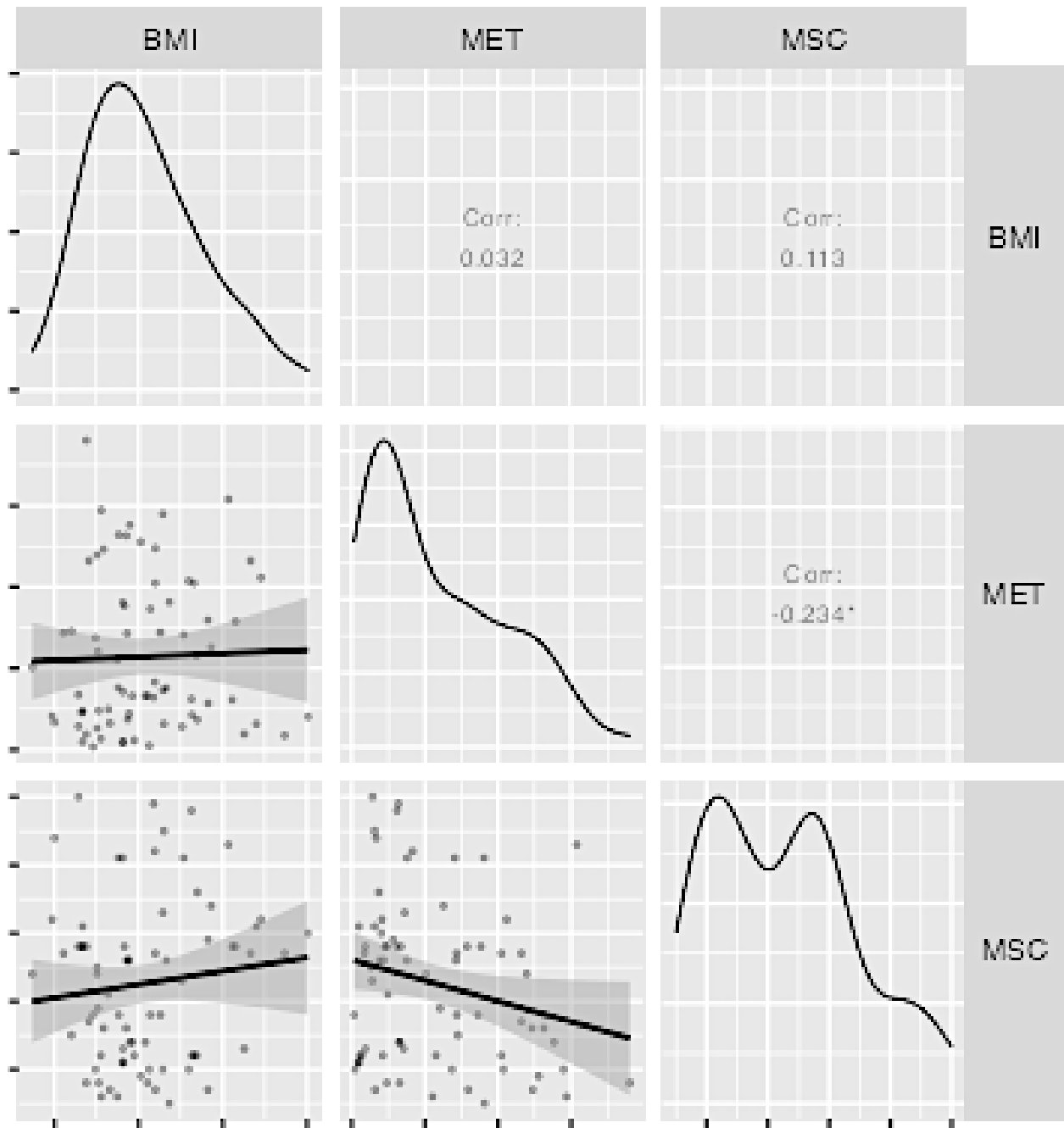


**Graph 1.** Pearson's correlation analysis results of the participants

## DISCUSSION

In this study, the relationship between multiple screen commitment levels of secondary school students and their physical activity levels and body mass indexes was examined and the following results were obtained.

The first result of the research was that the participants who do sports out of school had a higher MET level and those who use social media had a higher BMI level. First of all, it was very critical for families to be conscious for children to do sports outside of school. It should not be forgotten that families should set an example for their children by determining an active lifestyle at the point of directing and encour-aging children to physical activity (Coşkuntürk et al., 2023). A qualitative study showed that parents think that using electronic devices to increase physical activity can be beneficial (Visier-Alfonso et al., 2023). These results show that parents' attitudes, thoughts and behaviors also affect children's physical activity level and multiple screen use. In a study conducted on 10028 middle and high school students in Canada, a negative relationship was found between students' outdoor physical activity (60 minutes or more of moderate intensity) after school on weekdays and screen time (less than 2 hours per day) within the recommended ranges and overweight/obesity (Sampasa-Kanyinga et al., 2019). In contrast to this study, in another study conducted in secondary school students, it was concluded that the levels of digi-tal game addiction and attitudes towards physical activity did not change according to whether children were active athletes (Eren, 2024). In addition, it was determined that there was no effect of attitude to-wards physical activity and digital game addiction levels on children's body mass index values. The re-sults of the analyzed studies were not in parallel with the results of this study. The reason for this is that today's children can easily access digital games or social media accounts in all kinds of sports activities, which suggests that the results may be different.

Another result of the research showed that those who use smartphones and social media had higher lev-els of multi-screen addiction. The social media application that 92% of the students in this study used the most was 'Instagram'. In a study conducted on children in Türkiye, it was determined that they use 'TikTok', 'Instagram', 'YouTube', 'WhatsApp' and 'Facebook' applications (Üstündağ, 2022). As in this study, the used social media accounts do not allow children under the age of 18 to open and use ac-counts, and it can be inferred that families do not know the accounts of children or knowingly allow them to open accounts. In a study, today's families stated that they had to introduce their children to the screen at an early age to make their daily routine work and tasks more comfortable (Güzel, 2021). Fami-ly attitude should not be forgotten in children's use of smartphones and social media and research can be conducted on this issue. In another study, it was also found that children who use smartphones had high-er social media addiction levels (Üstündağ, 2022). In another recent study, it was concluded that chil-dren who use smartphones had higher multi-screen addiction levels compared to children who watch tel-evision (Bekar &

Efe, 2024). Smartphone and television were used as screen time in the literature; in this context, children's smartphone usage and having social media accounts can be considered among the reasons that directly increase their multi-screen addiction.

According to another result of the study, MET levels of the participants were significantly affected by multi-screen addiction levels and compulsive behavior scores. BMI levels were affected by excessive screen time and loss of control scores. It was found that Internet addiction negatively affects physical and mental health and physical activity was recommended to reduce the negative effects of the Internet (Demenech et al., 2023). In a study conducted on 9913 students aged 7-12 years in Canada, it was de-termined that only 11% of the sample fulfilled the recommended physical activity level and screen time, and the classification of children in this sample as overweight/obese was lower (Crowe et al., 2020). In a study conducted on 196 secondary school students in Saudi Arabia; it was concluded that the physical activity levels of students with smartphone addiction were lower and that smartphone use reduced phys-ical activity levels (Al-Amri et al., 2023). These results were in parallel with the results of this study. It can be thought that students with excessive screen time cannot control themselves, and children who were addicted to the screen engage in behaviors that force their family and environment to stay on the screen for a long time. It was also more likely that these students with long screen time had lower physi-cal activity levels.

Moreover, as a result of the study it was found that the MET level decreases as the multiple screen ad-diction scores increase. It is known that increasing screen time in school-age children and adolescents causes a decrease in physical activity level (Pearson et al., 2017; Aşut et al., 2019). According to the 2021 reports of the Türkiye Statistical Institute, the internet usage rate of children between the ages of 6-15 was 82.7% and smartphone usage was 64.4% (TÜİK, 2021). In a study conducted on 31,954 adoles-cents in grades 7-12 in China, it was reported that adolescents with high levels of screen time had lower levels of physical activity and were approximately 2 times more likely to prefer the internet than those with high levels of physical activity (Han et al., 2021). In another study conducted similar to this study, it was found that those who were interested in any sport among the children in the sample group had lower levels of digital game addiction (Gülbetekin et al., 2021). In contrast to these studies, the study conducted in 100 secondary school students aged 9-14 years, no significant relationship between digital game addiction and physical activity level was found (Marufoğlu & Kutlutürk, 2021). In another study conducted in secondary school students, it was found that students with an athlete license had higher levels of digital game addiction (Delebe & Hazar, 2022). These results suggest that there may not al-ways be a negative relationship between screen addiction levels and physical activity level, and the sample groups examined are important. Moreover, it should not be forgotten that the families of the sample groups may also be effective in children's screen addiction and physical activity levels.

## CONCLUSIONS

As a result, it can be said that the physical activity level of secondary school students is at a high level, smartphone and social media use and multiple screen addiction level are related to physical activity lev-el. Furthermore, the fact that 66% of the children have social media accounts even though they are under the age of 18 suggests that the attitudes and behaviors of their parents are effective on children's screen exposure and screen addiction. In a study conducted on preschool children, a positive relationship was found between the screen addiction levels of children's parents and children's screen addiction levels (Li et al. 2022). Considering this result, it may be useful to determine the physical activity level or attitude levels of parents in future studies and to determine the screen addiction levels of families. In addition, it can be extremely useful for the media to develop broadcasting policies that will encourage people to practice sports in a way that will bring the beauties of sports to all segments of society by acting with a sense of social responsibility (Ulukan et al., 2008).

### Author Contributions

Conceptualization, M.G. and S.I..; methodology, M.G.; formal analysis, M.G..; investigation, S.I..; data cura-tion, S.I..; writing–original draft preparation, M.G. and S.I..; writing–review and editing, M.G.

### Informed Consent Statement:

### Acknowledgments:

### Funding:

### Conflicts of Interest:

The authors declare no conflict of interest.

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