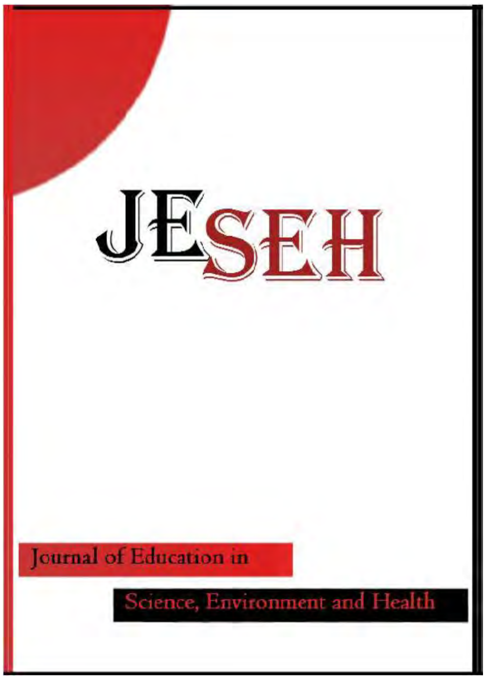

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The Relationship between Physical Activity and Smart Phone Use in University Students

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Abstract

Smartphone addiction and physical inactivity are often a major public health problem across the world. This research was aimed to determine the smartphone addiction status, physical activity levels and related factors of university students. Using convenience sampling, university students in Isparta/Turkey completed two questionnaires in Spring semester assessing smartphone addiction and physical activity levels. A total of 147 participants attended in this study. The participants included in the scope of the research; the questionnaire including the International Physical Activity Questionnaire and the Smartphone Addiction Questionnaire, which were considered to be related to socio-demographic characteristics, smartphone use and physical activity habits were applied under direct observation. The physical activity for males was higher than females. There was a significant relationship between age and smart phone use. Whereas the age of the participants increased, a decrease in the number of smartphone usage was observed. The differences of between educational groups are related to the lower level of smartphone addiction of the graduate students compared to the associate degree students. Finally, there was no significant difference between the level of physical activity and the score of smartphone usage as the main aim of this study.

Introduction

Smartphones have brought dramatic changes to individuals' daily lives. They are one of the important technological developments and become an integral part of our daily lives. When used effectively, smart phones are useful technology. However, they may cause serious adverse effects especially in young people if they are not used properly. Smartphone usage is almost out of control among the young people (Choudhary, 2014). Therefore, many new health problems have started to appear with the use of uncontrolled smartphones. Todays' smartphones have many new interaction features with the internet connection. Smart phones, which we can call new generation mobile phones, have more extraordinary functions compared to the traditional mobile devices such as information sharing, message service applications, image sharing, video conferencing as well as communication use. With these features' smartphones have become the high-tech tool for individuals who spend most of their time with them.

Physical activity is the activities that involve the consumption of energy by using our muscles and joints in our daily life, increasing the heart and respiratory rate, and can be performed at different intensities, resulting in fatigue (Bayrakci, 2008). However, with the developing technological products, many technological developments negatively affect physical activity such as devices used in homes or workplaces, elevators and escalators, vehicles used in agriculture and industry. Even though they have free time, young people do not prefer to allocate time for physical activity instead they spend most of their time with smartphones.

Usage of Smartphone

Phone's shapes and features have changed dramatically since it was invented. The first phone was with cable with no interaction features. It only transfers the sound between two speakers. In the 1900s, the concept of mobility was introduced to human life and caused dramatic changes the way we live and interact with the people. Many services offered on smartphones make people's lives easier and the use of these devices is becoming more and more common.

The mobile phones are portable and convenient, making it easier to access the internet. For this reason, internet access via mobile phone is preferred by people. The use of smart phones has brought a different dimension to communication today. Mobile phones, which were the communication tools of the first time, are now used for more complex purposes such as connecting to the internet under the name of smart phones, social media, playing games, listening to music, paying, banking and shopping (Meral, 2017). In addition to advantages of smartphones, there are also pitfalls of using smartphones.

In the case of addiction, the person spends all his time and physical energy on the object or behavior to which he is highly dependent, except for the work he has to do and the relationships he has to establish. There is no clearly definition for smartphone addiction. However smartphone addiction can be defined that a form of addiction that does not have chemical substances but reveals a psychologically negative situation when it is not used (Minaz & Bozkurt, 2017). This is especially true for young people who spend excessive time with their smart phones than older people.

Today, some of the individuals have not been able to use their smart phones according to their needs and therefore they have started to experience some problems. So much so that for some individuals, smart phones have become an integral part of life and the phrase “nomophobia”, namely “no mobile phone phobia/mobile phone addiction” has been introduced. Nomophobia is defined as the accompanying feelings such as discomfort and anxiety, irritability caused by not contacting the mobile phone (Griffiths, 2003; King et al., 2010).

It has been reported in positive results for the treatment of chronic diseases such as diabetes, alcoholism, as well as problems with excessive smartphone use (Arsand et al., 2015; Gustafson et al., 2014). In the literature, the problems caused by the excessive use of smart phones were mentioned as “problematic mobile phone use” (Bianchi & Phillips, 2005),“ mobile phone addiction ”(mobile phone dependency; mobile phone addiction) (Toda et al., 2008),“ smartphone addiction ”(smartphone addiction) (Kwon et al., 2013).

Nomo phobic people show constant control of messages or calls, excessive anxiety and tension when they are out of range, constant access to the phone and dealing with a smartphone in the bed, and behaviors that can be increased further (Meral, 2017).

Physical Activity

Physical activity is defined as body movements caused by contraction of skeletal muscles that increase energy expenditure above basal level (Baranowski et al., 1992; Pate et al., 1995). All activities that increase energy expenditure can be called physical activity. Therefore, physical daily life activity can also be evaluated as “the sum of voluntary movements that occur through skeletal muscles during everyday functions” (Steele et al., 2003).

Physical activity is a complex reaction of the body in terms of health and performance, biochemically, biomechanically. Physical activity in daily life can be classified as housework, work, school, sports or other activities. If exercise is; it is a subset of physical activity that is structured, planned and performed to achieve, develop or maintain physical condition (Haskell & Kiernan, 2000). The effect of physical activity on an individual's daily energy need varies from person to person and age (Pekcan, 2008). There is no evidence that physical activity is more or less in adulthood than in children or youth periods (Li et al., 2010). However, there is often a study showing that there is a significant decrease in physical activity during adolescence (Budd et al., 2018). However, there are also studies showing that physical activity decreased during the adolescent period (Bauer et al., 2008; Li et al., 2010). In studies related to gender, it has been reported that female students are less active than male students (Hallal et al., 2012; HBSC, 2010). It has been reported that it is recommended to make social and physical conditions enjoyable to increase the level of physical activity in this period (Budd et al., 2018). It increases the risk of chronic disease (obesity, metabolic syndrome, diabetes, cardiovascular diseases, etc.) in adulthood (childhood and adolescence) and a lifestyle away from physical activity (Poti et al., 2014).

In order to increase the quality of life of individuals, it is necessary to adopt a healthy lifestyle and increase the level of physical activity in a more conscious way (Bozkus et al., 2013). Although young people benefit their health by doing physical activity, these activities may become a habit over time. This situation will have a positive impact on public health in the long term and will also have a positive effect on individual health (Malina, 2001). Transition processes that people encounter by their ages may affect their physical activities. Regular physical activity at a young age will bring similar activity in life in the future (Malina, 2001). Physically active children have less fat body mass than passive children (Muratli, 2007). Regular physical activities of young people and children are important in terms of being a barrier to possible health problems that may occur in the future (Garibagaoglu et al., 2006; Mazicioglu & Ozturk, 2003). Regular physical activity is essential for the healthy growth and development of children and young people. Physical activity provides young people with social, behavioral and mental benefits. Having fun and being with friends are among the main reasons for dealing with physical activity and sports for children and young people (Peggy & Tsouros, 2006).

The Relationship between Smartphone Usage and Physical Activity

Whereas smartphones have made life more helpful, it has too brought numerous side-effects. Although there is insufficient evidence that the use of technological devices changes physical activity, it is investigated whether the use of excessive technological devices replaces sleep, especially at night. While sedentary behavior increases in children with insufficient sleep habits, their level of participation in physical activity decreases (Strasburger et al., 2010). In one study, 37% of 4-11 year-old children have low levels of active gaming, 65% have high screen-watching time (television, computer, smartphone etc.) and 26% have both behaviors together has been reported (Anderson & Whitaker, 2010). In another study, it was reported that only 4 out of 10 children between the ages of 6 and 11 match both the physical activity and the time of use of the technological device. In addition, it was found that physical inactivity levels increased with the increase in the age of the children (Fakhouri et al., 2013).

In a recently published study, it was reported that during playing games with a smartphone or tablet, children require more head, trunk and upper arm angles than watching television and playing with toys. However, compared to games played with toys, children playing with smartphones have been shown to exhibit less body, upper arm and elbow posture variation, less trapezius muscle activity, more sitting, and less physical activity behaviors. Therefore, it has been reported that instead of using technological devices, playing with toys should be encouraged to minimize potential musculoskeletal disorders and sedentary lifestyle in children. It has been suggested that conscious manuals of smartphones and other technological devices should be created for parents and caregivers (Howie et al., 2017).

Concerns have been expressed that as time spent on digital technology increases, time spent on physical activity decreases and may be a factor contributing to child and adolescent obesity and physical health problems (Kautiainen et al., 2005). In a study on children aged 6-17, it was found that those who have low physical activity level and who use technological devices (watching television or video and using smart phones) for a long time are 2 times more likely to be obese than those who do not use (Sisson et al., 2010). A large-scale national survey on survey data from 200,000 adolescents aged 11-15 revealed that the relationship between time spent using digital technology and leisure physical activity varied depending on age, gender and nationality (Melkevik et al., 2010). Also, the relationship between obesity and screen time seen in some studies may result from nutritional behavior rather than lack of physical activity. This claim was supported by a systematic review of studies on immobile behavior and nutrition for children, adolescents, and adults (Pearson & Biddle, 2011). Therefore, although the relationship between physical activity and smartphone use is the main research topic, the relationship between calculated body mass indices, principle obesity, and physical activity and smartphone use will be examined.

Method

Population and Sampling Procedure

This study was conducted on a total of 147 students in higher education. The samples, which are considered as university education, are composed of students who have received undergraduate, graduate and postgraduate education at Süleyman Demirel University. The students participating in the study are 64 (45.6%) male and 80 (54.4%) are female. Participants who are in associate degree (N=36) age average was 20.94, in undergraduate degree age average was 22.74, and in graduate degree age average was 25.60. Smartphone addiction and physical activity levels were determined in line with the survey study. However, in order to examine the correlation between personal characteristics and smartphone addiction and physical activity levels presented in the surveys, a section containing demographic features was presented in the survey study. Thus, the survey study consists of three main sections (demographic characteristics, physical activity scale and smartphone addiction scale).

Smartphone Addiction Scale

The scale used to determine smartphone addiction (Smartphone Addiction Scale: SAS) contains 33 Likert-type questions. The scale developed by Kwon et al. (2013) was developed based on Young's Internet addiction scale and smartphone features. Translation into Turkish Demirci et al. (2014), it was first translated by 2 linguists and then the Turkish version was translated to English and prepared by 5 linguists in line with the similarity of the two English scales. For the reliability study of the scale, the original Cronbach Alpha value was found to be 0.98 and 0.93 for the adaptation study. The scale consists of one dimension. Participants are asked to choose the one that suits them from “I strongly disagree”, “I disagree”, “I have no idea”, “I agree”, “I strongly agree”. Answers are evaluated between 1-6. The lowest answer score is 33, the highest answer score is 165. Higher scores indicate higher risks of smartphone addiction.

Physical Activity Scale

The International Physical Activity Questionnaire (IPAQ) was used to determine physical activity levels of the participants. The first pilot study for IPAQ was carried out in 1998-1999. The survey has a total of eight versions. IPAQ, which is developed to be four short and four long, has a telephone, bilateral call or self-applicable method. In addition, there are different question types such as 'last 7 days' and 'any week'. For this study, the 'last 7 days' short form, which can be applied on its own, was used (Sjostrom et al., 2005). International validity and reliability of Craig et al. (2003) the validity and reliability study in Turkey for this survey made by Ozturk (2005) was conducted by university students.

IPAQ short form; walking gives information about the time spent in moderate and severe activities. The time spent in sitting is considered as a separate question. The calculation of the total score of the short form includes the sum of walking, moderate activity and duration (minutes) and frequency (days) of the intense activity. It is a criterion that physical activities in IPAQ are performed for at least 10 minutes at a time.

In the last 7 days with the survey;

- Duration of severe physical activity (football, basketball, aerobics, fast cycling, lifting weights, carrying loads, etc.) (min).
- Moderate physical activity (light load carrying, normal speed cycling, folk dances, dance, bowling, table tennis, etc.) duration (min).
- Walking and one-day sitting times (min) were questioned.

The total physical activity score (MET-min/week) was calculated by converting severe, moderate activity and walking times to MET, which corresponds to the basal metabolic rate, by the following calculations Craig et al., (2003).

From these calculations, a score in MET-minutes is obtained. A MET-minute is calculated from the product of the activity performed and the MET score. MET-minute scores were determined according to the kilocalorie values of a 60 kilogram person. Kilocalories can be calculated from the following equation:
MET-min x (person's body weight kg/60 kilograms).

The following values are used for the analysis of IPAQ data:
Walking = 3.3 MET
- Moderate to severe physical activity = 4.0 MET
- Severe physical activity = 8.0 MET.

For example, a person walking 30 minutes 3 days a week has a walking MET-min/week score; it is calculated as 3.3 x 30 x 3 = 297 MET-min/week. In addition to this continuous scoring, categorical scoring is done with the numerical data obtained from it.

There are three levels of physical activity identified when categorizing populations - 'active', 'minimally active' and 'very active (physical activity that improves well-being'). The criteria for these levels were established by calculating the continuous scoring values obtained above.

Total Physical Activity Score (MET-min/hf) = Walking + Moderate activity + Severe activity scores

While the physical activity levels of the participants were classified as "low, medium and high" according to the total physical activity score;
Physical Activity Levels:
• Inactive (Low Intensity) Level: 599 MET-min/week and below,
• Minimal Active (Moderate Intensive) Level: 600-2999 MET-min/week,
• Very Active (Severe) Level: It is classified as 3000 MET-min/week and above (Ozturk, 2005).

Statistical Analysis

All statistical studies were analyzed using IBM SPSS Statistic 24 version. Depending on the nature of the variables, percentage, mean, t test, Pearson correlation analysis and ANOVA test between the single factor groups, post hoc Tukey HSD test were applied. While the age, height, weight, BMI and smartphone addiction score variables of the participants show normal distribution, their physical activity score is not normal distribution. Therefore, parametric tests were applied in the analysis of variables with normal distribution. Spearman correlation, Mann-Whitney test and Kruskal Wallis test as non-parametric analysis and square root physical activity score as normalized parametric analysis were applied in the analyzes including the physical activity variable. Averages are given with standard deviation, $p < 0.05$ is considered significant.

Results and Discussion

Descriptive Statistics Results of the Participants

The relationship between smartphone use and physical activity severity was examined on 147 university students. Pearson correlation analysis was performed to examine the relationship between age, height, weight and BMI. While there was a significant relationship between age and height and weight according to Pearson correlation coefficient ($r = 0.17$, $p < 0.05$ and $r = 0.19$, $p < 0.05$), there was no significant relationship between BMI variable and age ($p > 0.05$). A positive increase was observed in height and weight variables with increasing age. This increase was found low in both variables. In addition, the age variable explains 2% of the total variance in the height variable and 3% of the variance in the weight variable.

In addition, it is aimed to participate in the study from institutes, faculties and colleges. Cross-tabulation and chi-square analysis were performed to examine the relationship between the groups. The results of the profound chi-square analysis reveal a significant difference between the groups. While 36 (24.5%) of the participants are in associate degree education, 81 (55.1%) continue their undergraduate education and 30 (20.4%) continue their graduate education. The proportion of female students attending associate education is 2.6 times more intense than male students and this situation reveals the difference with chi-square analysis. In addition, 14.9% of male students are associate degree students, while 24.5% of female students continue their associate degree education. The main reason for the difference between the groups is due to the density of female students who continue their associate degree education.

Weight and height information were obtained to describe the body mass characteristics of the participants. The average height of the participants was 172.46 cm, the arithmetic average of 68.21 kg and the average body mass index (BMI) was 22.75 kg/m2. Body mass index classes of adult individuals are defined if BMI (kg/m2) ≤18,49 as slim, if it is between 18,5 and 24,99 as normal, if it is between 25 and 29,99 slightly fat and if it is ≥30 as fat.

Independent samples t-test was applied to compare the BMI, height and weight values of the participants by gender. Accordingly, there was a significant difference between all groups [BMI ($t(145) = 1.335$, $\eta 2 = 0.19$, $p < 0.01$), Length ($t(145) = 1.187$, $\eta 2 = 0.5$, $p <0, 01$) and Weight ($t(145) = 4.365$, $\eta 2 = 0.47$, $p < 0.01$)]. Females' BMI, height and weight averages are lower than male participants.

A significant difference was sought between the BMI, height and weight variables of the participants and their educational status by applying the ANOVA test between the single factor groups. The results show that the BMI, height and weight values of the participants did not make a significant difference with their educational status [$p > 0.05$]. This is supported by the fact that the BMI, height and weight arithmetic averages are close to each other for each learning group as associate degree (N=36), 22.27, undergraduate (N=81) 22.80, graduate (N=30) 23.20. In addition, when cross tabulation categorically between BMI values and education levels, it is seen that the BMI values of all learning groups contain normal levels of BMI (Table 1).

Table 1. Cross-tabulation between participants' educational status and BMI means

			BMI Groups				
			Weak	Normal	Slightly Fat	Obese	Total
Degree	Associate Degree	Number	5	23	7	1	36
		%	13,9%	63,9%	19,4%	2,8%	100,0%
	Undergraduate	Number	8	53	16	4	81
		%	9,9%	65,4%	19,8%	4,9%	100,0%
	Graduate	Number	2	21	4	3	30
		%	6,7%	70,0%	13,3%	10,0%	100,0%
Total		Number	15	97	27	8	147
		%	10,2%	66,0%	18,4%	5,4%	100,0%

Statistical Results of Physical Activity Scale

The physical activity levels of the participants are important variables of the study and the average and classification of the participants' physical activity (PA) level mean (MET-min/week) is 2753.78 (Sd:2690.99) and (PA_Cat) values are love level frequency: 26 (17.7%), intermediate frequency: 70 (47.6%) and severe level frequency:51 (34,7%). Considering the standard deviation values, there is no homogeneous distribution in physical activity levels and it can be said that there is a wide range between PA levels and arithmetic means. Considering the PA categorical variables, the highest frequency was observed for the intermediate level PA class (47.6%). In addition, when the box chart is examined for the normality distribution of PA levels, the fact that the PA level of the participant number 114 is approximately 6.5 times higher than the average level affects the normality of the PA levels (skew coefficient: 2.07).

It is necessary to regulate the distribution of normality for the PA variable in order to prevent statistical errors and perform statistical analysis. Therefore, since there is a positive distortion in the PA variable, first of all, normalization is performed by applying the square root procedure to the PA variable belonging to all participants. For the PA variable with square root operation, the new normality analysis was performed by naming PA_Sqr and the results showed the normality of the new variable (Skewness coefficient: 0.789). The new arithmetic average for the PA_Sqr variable is 46.16 MET-min/week and the standard deviation is 23.08.

Pearson correlation coefficient was calculated to examine the relationship between the ages of the participants and PA_Sqr. Since the normality of the PA variable is not observed, the PA_Sqr variable is used. As a result of the analysis, no significant relationship was found between the ages of the participants and their physical activity levels ($p > 0.05$). It is not possible to comment on the increase or decrease tendency for age-related physical activity levels. Independent samples t-test was conducted to examine a significant difference between gender difference and physical activity levels. No normal distribution was observed in PA for each gender variable and in PA_Sqr for females. Therefore, the logarithm of the PA variable belonging to each participant was taken as two degree normalization. As a result, statistical analysis of physical activity levels by gender was performed.

Independent samples t-test was applied to compare participants' physical activity levels by gender (Table 2). Accordingly, a significant difference was observed in the levels of physical activity towards gender [$t(141.90) = 2.42$, $\eta 2 = 0.04$, $p < 0.05$]. Male participants (X = 3.33, SS = 0.42) were found to have higher levels of physical activity compared to female participants (X = 3.16, SS = 0.44). Physical activity levels have a minor effect on males and explain 4% of the total variance. When analyzed categorically, chi-square analysis was conducted between gender and PA_Cat. It has been observed that the majority of males have severe physical activity levels, and for females, mostly moderate to severe physical activity levels (Table 3). In addition, 65.4% of those who do low physical activity are females, while males make up 34.6%. On the other hand, 62.7% of those who do violent activities are males, while females make up 37.3%. In general terms, males have higher activity than females in terms of physical activity levels.

Table 1. Physical activity levels by gender (MET-min/week)

Variable	Group	N	$\bar{x}$	Ss	t	η^2
PA_Sqr	Male	67	3,3357	0,4266	2,428	0,04
	Female	80	3,1616	0,4408		

*p<0,05

Table 2. Cross tabulation between gender and physical activity classes

Gender * PA_Cat Crosstabulation						
			PA_Categories			
			Low Level	Intermediate	Severe Level	Total
Gender	Male	Number	9	26	32	67
		% Gender	13,4%	38,8%	47,8%	100,0%
		% PA_Cat	34,6%	37,1%	62,7%	45,6%
	Female	Number	17	44	19	80
		% Gender	21,3%	55,0%	23,8%	100,0%
		% PA_Cat	65,4%	62,9%	37,3%	54,4%
Total		Number	26	70	51	147
		% Gender	17,7%	47,6%	34,7%	100,0%
		% PA_Cat	100,0%	100,0%	100,0%	100,0%

*p<0,01

ANOVA analysis was conducted between the single-factor groups to investigate a significant difference in participants' physical activity levels for different BMI classes. Descriptive statistics of the participants' physical activity levels are given in Table 4. Table 5 presents the ANOVA results between single factor groups. The PA_Sqr variable gave appropriate normality results for ANOVA analysis. The results did not reveal a significant difference in physical activity levels with different BMI values [F (3,143) = 0.155, p> 0.05].

Table 3. Descriptive statistics of participants' physical activity levels for different BMI classes

PA_Sqr (MET-min/week)	N	Mean	Ss
Weak	15	44,3446	24,37199
Normal	97	46,9968	22,72328
Slightly Fat	27	49,3621	22,12019
Obese	8	47,0359	31,55714
Total	147	47,1627	23,08867

Table 4. ANOVA test for different BMI classes of participants' physical activity levels

PA_Sqr (MET- min/week)					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	252,536	3	84,179		
Within Groups	77578,098	143	542,504	,155	,926
Total	77830,634	146			

*p>0,05

In order to investigate the effect of physical activity on the educational status of the participants and to find a statistically significant difference, ANOVA analysis was performed between the single factor groups. In order to ensure normality, PA_Sqr was used as a physical activity variable. The results showed that there was no significant difference between educational status and physical activity levels (Table 6).

Table 5. Physical activity impact on participants' educational status

Education Level	N	Mean (MET- min/week)	Ss	F	p
Associate Degree	36	48,87	22,13		
Undergraduate	81	45,64	21,64	0,389	0,679
Graduate	30	49,20	28,02		
Total	147	47,16	23,08		

*p>0,05

When the intersection between educational status and classification as a result of classification of physical activity levels is examined, the superiority of medium level physical activity for all education levels is remarkable (Table 7). According to the chi-square analysis, no significant difference was observed between the groups.

Table 6. Cross-tabulation between participants' education and physical activity classes

			PA_Cat			
			Low Level	Intermediate	Severe Level	Total
Education Level	Associate Degree	Number	3	20	13	36
		%	8,3%	55,6%	36,1%	100,0%
	Undergraduate	Number	17	38	26	81
		%	21,0%	46,9%	32,1%	100,0%
	Graduate	Number	6	12	12	30
		%	20,0%	40,0%	40,0%	100,0%
Total		Number	26	70	51	147
		%	17,7%	47,6%	34,7%	100,0%

*p>0,05

Statistical Results about Using Smartphone

The smartphone addiction scale used to analyze the smartphone usage of the participants was used. According to the scale of smartphone addiction, answers to 33 questions were sought and 5-level Likert answers were prepared for each question. Accordingly, the measurement of the answers for the research findings provides a minimum of 33 and a maximum of 165 points. Within the scope of our study, an average of 76.85 ± 22.13 points was observed in line with the answers of the participants. The distribution of normality, which is the dominant assumption of statistical analysis related to the use of smart phones, was examined. Normality was observed in the box chart and Q-Q chart (Skewness coefficient: 0,208).

Pearson correlation coefficient was calculated to determine the relationship between the ages of the participants and their smartphone use (Table 8). As a result of the preliminary examination, it was observed that the variables of age and smartphone use provide normality and linearity assumptions. There is a low-level negative relationship between the two variables ($r = -0.21$, $p < 0.01$). As the ages of the participants increase, there is a decrease in the use of smartphones. Age explains 4.4% of the total variance in smartphone use.

Table 7. Correlation between age and smartphone use

		Age	Smartphone Addiction
Age	Pearson Correlation	1	-,212*
	p		,010
	N	147	147

*p<0,01

Independent samples t-test was carried out to examine the statistical difference in smartphone usage depending on gender. Smartphone use was normally distributed for both sex groups. No significant difference was found between smartphone use and gender (Table 9).

Table 8. Smartphone use by gender

Gender	N	Mean	Ss	F	p
Male	67	76,16	23,04	1,202	0,730
Female	81	77,43	21,47		

*p>0,05

The difference between BMI and smartphone usage has been examined. First of all, smartphone usage shows normal distribution for all BMI groups. ANOVA analysis was performed between single factor groups between BMI and smartphone usage. Since the Levene test is significant ($p < 0.05$), it can be said that group variances are not homogeneous. Accordingly, in the ANOVA analysis, the significance levels of Welch or Brown-Forsythe results were examined and the results showed that there was no significant difference between the participants' BMI classes and their smartphone use (Table 10).

Table 9. ANOVA test of smartphone use belonging to different BMI classes

BMI	N	Mean	Ss	F (Welch)/p	F (Brown-Forsythe)/p
Weak	15	79,06	20,03	1,932/0,147	0,805/0,496
Normal	97	77,15	23,51		
Slightly Fat	27	77,37	20,83		
Obese	8	67,37	10,37		

*p>0,05

When the smartphone usage levels of the participants with different education levels were examined, the normal distribution assumption of the smartphone use was checked for all groups. ANOVA results between the single factor groups made according to the education level are presented in Table 11. Since the Levene test results are not significant, the variances of the group are homogeneous.

Table 10. ANOVA test of smartphone use for different educational situations

Usage of Smartphone	Sum of Squares	df	Mean Square	F	η^2	p
Between Groups	3692,164	2	1846,082	3,919	0,0516	0,022
Within Groups	67831,836	144	471,054			
Total	71524,000	146				

*p<0,05

Accordingly, a significant difference was found in the ANOVA results examined [F (2,144) = 3,919, η2 = 0.0516, p <0.05]. Tukey HSD post hoc test was applied to determine which groups the differences were between (Table 12). According to the Tukey HSD test, the difference between associate students and graduate students was observed. Considering the arithmetic averages, it was found that graduate students had a lower smartphone habit than associate students.

Table 11. Tukey HSD post hoc analysis of smartphone use for different educational situations

	(I) Education Level	(J) Education Level	Mean Difference (I-J)	Std. Error	p	95% Confidence Interval Lower Bound	Upper Bound
Tukey HSD	Associate Degree	Undergraduate	8,04938	4,34745	,157	-2,2462	18,3450
		Graduate	14,90000*	5,36532	,017	2,1939	27,6061
	Undergraduate	Associate Degree	-8,04938	4,34745	,157	-18,3450	2,2462
		Graduate	6,85062	4,63867	,305	-4,1347	17,8359
	Graduate	Associate Degree	-14,90000*	5,36532	,017	-27,6061	-2,1939
		Undergraduate	-6,85062	4,63867	,305	-17,8359	4,1347

*p<0,05

The statistical study between the use of the smartphone belonging to the participants and the PA_Cat was analyzed with the single factor intergroup ANOVA test (Table 13). It provided normal distribution for all physical activity classes of smartphone use. The results show that smartphone use does not have a significant difference in physical activity levels [F (2,144) = 2,042, p = 0,134].

Table 12. Statistical analysis between participants' smartphone use and PA_Cat

	N	Mean	Ss	F	p
Low Level	26	70,84	17,51	2,042	0,134
Intermediate	70	80,38	23,28		
Severe Level	51	75,07	22,13		

*p>0,05

The questions on the scale of smartphone addiction conducted by the students of Süleyman Demirel University were evaluated individually. Accordingly, the column graph obtained with the arithmetic means of the answers from the participants for each question is shown in Figure 1. In particular, the answers given to the 32th (3,32), 29th (3,2), 27th (3,15) and 25th (3,13) options have a positive effect on smartphone addiction. When these 4 options are examined, the question with the highest average number 32 is “I always think that I should shorten my smartphone usage period” option. The second question of questionnaire to the highest average by the participants is “I use my smartphone more than I planned” option. These two options can be considered as complementary questions and show that users are not able to overcome these habits even though they are aware that their smartphone use affects them negatively. The other two high averages are “I prefer to research from my smartphone rather than asking other people” and “I check social networks such as Twitter, Instagram, Whatsapp or Facebook as soon as I wake up” options. Compared to other options, the high observation of these two options reveals the telephone usage purposes of the participants using smart phones. Participants generally control social networks with their smart phones and research with their phones using internet access, which we can consider as an innovative research method.

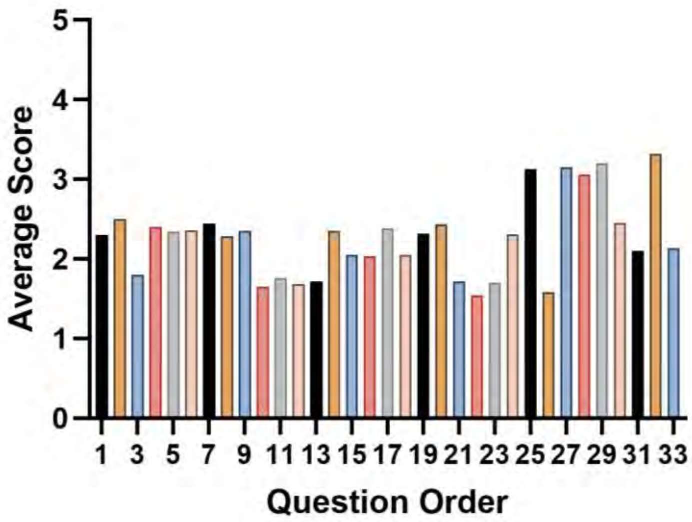

Figure 1. Arithmetic mean of the answers given to individual questions about smartphone addiction questionnaire

Conclusion

Within the scope of the present study, the relationship between physical activity and smartphone addiction was examined on 147 students studying at Süleyman Demirel University with an average age of 22.88. In similar studies, the average age is between 20-25 years (Cengiz, 2007; Kurt, 2018; Ozturk, 2005). Similar to the population, 54.4% of the students participating in the survey study are women and 45.6% are men. In the literature, there are studies in which female and men participants are distributed in a balanced way (Alacam, 2012; Kargul et al., 2016; Reyhanoglu, 2015; Tohumcu, 2018). In addition, 24.5% of the participants study at associate degree, 55.1% at undergraduate and 20.4% at graduate. According to the actual statistics of Süleyman Demirel University, 71.9% of current students study undergraduate, 15.9% graduate and 9% associate degree. Undergraduate student density in this study is proportional to the rate of undergraduate students studying at the university.

According to the Pearson correlation analysis, a low and positive correlation was found between increasing height and weight and the age of the participants. Based on the BMI classification calculated according to the height and weight stated by the adult population aged 15 and over, 16.9% are obese and 33.0% are overweight in Turkey (TSI, 2010). According to OECD (2012), the prevalence of overweight (including obesity) boys between the ages of 5-17 in Turkey is 11.3% and that of girls is 10.3%. A significant difference was observed between the gender and the variables of height, weight and BMI. Height, weight and BMI values of female participants were found to be lower compared to males with similar to a study (Ayhan, 2014). It is striking that female students participating in the study are more fit and healthier than male students.

International physical activity scale was used to determine the PA levels of the participants. Accordingly, the PA levels of the participants were examined for two different scenarios as continuous and categorical variables. The average PA levels of the participants were found to be 2753.78±2690.99 MET-min/week. The standard deviation value indicates that the PA level will not provide a normal distribution for the participants. Results for categorical physical activity levels were observed as 17.7%, 34.7% and 47.6% for low, severe, and moderate FA, respectively. Weekly energy consumption point averages calculated according to the IPAQ are 1618.10±1934.30 in the study of Akova & Koçoğlu (2018), 1838.5±2452.6 in the study of Bayram (2017), 1916.30±1368.46 for Yıldırım et al. (2015) and 1958±1588 for Savcı et al. (2006). On the other hands, In a study conducted with 2125 university students in Ukraine, the average IPAQ scores were found 3560 MET min/week (Bergier et al., 2014). This variation in the level of physical activity between countries stems from the differences in socioeconomic development, technology and urbanization levels (Haase et al., 2004). The results of many studies on physical activity levels in the literature are intermediate (Cengiz, 2007; El-Gilany et al., 2011; Genc et al., 2011; Koksal, 2016; Yarasır, 2018). Male participants were found to have higher PA levels compared to female participants. Physical activity levels have a small effect on men and explain 4% of the total variance. Categorically, a chi-square analysis was performed between gender and PA_Cat. It was remarked that the majority of men had a severe physical activity level, and for women, mostly a moderate physical activity level was observed. In addition, women constitute 65.4% of participants who do low physical activity, while men make up 34.6%. On the other hand, 62.7% of those who do severe activity are men, while women make up 37.3%. In general, men have severe activity than women in terms of physical activity levels. It has been found that women live more sedentary than men. This can be explained by the tendency of women to spend time at home in our traditional culture, and the tendency of men to spend more time outside the home for sports activities and exercise at different times of the day. In Turkey, men moves more freely than women, and can do many exercises at different times of the day. On the contrary, female students have more limited sport areas, activities and time due to family and social pressure (Sayer, 2011). In many studies, male total physical activity mean scores were found to be significantly higher than female students (Akova & Koçoğlu, 2018; Alricsson et al., 2006; Cengiz, 2007; Kargul et al., 2016; Oztürk, 2005; Quadros et al., 2009; Yarasır, 2018; Yıldırım et al., 2015)

The smartphone addiction scale was used to examine the impact of smartphone use. In the smartphone addiction scale with a minimum score of 33 and a maximum of 195, the average of the smartphone addiction scores for the participants was found to be 76.85. In a study in which the short form of smartphone addiction with the lowest 6 and the highest 60 points was analyzed, the average smartphone addiction was found to be 27.00 ± 10.24 (Kurt, 2018). If the average value in this study is normalized in accordance with our study, the average value is 74.25 points and it is compatible with our study. A low negative relationship was observed between smartphone addiction and age. It has been observed that the use of smartphones decreases with increasing age. This situation is associated with increasing age and increased responsibilities and awareness of users. As the age range decreases, addiction to smartphone use increases. This is related to the age of having a mobile phone for the first time, and as this age decreases, it is normal that smartphone addiction increases. Similarly, in the studies conducted by Demirci et al. (2014) and Heo et al. (2014), an negative correlation was observed between increasing age and smartphone addiction score. There was no significant difference between smartphone use and gender. The fact that current smartphone types include various functions that appeal to both genders (such as social networks for girls, video games for boys) seems to be effective in closing the difference between the genders in terms of smartphone addiction reported by previous study (Kurt, 2018). A significant difference was observed between smartphone addiction and education levels. According to this difference, associate degree students spend more time with smartphones than graduate students. This difference shows the decrease in smartphone addiction score due to increasing education level. In a similar study, a significant difference was found between the smartphone addiction scores of the students and their education level (Tohumcu, 2018).

Finally, there was no significant difference between smartphone use and PA. When the Pearson Correlation Coefficient analysis between PA_Cat and smartphone use was examined, no significant relationship was observed. Since there are no studies in the literature regarding the relationship between smartphone addiction and physical activity level, supporting studies for smartphones can be considered by examining the internet addiction scale, which is a similar measurement.

Recommendations

Today, technology has become an important criterion in determining the living standards for nations. With the development of technology, changes have occurred in many areas. Among these, smart phones have been developed very rapidly in a short time after the invention of the phone that enables communication between people. However, with the integration of many technologies, smartphones have become a threat especially for young children. Technological developments on smart phones lead to sedentary life. For this reason, smartphones can be a risk factor that may affect the development of obesity and that obese individuals may become addicted to smartphones or online games. Especially for the z generation, where physical activity is very low, smartphone addiction pushes societies to an unhealthy life. Therefore, families should prevent or restrict the use of smartphones in the process of raising their children. In order to protect school-age children against addiction, the use of smart phones under family supervision should be provided. In addition, lessons that will increase students' physical activities and define the negative impacts of using wrong technology should be added to the school curriculum. People look for elevators instead of stairs, and instead of cooking, they order unhealthy meals with the smartphone app. Despite all these negativities, there is a gap in the literature for smartphone use and physical activity levels. This study is an example of further studies that will raise awareness to reduce sedentary life.

Scientific Ethics Declaration

The author(s) declare that the scientific ethical and legal responsibility of this article published in JESEH journal belongs to the author(s).

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