

# The Relationship Between Academic Performance and Physical Activity, Smart Phone Use and Sleep Quality in University Students

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## ABSTRACT

**Objective:** Our study was planned to examine the academic achievement, physical activity, smart phone use and sleep quality of university students.

**Methods:** Young individuals between the ages of 18-25 studying at a vocational school were included in the study. While recording the demographic information of the participants, individuals were classified as “heavy users” and “light users”, taking into account the duration of smartphone use during the day. In addition, the physical activity levels of the individuals were evaluated with the International Physical Activity Questionnaire-Short Form (IPAQ-SF), the smartphone usage level with the Smartphone Addiction Scale-Short Form (SAS-SF), and the sleep quality with the Pittsburgh Sleep Quality Index (PSQI).

**Results:** A total of 424 people, 326 of whom were women, with a mean age of  $20.30 \pm 1.34$  years, participated in the study. It was determined that 70.3% of the participants used smartphones for more than 4 hours a day. It was determined that there was a weak negative correlation between the academic success of the students and their physical activity levels, and that their academic success was not affected by smart phone use and sleep quality. However, it was determined that there was a weak positive correlation between the sleep quality of the students and their smartphone use. It was observed that the physical activity levels of male students were higher, while the academic success and sleep quality of normal education students were better.

**Conclusion:** We think that active life, adequate and conscious smartphone use and quality sleep habits can affect academic success in university students.

**Keywords:** Academic performance, physical activity, sleep quality, smartphone, students

## 1. INTRODUCTION

Academic performance, which reveals the level of achievement of individuals' targeted behavior in school life and is generally measured by exams, is a result of education (1). Students' performance is affected by psychological, economic, social, personal and environmental factors (2). In addition, it is stated that the physical activity level and sleep quality of the university students, provided that each of them is a separate factor, can affect academic success (3-6).

Physical activity is anybody activity that requires energy expenditure and is caused by the contraction of skeletal muscles (7,8). In addition to the contribution of physical activity to health, it is thought that it can have a positive effect on academic achievement, as it increases self-esteem in individuals (9,10). The World Health Organization recommends at least 150 minutes of moderate-intensity physical activity per week or 75 minutes of vigorous aerobic exercise per week for adults aged 18-64. (11). Many studies have attempted to determine the relationship between physical activity and academic achievement, and conflicting results have been obtained. While some findings show

that there is a positive relationship between academic achievement and physical activity, on the contrary, there are studies that reveal that there is no relationship, or even a weak, negative relationship (3-5).

Advances in technology in the last 20 years have increased the use of internet, smartphones, and social media, and have led to the adoption of a sedentary lifestyle by keeping individuals away from physical activity (12-14). Apart from the convenience that smartphones provide in many areas of life such as business, education, entertainment, communication and commercial activities, the increasing time spent in front of the phone has brought concerns about addiction in individuals (14,15). Studies have shown that the use of smartphones increases the level of phone addiction in individuals, causes many physical and mental problems, but increases academic assistance and success because it increases cooperation and information sharing among students (16-18).

University students experience insomnia and sleep problems due to environmental change, intensive education

and exams, friendship, messaging and time spent on social media accounts. Quality sleep is defined as feeling rested when the individual wakes up in the morning and feeling ready for the new day both physically and mentally (19, 20). It has been stated that quality sleep facilitates memory, thus facilitating learning, helping to preserve the individual's concentration, cognitive functions, sensorimotor integration and memory (6).

Studies have shown that academic achievement is positively or negatively affected by physical activity and phone use. On the other hand, studies indicate that quality sleep increases student achievement. Increasing use of technology and spending more time in front of the phone in recent years may cause young adults to adopt a sedentary life away from physical activity. In different studies on this subject in the literature, contradictory results have been revealed. For this reason, our study was planned to reveal the relationship between academic performance of young adults with physical activity, smartphone use and sleep quality with comprehensive research among university students.

## 2. METHODS

### 2.1. Individuals

Students were informed about the study. 424 students who voluntarily accepted to participate in the study between November 2019 and January 2020 and who were able to communicate verbally and using smartphones were included in the study. Individuals who were not health vocational college students and had communication and cooperation difficulties were excluded from the study. Our research was conducted with students studying at a health vocational school in the 2019-2020 academic year. This cross-sectional study was approved by the Ethics Committee of the Ankara Yıldırım Beyazıt University (16.10.2019-50).

### 2.2. Measurements

#### *Academic success*

The academic achievement of all students participating in the study was evaluated by recording the year-end Academic Grade Point Average (AGPA).

#### *Physical activity*

The International Physical Activity Questionnaire-Short Form (IPAQ-SF) was used to determine the physical activity levels of individuals (21). The questionnaire consists of seven questions questioning the frequency of walking, moderate and vigorous activities, the time spent during the activities, and the sitting time. Using the sum of the duration and frequency values of the activities, the MET values corresponding to basal metabolism were evaluated as the total score. In the calculation of the total score, walking was considered as 3.3 MET, moderate activity 4, vigorous physical activity 8, and sitting activity 1.5 MET.

#### *Smartphone use*

Smartphone Addiction Scale-Short Form (SAS-SF) was created by Kowan et al. (22). The scale, whose Turkish validity and reliability was carried out by Noyan et al. in 2015, includes a total of 10 questions (23). The total score ranges from 10-60, and it is stated that as the total score increases, phone addiction increases. The cut-off score of the scale was determined as 31 for women and 33 for men, and the Cronbach alpha coefficient was calculated as 0.867. In addition, those who use a smartphone less than 4 hours a day are classified as "light use", and those who use more than 4 hours a day are classified as "heavy use" (24).

#### *Sleep quality*

Pittsburgh Sleep Quality Index (PSQI), which provides information about the sleep quality of individuals in the last month and the type and severity of sleep disorder, was developed by Buysse et al (25). The Turkish validity and reliability of PSQI made by Ağargün et al. 19 of the 24 questions are answered by the person himself, and the remaining 5 questions are answered by the person's bed partner (26). There are 7 sub-dimensions: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbance, use of sleeping pills, and daytime dysfunction. The score of each sub-dimension ranges from 0 to 3. Sleep quality of those with a total score of 5 or less is considered to be "good".

Statistical Package for Social Sciences (SPSS) version 22 software was used for the statistical analysis of the data obtained. The compliance of the variables to normal distribution was evaluated by Shapiro-Wilks test, Q-Q Graphs, and histograms. The mean, standard deviation, frequency, and percentage values of the data were recorded by statistical analysis. Spearman Rho Correlation Analysis was used for the relationship between the evaluation scores, and the Mann Whitney U test was used for the difference analysis between groups. In the post hoc analysis, the power of the study was determined as 99% ( $\alpha = 0.05$  for  $r = 0.3$ ). Significance level was accepted as  $p < 0.05$ .

## 3. RESULTS

Of the 424 individuals participating in the study, 76.9% were women and 26.3% were men, and the average age of the individuals was  $19.53 \pm 2.134$  years. It was determined that 70.3% of the participants had more than 4 hours of smartphone use during the day, and 51.7% were studying in normal education (Table 1)

It was observed that there was a weak negative correlation between the academic achievement and physical activity levels of individuals ( $r: -0.147$ ;  $p = 0.002$ ), and a weak positive correlation was found between smartphone addiction level and PSQI total scores ( $r: 0.190$ ;  $p = 0.000$ ). On the other hand, it was found that academic success was not affected by sleep quality and phone use ( $p > 0.05$ ) (Table 2)

It was determined that the phone usage levels of the participants did not affect the academic achievement, sleep

quality and physical activity level ( $p>0.05$ ). It was determined that the academic success rate of women and the level of physical activity of men were higher ( $p<0.05$ ). In addition, it was found that the academic achievement and sleep quality of the normal education students were better ( $p<0.05$ ). The comparison of AGPA, PSQI, IPAQ-SF and SAS-SF of the participants' phone usage, gender and educational status is shown in Table 3.

**Table 1.** Demographic information and scale averages of the participants ( $n=424$ )

Variable	X $\pm$ SS
Age (year)	19.53 $\pm$ 2.134
AGPA	2.47 $\pm$ 0.67
IPAQ-SF	2251.78 $\pm$ 2874.169
SAS-SF	29.88 $\pm$ 10.313
PSQI	6.55 $\pm$ 2.48
<b>Sex</b>	<b>N (%)</b>
Female	326 (76.9)
Male	98 (26.3)
<b>Education status</b>	
Normal education	219 (51.7)
Secondary education	205 (48.3)
<b>Daily phone use</b>	
Under 4 hours	126 (29.7)
Over 4 hours	298 (70.3)
<b>Smartphone usage reasons</b>	
Speech and messaging	150 (35.4)
Entertainment (internet, game, TV-movie-video watching, video-photography)	135 (31.8)
Social media (facebook, twitter, instagrametc.)	135 (31.8)
Health (pedometer, calorieetc.)	4 (0.9)
<b>Sleep quality of the participants (based on PSQI scores)</b>	
Healthy sleep (0-5 points)	160 (37.7)
Poor sleep (6-10 points)	239 (56.4)
Advanced sleep problems (over 10 points)	25 (5.9)
<b>Physical activity status of the participants (based on IPAQ scores)</b>	
Inactive group (<600 METs)	112 (26.4)
Minimal active group (600-3000 METs)	205 (48.3)
Active group (> 3000 METs)	107 (25.2)

mean  $\pm$  standard deviation; Number (Percent); Academic Grade Point Average; Physical Activity Questionnaire-Short Form; Smartphone Addiction Scale-Short Form; Pittsburg Sleep Quality Index Relationship between participants' AGPA values and IPAQ-SF, SAS-SF and PSQI scores

**Table 2.** Relationship between participants' AGPA values and IPAQ-SF, SAS-SF and PSQI scores

Variable	IPAQ-SF		PSQI		SAS-SF	
	r	p	r	p	r	p
AGPA	-0.147	0.002	-0.062	0.205	-0.077	0.112
IPAQ-SF			0.020	0.686	-0.045	0.358
PSQI					0.190	0.000

Academic Grade Point Average; Physical Activity Questionnaire-Short Form; Smartphone Addiction Scale-Short Form; Pittsburg Sleep Quality Index; Spearman rho correlation coefficient; significance level Comparison of participants' phone use, gender and teaching status with AGPA, PSQI and IPAQ-SF

**Table 3.** Comparison of participants' phone use, gender and teaching status with AGPA, PSQI and IPAQ-SF

Variable	Light use (n=126)		Heavy use (n=298)		Test statistic	
	IQR	Min; Max	IQR	Min; Max	z	p
AGPA	2.62 (0.79)	0;3.92	2.49 (0.78)	0;4	-1.907	0.057
PSQI	6 (4)	2;14	6 (3)	1;13	-1.203	0.229
IPAQ-SF	1173 (2341)	0; 25200	1245 (2531)	0;15192	-0.052	0.958
	Female (n=326)		Male (n=98)			
AGPA	2.57 (0,74)	0;4	2.27 (0.80)	0;3.90	-4.713	0.000
PSQI	6 (3)	1;14	6 (3)	2;13	-1.065	0.287
IPAQ-SF	990 (2246)	0;25200	2368.50 (3510)	0;15768	-5.541	0.000
SAS-SF	29.50 (16)	10;56	29 (12)	10;59	-1.552	0.121
	Day teaching (n=219)		Evening teaching (n=205)			
AGPA	2.55 (0,83)	0;4	2.48 (0.82)	0;3.90	-2.106	0.035
PSQI	7 (4)	2;14	6 (4)	1;13	-3.681	0.000
IPAQ-SF	1356 (2143)	0;15057	1104 (2826)	0;25200	-1.745	0.081
SAS-SF	30 (13)	10;56	28 (15)	10;59	-1.244	0.214

Academic Grade Point Average; Physical Activity Questionnaire-Short Form; Smartphone Addiction Scale-Short Form; Pittsburg Sleep Quality Index; Interquartile range Spearman rho correlation coefficient; significance level

#### 4. DISCUSSION

In our study, it was found that there was a weak negative relationship between the academic achievement of university students and their physical activity levels, while smartphone usage levels and sleep quality did not affect academic success. In addition, it was determined that there was a weak positive correlation between the sleep quality of university students and their phone usage levels. On the other hand, it was observed that the academic achievement of women was higher than that of men, and normal education students compared to secondary education students. It was found that the physical activity levels of the men were higher than the women, and the sleep quality of the normal education students was better than the secondary education students.

The results between physical activity and academic achievement, which is one of the indicators of personal success, are remarkable. In a study conducted with high school students, it was determined that there was no correlation between the physical activity level of the students and their academic performance (27). In a study conducted between students who are involved in physical activity and those who do not, a positive significant relationship was found between physical activity and academic performance, and it was stated that increasing physical activity can increase academic achievement (28). Another study stated that 2-3 hours of physical activity per week increased academic performance, 4 hours or more did not contribute to academic success (3). On the other hand, in a study conducted with 324 university students in Malaysia, it was observed that there was a weak negative relationship between the students' maximum oxygen consumption and their academic achievement (29). In our study, it was observed that there was a negligible negative relationship between the academic achievement

of the students and their physical activity levels, albeit weak. The fact that 75% of the individuals participating in our study led an inactive or minimally active life made us think that the individuals lead a more sedentary life, and that the duration of smartphone use may have increased because of this. We believe that the use of objective measurement parameters in determining the duration, intensity and type of physical activity, long-term monitoring and control of physical activity habits in individuals, and the relationship between academic achievement and physical activity can be revealed more clearly.

In addition, studies have shown that gender affects physical activity. In a study with 101 female and 106 male participants between the ages of 18-25, it was determined that the physical activity levels of men were higher than women (30). In a study by Kizar et al. examining the physical activity levels of university students, it was stated that men had more physical activity levels than women (12). Similar to the literature, in our study, it was observed that male students had a more active lifestyle than female students.

Smartphones can make mobile learning more attractive and easier through mobile applications by minimizing the disadvantages of traditional applications or in-class activities in schools and universities (31). In addition to the life-enhancing effects of smartphones, excessive use among young people also brings some risks (15). It is still unclear to what extent smartphone use, also widespread among students at higher education levels, affects their academic achievement (13). In a study conducted in 2015, it was reported that students who use mobile phones more frequently on a daily basis have lower grade point average (32). In studies conducted with medical school students, it is also stated that increasing the time spent by phone negatively affects academic performance (33,34). Smartphone addiction not only affects individuals' behavior, communication skills, and social lives, but also negatively affects their academic performance (35,36). Contrary to the literature, it was seen in our study that smartphone usage levels did not affect academic achievement. We believe that the differences in the reasons individuals use smartphones may be related to this situation.

Many factors, such as coffee habits, social media and phone use and drug use, can change sleep habits, and the resulting table of insomnia can affect the physical, cognitive and emotional functions of individuals (23, 37). Insufficient sleep has been associated with decreased academic success, and sleep quality can negatively affect the health and emotional state of college students (38,39). In a study conducted with medical faculty students in 2020, it was stated that students' sleeping habits affect academic success (17). The academic success of the individuals participating in our study was not affected by their sleep quality. However, similar to the literature, in our study, it was found that as the sleep quality of the students decreased, the level of phone addiction increased. It was observed that as the sleep quality of the students decreased, their phone addiction levels increased. The literature also showed similar findings in our study that there is a positive weak relationship between smartphone

usage levels and sleep quality, and it has been reported that sleep problems may occur with an increase in the time spent in front of the smartphone (15,40). We believe that the adoption of a sedentary life with the technological development in recent years, the increase in interest in virtual environments and the fact that more time is spent may be the reason for this situation.

It can be said that the educational status of the students also affected their sleep quality. In our study, it was found that the sleep quality of the normal education students was better than the secondary education students. The reason for this may be that secondary school students generally stay awake at night and prefer to sleep during the day.

Our study has some limitations. Our research was carried out with students studying health-related education in a single center. Sleep quality, physical activity and smart phone usage habits were evaluated with scales. The use of quantitative assessment methods with different student populations in further studies may reveal more reliable results.

## 5. CONCLUSION

Although the effect of physical activity on academic achievement has not been clarified yet, it is very important to plan appropriate physical activity with the guidance of a physiotherapist on certain days of the week and for the development of cognitive functions. It should also be taken into account that academic performance can be increased by gaining conscious smart phone usage habits for academic activities in young individuals who are the guarantee of our future. It should not be forgotten that ergonomic recommendations and preventive rehabilitation are important for reducing the time spent on the phone and correcting the postural posture during the time spent. It should be known that quality sleep will play a role in success in young individuals who progress with academic success and set goals. We believe that increasing the activities suitable for young people's research, learning, acquiring knowledge and social skills and providing the necessary guidance and information in order to make conscious use of the time outside of sleep will contribute to the personality and academic development of the youth.

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*Design of the study: AC*

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*Drafting the manuscript: AC*

*Revising it critically for important intellectual content: ED*

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