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The effects of smartphone addiction on sleep quality and obesity level in obese men

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ABSTRACT

Aims: To investigate the effects of smartphone addiction on sleep quality and body mass index (BMI) values in obese men.

Methods: During the study period, 90 men aged 18 to 45 years who were monitored for obesity, presented to the hospital, and agreed to participate in the study were recruited. The study statistically evaluated sleep quality and factors affecting it using patient demographic characteristics, the Pittsburgh Sleep Quality Index (PSQI), the Smart Phone Addiction Scale (SPAS), and the Hospital Anxiety-Depression Scale (HADS).

Results: Patients were divided into two groups according to PSQI score: PSQI ≥5 n:51 (56.7%) and PSQI <5 n:39 (43.3%). The association between PSQI scores and age, body mass index (BMI), educational status, HADS-A, and HADS-D, SPAS, was examined. HADS-A, and HADS-D, SPAS scores were higher in the group with poor sleep quality ($p<0.001$). In addition, a high smartphone addiction score was found to increase the presence of PSQI ≥5 12-fold. It was shown that BMI values were higher in patients with high SPAS ($p< 0.030$).

Conclusion: Poor sleep quality and smartphone addiction appear to influence BMI in obese individuals. Studies to improve sleep quality are very important to identify modifiable risk factors, improve the design of prevention programs, and reduce the prevalence of obesity in the young population.

Keywords: Sleep quality, obesity, smartphone addiction, depression, anxiety

INTRODUCTION

Obesity is global public health problem is estimated to be largely responsible for increased mortality from cardiovascular disease and cancer. Obesity is a multifactorial disease in which many behavioral, environmental, genetic, metabolic and sociocultural factors play a role.[1,2]

Recent studies have shown that the development of sleep problems parallels the development of obesity.[3,4] Adequate and quality sleep is very important for overall health. Lack of sleep contributes to obesity by triggering metabolic, hormonal and behavioral steps that increase dietary energy intake and decrease energy expenditure.[4-6] Meta-analyzes confirm that poor sleep quality and duration are associated with higher positive energy balance, leading to higher body mass index (BMI).[7-9]

Many factors affect sleep quality and duration, and one of the rapidly evolving factors may be the increasing use of technology, particularly smartphone addiction.

Cell phone addiction is a rapidly growing factor that affects physical and mental health. There are several reasons why cell phone addiction leads to shorter sleep duration or less sleep.[10] Cell phones are now used not only to make phone calls, but also to text, surf the internet, play mobile games, or use social networks. These behaviors can lead to short nights' sleep and disturbed sleep patterns in cell phone addicts.

Thank you to the capabilities offered by smartphones; our daily lives have become very convenient and easy. However, this leads to significant changes in people's lifestyles. As conditions such as a changing diet and lack of exercise increase daily, the incidence of obesity continues to rise. This is a widespread and important health problem, not only in our country but worldwide.

The aim of our study was to investigate the effects of smartphone addiction on BMI values and sleep quality in obese individuals. In the literature, studies on the relationship between smartphones, which we frequently

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use today, obesity and sleep quality are limited. For this reason, the subject of the research can be a pioneer for other researches in the future.

METHODS

The study was carried out with the permission of Ethics Committee of the Ministry of Health and Scientific Research of Haydarpaşa Numune Training and Research Hospital (Date: 18.04.2022, Decision No: HNEAH-KAEK 2022/85). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Consecutive obese individuals aged 18 to 45 years who used a smartphone during the study period (May-September 2022), who agreed to participate were included. The study's participants gave their written informed consent. The World Health Organization (WHO) defines obesity as excessive fat accumulation in the body to a degree that adversely affects health.[11] Obesity was described by a BMI of 30 or more.[12]

Participants were informed about the study in advance. Individuals with a BMI of 30 or more who agreed to participate in the study and were cooperative were included. Individuals with a known sleep disorder diagnosis, individuals on medication to treat a sleep disorder any other psychiatric and endocrine disorder, and individuals working shift work were excluded from the study. To measure smartphone addiction, an interview-based semi structured questionnaire, which asked for sociodemographic characteristics of patients (age, gender, height, weight, educational status, comorbidity, etc.), and the smart phone addiction scale were used. The Pittsburgh sleep quality index (PSQI) scale was used to assess patients' sleep quality, and the hospital anxiety and depression scale (HADS) was completed to assess emotional state.

Assessment Scales

Sociodemographic questionnaire: Patients were asked about age, gender, educational status, marital status, additional disease, height, and weight. Values were recorded by calculating BMI.

Smart phone addiction scale: The Smart Phone Addiction Scale (SPAS) is a scale developed by Kwon et al.[13] based on Young's Internet Addiction Scale and characteristics of smartphone use. The Smart Phone Addiction Scale consists of 33 items. It is a Likert scale. Demirci's research and studies were used to determine its translation from English to Turkish and its validity and reliability.[14] In this study, the mean SPAS score of smartphone users was found to be greater than or equal to 76. Individuals with high scores are considered risky smartphone users (high smartphone users), whereas individuals with low scores are not considered risky smartphone users (low smartphone users).

Pittsburgh sleep quality index (PSQI): The PSQI, a reliable and consistent test, was used to determine patients' sleep quality during the past month (α= 0.77).[15] The PSQI, which includes 19 questions and allows us to assess sleep quality, amount of sleep, presence and severity of sleep disorders, was completed by the same physician during individual patient interviews. The PSQI consists of seven questions assessing subjective sleep quality, sleep duration, sleep efficiency, sleep delay, sleep disorder, use of sleeping pills, and interference with daytime work. Each response is assigned a score between 0 and 3 according to symptom frequency. The total score ranges from 0 to 21, with high scores indicating poor sleep quality and high levels of sleep disorder. A total score of 5 or more clinically indicates significantly poorer sleep quality. Diagnostic sensitivity is 89.6% and specificity is 86.5%. Agargün et al.[16] adapted the PSQI questionnaire to Turkish patients.

Hospital anxiety and depression scale (HADS): This scale was developed by Snaith and Zigmond.[17] The reliability and validity of the Turkish version was confirmed by Aydemir et al.[18] It is easy to use because it is short and understandable. There are 14 items in total. Seven of the 14 questions (odd numbers) measure anxiety and seven (even numbers) measure depression. Responses are rated on a four-point Likert scale ranging from 0-3. The lowest score patients can achieve on both subscales is 0 and the highest is 21. The cut-off points of the Turkish version of the HADS were set at 7 for the depression subscale (HAD-D) and 10 for the anxiety subscale (HAD-A). Accordingly, those who score above these levels are considered to be at risk.

Statistical Analysis

Statistical analyzes were performed using the SPSS version 25.0 program. Histogram plots and the Kolmogorov-Smirnov test were applied to examine the fit of the variables to the normal distribution. Mean, median, standard deviation, and min-max values were used to present descriptive analyzes. Categorical variables were compared using the chi-square test. The Mann-Whitney U test was implemented to evaluate nonnormally distributed (nonparametric) variables between two groups. The Kruskal-Wallis test was implemented when more than two groups were to be compared. The Spearman correlation test was performed to analyze the measurement data between groups. Binary logistic regression analysis was used to examine the factors affecting the presence of poor sleep on the PSQI. Cases with a P-value less than 0.05 were considered statistically significant results.

RESULTS

Ninety men aged 19-33 years (mean 24.36±3.03) were included in our study.

10% (n=9) of participants had a secondary school degree, 53.3% (n=48) had a high school degree, and 36.6% (n=33) had a university degree.

No additional disease was present in 86.6% (n=78) of the study participants. The mean BMI of the participants was 39.79±3.99, and 48 (53.3%) of the participants had a SPAS score of 76 or more. Patients were assessed for anxiety and depression using the HAD scale. 28 (31.1%) individuals were above the HADS scale threshold for anxiety (HADS-A) and 42 (46.7%) for depression (HADS-D) (Table 1).

Table 1. Demographic characteristics of participants

	n	%
Age	24.36±3.03	24 (19-33)
BMI	39.79±3.99	39.65 (31.4-50.6)
Educational Status		
Middle school	9	(10)
High school	48	(53.33)
University	33	(36.67)
Additional Disease		
Absent	78	(86.67)
Present	12	(13.33)
Marital Status		
Single	64	(71.11)
Married	26	(28.89)
Employment Status		
Unemployed	41	(45.5)
Employed	49	(54.5)
PSQI	6.11±3.62	5 (0-14)
<5	39	(43.33)
≥5	51	(56.67)
SPAS	78.98±28.11	76 (36-153)
<76	42	(46.67)
≥76	48	(53.33)
HADS-A	8.03±4.08	7.5 (0-16)
Anxiety		
Below the threshold (0-10 points)	62	(68.89)
Above the threshold (11-21 points)	28	(31.11)
HADS-D	7.02±4.09	6 (0-16)
Depression		
Below the threshold (0-7 points)	48	(53.33)
Above the threshold (8-21 points)	42	(46.67)

Patients were divided into two categories according to PSQI scores: PSQI ≥5 n=51 (56.7%) and PUKI <5 n=39 (43.3%). The association between PSQI scores and age, BMI, educational status, marital status, employment status, SPAS, HADS-A, and HADS-D was examined. Those with high SPAS and those with HAD anxiety and depression scores above threshold had higher rates of PSQI ≥5. In addition, those with a PSQI ≥5 had higher SPAS, HADS-A, and HADS-D scores (p< 0.01, p< 0.01, p=0.02) (Table 2).

Table 2. Comparative assessment of groups in terms of demographic characteristics according to sleep quality

	PSQI		p
	<5 median±SD/n	≥5 median±SD/n	
Age	24.23±2.92	24.45±3.14	0.740[1]
BMI	38.93±3.7	40.45±4.12	0.072[1]
Educational Status			0.258[2]
Middle school	2	7	
High school	24	24	
University	13	20	
Additional Disease			0.009[2]
Absent	38	40	
Present	1	11	
Marital Status			0.416
Single	25	38	
Married	13	13	
Employment Status			0.042[2]
Unemployed	13	28	
Employed	26	23	
SPAS	61.23±17.93	92.55±26.98	<0.001[1]
<76	31	11	<0.001[2]
≥76	8	40	
HADS-A (Mean ± SD)	5.97±3.2	9.61±4	<0.001[1]
Anxiety			<0.001[2]
Below the threshold (0-10 points)	36	26	
Above the threshold (11-21 points)	3	25	
HADS-D (Mean ± SD)	5.46±3.63	8.22±4.06	0.002[1]
Depression			<0.001[2]
Below the threshold (0-7 points)	29	19	
Above the threshold (8-21 points)	10	32	

[1]Mann-Whitney U Test [2] Chi-Square Test

The correlation between age, BMI, SPAS, HADS-D and HADS-A scores, and PSQI score was examined. Accordingly, there was a statistically significant relationship has been identified between PSQI and BMI, SPAS, HADS-A, and HADS-D scores (p<0.05) (Table 3).

Table 3. Sleep quality correlation

	Age	BMI	SPAS	HADS-A	HADS-D
PSQI					
r	0.117	0.279	0.603	0.516	0.400
P	0.271	0.008	<0.001	<0.001	<0.001

Spearman Correlation Test

When examining the factors that affect poor sleep quality on PSQI, a SPAS≥76 was found to increase the presence of PSQI ≥5 12.4 fold (p<0.001) (Table 4).

Table 4. The factors that affect poor sleep quality

	B	S.E.	p	Exp(B)	95% C.I. for EXP(B)	
					Lower	Upper
Additional disease	0.984	1.202	0.413	2.674	0.254	28.187
SPAS	2.520	0.580	<0.001	12.428	3.986	38.749
Anxiety	1.492	0.916	0.103	4.447	0.739	26.758
Depression	0.731	0.709	0.302	2.078	0.518	8.336

Binary Logistic Regresyon

Significant results were obtained when comparing between SPAS groups. Accordingly, to convey that the number of individuals who were single in terms of 'marital status', BMI, PSQI, and HADS-A scores were significantly higher in those with SPAS≥76 (p=0.001, p=0.030, p<0.001, p=0.017) (Table 5).

Table 5. Comparative assessment of groups in terms of demographic characteristics according to smarthphone addiction

	SPAS		p
	<76 median±SD/n	≥76 median±SD/n	
Age	24.57±2.98	24.17±3.09	0.338[1]
BMI	38.85±3.97	40.61±3.87	0.030[1]
Educational status			
Middle school	5	4	0.758[2]
High school	23	25	
University	14	19	
Marital status			
Single	23	41	0.001[2]
Married	19	7	
Employment status			
Unemployed	14	27	0.029[2]
Employed	28	21	
PSQI	3.86±2.27	8.08±3.43	<0.001[1]
<5	31	8	<0.001[2]
≥5	11	40	
HADS-A	6.81±3.47	9.1±4.3	0.017[1]
Anxiety			0.006[2]
Below the threshold (0-10 points)	35	27	
Above the threshold (11-21 points)	7	21	

[1]Mann-Whitney U Test [2] Chi-Square Test

In the analysis of SPAS and PSQI scores according to the working status of the participants, a statistically significant difference was found between the working status variable (p<0.05) (Table 2-5).

DISCUSSION

In our study, 51 of 90 obese patients were found to have poor sleep quality. It was determined that the frequency of anxiety and depression was high in the group with poor sleep quality. Body mass index was higher in those with high cell phone addiction. Poor sleep quality, BMI, cell phone addiction, anxiety, and depression were found to be correlated in the same direction.

Obesity is a global public health problem that is estimated to be primarily responsible for increased mortality from cardiovascular disease and cancer.[1,2] Recent estimates indicate that the prevalence of obesity has doubled worldwide since 1980.[19] This obesity epidemic is accompanied by a trend toward shorter sleep duration and poorer sleep quality in modern society.[20] Poor sleep quality and length are associated with obesity, according to an increasing corpus of research.[20,21] A key regulator of hormonal activity is sleep. Glucose metabolism and sleep loss have led to metabolic and endocrine changes, including decreased glucose tolerance and alterations in appetite-regulating hormones.[22,23] Sleep quality affects energy balance via appetite, gut peptide concentrations, hypothalamic-pituitary-adrenal axis activity, and substrate oxidation. Poor quality sleep results in hormonal shifts like lower leptin and greater ghrelin concentrations, which improve positive energy balance, leading to excessive food intake and weight gain.[24] High BMI and waist circumference were significantly correlated with poor sleep quality, according to Jennings, Muldoon, and Hall's 2007 study.[25] Rahe et al.[26] found a significant connection between obesity and a poor quality sleep. Sleep problem is a significant risk factor for obesity, according to a research involving almost 140,000 participants.[27] Defined poor sleep quality as a risk factor for obesity and found that 100% of the morbidly obese people who participated in their study had poor sleep quality.[26] In a study conducted by Vargas et al.[9] with university students, it was found that being slightly overweight increased the risk of sleep disorders by 1.66 times. Our study showed that 56.7% of obese individuals had poor sleep quality and there was a positive correlation with BMI.

In our study, a statistically significant difference was observed between the sleep quality of those with and without chronic diseases. The sleep quality of those with chronic disease was found to be worse than the sleep quality of those without the diseases. In a study conducted in Nigeria on this subject, it was reported that the presence of a chronic disease affected sleep quality poorly,[28] while in some studies conducted in our country, it was found that chronic diseases decreased sleep quality.[29,30]

Ankara et al.[31] conducted a study with 144 participants and found that there was no significant difference between employees and non-employees in terms of SPAS.

In the study of Obuz,[32] no significant difference was found between employees and non-employees in SPAS

scale scores and diagnoses. In our study, in the analysis of SPAS and PSQI scores according to the working status of the participants, there was no statistical difference between SPAS and the working status variable significant difference was found.

When we examined the literature on the effect of marital status on SPAS, we found that there were few studies on this subject. Alosaimi et al.[33] with 2367 participants marital status and problematic smartphone use scale scores between the two groups was not found to be significantly different. In Obuz's[32] study, the mean SPAS score of singles was significantly higher than the mean score of married individuals. In our study, according to the marital status of the participants, there was a statistically significant difference between SPAS and marital status.

Sleep quality and daytime sleepiness have been reported to be significantly associated with mood disorders (depression and anxiety). A British study examining the association between sleep disorders, quality of life, anxiety, and depression found that these variables were particularly prevalent in extremely obese individuals, more than two-thirds of whom reported poor sleep quality.[35] Our study was consistent with the studies conducted and found that the incidence of anxiety and depression was significantly higher in obese individuals with poor sleep quality.

Many factors affect a person's sleep quality and duration, and one of the rapidly evolving factors may be the increasing use of technology, particularly cell phone addiction. There are several reasons why cell phone addiction causes shorter sleep duration or less sleep.[10] The smartphone can support social networking, gaming, and perform various functions such as phone, multimedia player, camera, navigation system, Internet browser, and e-mail service. These behaviors can cause short night's rest and disturbed sleep patterns in cell phone addicts. Cell phone addiction can lead to less and poorer sleep. Many studies show that cell phone use is associated with inadequate sleep duration.[10,36]

In a study conducted by Zhang et al.[37] with 427 university students in China, sleep latency, short sleep duration and poor sleep quality variables were found to have significant positive correlations with smartphone addiction. Sleep latency was significantly and positively associated with smartphone addiction. 32.3% of students subjectively reported having poor sleep quality. Researchers have found that excessive cell phone use and use in the dark are related to poor sleep.[38,39] Loughran et al.[40] reported the adverse effects of cell phone electromagnetic fields on electroencephalograms during sleep.

Similarly, Huber et al.[41] reported that exposure to electromagnetic fields (cell phone use) in the evening affects physiological factors such as sleep quality and melatonin rhythm and may affect brain activity, especially the pineal gland. They also stated that they could cause changes in brain electrical activity and cerebral blood flow. In addition, it has been reported that long-term use of cell phones may cause physical disorders such as muscle pain and headache, which may negatively affect sleep.[38]

In a 2004 study of university students, Thomée et al.[42] found that those classified as heavy computer, social media and cell phone users reported higher levels of long-term stress, depression and sleep disturbances. Furthermore, in another study of young adults, after excluding participants with baseline mental health problems, high cell phone use was associated with stress, sleep disturbances and depression following a one-year follow-up.[38]

When our study examined the factors that influence poor sleep quality (anxiety, depression, chronic diseases and smarthphone addiction), it showed that it was increased 12-fold in individuals with high smartphone addiction. There was a similar correlation was found between PSQI and BMI, rates of smarthphone use.

Several recent studies have found that problematic smartphone use is associated with certain health risks, ranging from psychosocial disorders such as depression, anxiety, and sleep problems[43-45] to possibly fatal injuries in traffic accidents.[46]

Excessive use of the calling and texting features of cell phones has been associated with depression, anxiety, and stress.[47] The results of a study conducted by Ithnain et al.[48] with 369 university students in Malaysia showed a significant positive relationship between smartphone addiction and anxiety and depression. Smartphone addiction has a significant impact on anxiety and depression is a was found to be a predictor.

Specifically, prolonged screen use leads to decreased physical activity, altered sleep schedules, and increased consumption of junk food, which increases the risk of obesity through decreased activity and increased energy intake.[49]

Our study found that individuals with high rates of smartphone use had higher BMI, poorer sleep quality, and higher anxiety scores.

In line with this information in the literature and our study based on the results, the risk of smartphone addiction, poor sleep quality, obesity and there is a relationship between psychological symptoms.

The rapid development of technology is leading to significant changes in people's lifestyles. As conditions such as dietary changes and lack of exercise increase, so does the incidence of obesity. In addition, excessive smartphone use leads to mood disorders and sleep problems, increasing the risk of developing obesity. Obesity is a widespread health problem, not only in our country but worldwide. Obesity is a major contributor to increasing disease rates and shortening life expectancy, and it significantly affects an individual's quality of life. Although the impact of behavioral addictions, including smartphone addiction, on our lives is increasing, little research has been conducted on these topics.

The limitations of our study are that it was conducted with a small sample and only males. The scales used are subjective assessments, and sleep problems should be confirmed by objective tests. Studies with large groups of patients are needed to verify the results.

CONCLUSION

Obese people's BMI seems to be impacted by poor sleep quality and smartphone addiction. Therefore, identifying potentially modifiable risk factors and underlying causes is critical to improve the design of prevention programs and reduce the prevalence of obesity in the young population.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Ethics Committee of the Ministry of Health and Scientific Research of Haydarpaşa Numune Training and Research Hospital (Date:18.04.2022, Decision No: HNEAH-KAEK 2022/85).

Informed Consent: All patients signed and free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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