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The Association between Smartphone Addiction, Type D Personality Traits and Insomnia in University Students

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Abstract

Introduction: We aimed to investigate the mediating role of smartphone addiction in the relationship between Type D personality and insomnia.

Materials and Methods: The study is a cross-sectional study conducted among university students. Participants completed a Sociodemographic Data Form, Insomnia Severity Index (ISI), Type D Personality Scale (DS-14), Smartphone Addiction Scale-Short Form (SAS-SF), and Subjective Vitality Scale (SVS). We compared the mean scores of the scales between individuals with and without Type D personality. A correlation analysis was performed between the scales and the mediating role of smartphone addiction in the relationship between Type D personality traits and insomnia severity was examined.

Results: The study included 375 participants with a mean age of 22.10 ± 3.95 years, ranging from 18 to 53 years. The results showed that individuals with Type D personality had significantly higher scores on the SAS-SF and ISI, but lower scores on the SVS. We also found a significant positive correlation between smartphone addiction, Type D personality traits, and the ISI. Additionally, there was a statistically significant negative correlation between SVS and the other scales. Type D personality had a significant effect on ISI scores directly (path c; β = 0.119; 95% CI = 0.07–0.16) and totally (path c + a x b; β = 0.148; 95% CI = 0.10-0.19) as well. Smartphone addiction had a partial mediation role in the relationship between DS-14 and ISI.

Conclusion: Type D personality traits and smartphone addiction should be questioned in the intervention of insomnia in university students and specific therapies should be developed.

Key words: Smartphone addiction; type D personality; insomnia.

Inroduction

Smartphone use has increased significantly in recent years. People of all ages use smartphones for a variety of purposes. The multi-functionality of smartphones, including cameras, access to the internet, social media, real-time broadcasting, and navigation systems, has contributed to their widespread use (1). While smartphones have positive aspects, such as increased productivity and social networking, excessive use can negatively impact daily life and mental health, leading to smartphone addiction (SA) (1). Although not officially recognized as a medical diagnosis, SA is an important topic that needs to be researched (2). Commonly reported symptoms of SA include a diminished interpersonal relationships, persistent smartphone usage despite adverse outcomes, an inability to regulate smartphone usage, and increased anxiety when smartphone access is unavailable (2). The SA has also been named as problematic, excessive, or compulsive mobile phone use (3). Studies have demonstrated that SA associated with mental health issues, poorer school performance (4). Furthermore, SA can have adverse consequences for sleep patterns, resulting in inadequate sleep, reduced sleep duration, and delayed sleep latency (2,5). Smartphone use, especially close to bedtime, can disrupt the circadian rhythm and reduce melatonin release, further exacerbating the negative effects on sleep (6). The poor sleep quality associated with smartphone use may be a mediator of the negative psychological effects of SA, such as depression and anxiety (2). Many studies have found that neuroticism, introversion, and extraversion can predict SA (7). Neuroticism, which is characterized by emotional instability, depression, anxiety, and guilt, has been shown to be a risk factor for addiction, including SA (7). Additionally, both introversion and extroversion have been linked to SA (8). Introverts who avoid

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face-to-face communication are more likely to use smartphones, making them vulnerable to SA (9). On the other hand, extroverts, who are more social and energetic, may use smartphones to engage in more social communication, putting them at risk for SA (8). Research findings on the relationship between extraversion or introversion and SA vary, with some studies showing a positive, negative, or no relationship (8). The Type D personality, also known as the 'distressed' personality, is characterized by a tendency to experience negative emotions and avoid social interactions (10). Type D personality combines two traits: negative affectivity (NA), which encompasses emotions such as melancholy, anger, and worry, and social inhibition (SI), which is an inability to reveal emotions in social situations due to fear of rejection (10). Studies have shown that Type D personality is associated with psychological suffering in persons with heart illnesses and can predict the occurrence of depression, anxiety, and social phobia in the general population (11,12). Individuals with Type D personality traits display high neuroticism, which coincides with higher NA scores, and high introversion, which coincides with high SI scores (10). The Type D personality is linked to unfavorable health habits such as smoking and insufficient physical activity. Additionally, it is connected with maladaptive coping strategies in response to stress (10,13,14). Research has demonstrated that adolescents exhibiting Type D personality qualities face a considerably elevated likelihood of suffering from insomnia. Furthermore, recent studies have revealed that persons with Type D personality traits experience more severe insomnia symptoms compared to those who do not possess this personality feature (15,16). University students are most prone to insomnia, and smartphone use is high among them. To date, Type D personality traits have been shown to be associated with insomnia. However, the path from Type D personality to insomnia has not been adequately examined. We aimed to examine for the first time the role of SA on the path from Type D personality to insomnia in university students. Our main hypotheses in our study are as follows: Insomnia severity and smartphone use scores are higher in those with Type D personality traits. Smartphone addiction plays a partial mediating role in the path from Type D personality to insomnia.

Materials and Methods

Procudure and Participants: Our cross-sectional study was conducted from November to December 2023 in the lecture theatres of the Ataturk University, Faculty of Medicine. Participants completed an informed consent form, Sociodemographic Data Form, Type D Personality Scale (DS-14), Smartphone Addiction Scale Short Form (SAS-SF), Insomnia Severity Index (ISI), and Subjective Vitality Scale (SVS). All volunteer participants were included in the study. Students who were absent or unwilling to participate were excluded. Sixty-three participants who filled out scales incompletely were excluded from our study. Finally, our study was completed with 375 pre-clinical medical students. The study was approved by the Ataturk University, Faculty of Medicine Clinical Research Ethics Committee (approval date: October 26, 2023, decision number: 14).

Psychometric Tools:

Sociodemographic data form: Our research team prepared a sociodemographic data form to collect information on age, gender, smoking, alcohol use, marital status, sleep quality, and total sleep duration in the last month.

Smartphone addiction scale short form (SAS-SF): The SAS-SF is a 10-item scale used to measure the risk of SA (17). Each item is rated on a six-point Likert scale, with total scores ranging from 10 to 60. Higher scores indicate a higher risk of addiction (17). In our study, we found the Cronbach's alpha value of SAS-SF to be 0.91.

Type D personality scale (DS-14): Type D personality was assessed using the 14-item DS-14 self-measurement tool (18). The scale consists of two subscales, each with seven items. As examples of the items of the two subscales: negative affect (NA) items ("I often feel unhappy," "I am often irritated," "I take a gloomy view of things," "I am often in a bad mood," etc.); social inhibition (SI) items ("I often talk to strangers," "I often feel inhibited in social interactions," "I find it hard to start a conversation," "I am a closed kind of person," etc.). Scores range from 0 to 28 for each subscale, with higher scores indicating more Type D personality traits (18). Participants scoring ten or more on both subscales are classified as having Type D personality traits (18). In our study, we found the Cronbach's alpha value of DS-14 to be 0.78.

Insomnia severity index (ISI): The severity of insomnia symptoms experienced by the respondent in the last two weeks was evaluated using the ISI, which comprises five items (19). The scoring system assigns a value between 0 and 4 to each item, resulting in a total score ranging from 0 to 28. Higher scores indicate more severe insomnia (19). In our study, we found the Cronbach's alpha value of ISI to be 0.85.

Subjective vitality scale (SVS): The Subjective Vitality Scale (SVS) measures individuals' subjective experiences of feeling alive, energetic, and alert (20). It is a 7-point Likert scale with 7 items, where participants rate their agreement with each statement. Total scores on the scale range from 7 to 49, with higher scores indicating higher subjective vitality levels (20). We used the Turkish version of the SVS, which Uysal et al. validated (21). In our study, we found the Cronbach's alpha value of SVS to be 0.88.

Statistical analysis: The analyses were performed utilizing SPSS version 20.0 and Jamovi version 2.3.28. The descriptive statistics presented as the mean, standard deviation, and percentage. The determination of the normal distribution of numerical variables was based on the values of skewness and kurtosis. The participants were categorized into two groups using the DS-14 scale: those with Type D personality and individuals without Type D personality. The scores obtained from the ISI, SAS-SF, and SVS scales were compared between the two groups. A correlation analysis was conducted between the SAS-SF, DS-14, ISS, and SVS. Analyzed was also the mediating role of SA in the association between Type D personality traits and the severity of insomnia. The mediation analysis was performed using the Jamovi 2.3.28 program, with 5000 bootstrap iterations. Pathways were deemed statistically significant if the 95% confidence interval did not include zero. A p-value below 0.05 was deemed to have statistical significance. The indirect effect is the part of X's effect on Y that can be explained, while the direct effect is the residual or unexplained part of the effect. Such analysis aims to explain why variable X (Type D personality) influences variable Y (insomnia severity) by specifying a mechanism: the effect occurs through the third variable M (smartphone addiction).

Results

Sociodemographic and psychometric tools: The mean age of the 375 participants was 22.10 ± 3.95 years, with the youngest participant being 18 years old and the oldest participant being 53 years old. A majority of the participants were female, comprising 243 individuals, or 64.8% of the total sample (n = 243; 64.8%). Most of the participants were unmarried. In the recent month, only 4.8% of the participants indicated a sleep duration of 5 hours or less. According to the DS-14, almost 50% of the participants exhibit Type D personalities. Table 1 displays the comprehensive sociodemographic information of the individuals. The participants' mean scores were 30.87 ± 10.43 for SAS-SF, 24.87 ± 11.45 for DS-14, 8.70 ± 5.05 for ISI, 28.98 ± 8.95 for SVS, 13.33 ± 6.82 for the NA subscale, and 11.54 ± 6.22 for the SI subscale. The distributions were deemed to be normal based on the skewness and kurtosis values of the scales falling within the range of -1.5 to +1.5 (22). Table 2 presents detailed information about the scale results.

Table 1: Sociodemographic and clinic variables of all participants (n = 375)

Age (years) (min-max)	22.10 ± 3.95 (18-53)
Sex (female)	243, % 64.8
Marital Status (unmarried)	363, % 96.8
Smoker (yes)	61, % 16.3
Alcohol use (yes)	35, %9.3
Sleep Quality	
Very good	20, %5.3
Good	186, %49.6
Bad	138, %36.8
Fairly Bad	31, %8.3
Total Sleep Time	
6 hours or more	282, %75.2
5-6 hours	75, %20
5 hours or less	18, %4.8
D type personality	
Yes	185, %49.3
No	190,%50.7

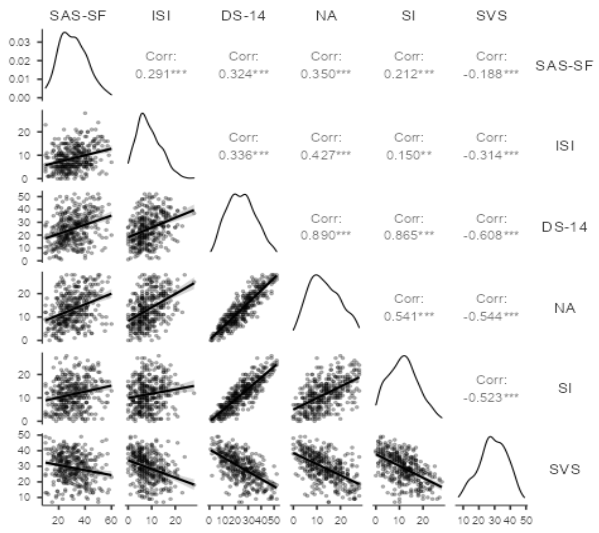

Figure 1: Correlations between the psychometric tools. **SAS-SF:** Smartphone Addiction Scale Short Form, **ISI:** Insomnia Severity Index, **DS-14:** Type D personality scale, **NA:** Negative Affect, **SI:** Social Inhibition, **SVS:** Subjective Vitality Scale.

Comparison of scale scores between type D and non-type D's: Participants were divided into two groups based on DS-14: those with Type D personality and non-Type D's. When comparing

the SAS-SF, ISI, and SVS scales between the two groups, it was found that the group with Type D personality had significantly higher scores on the SAS-SF and ISI scales, while their SVS scores were significantly lower. Table 3 presents information about the comparison of scale scores between both groups.

Correlations between the psychometric tools: We performed a Pearson correlation analysis on the SAS-SF, DS-14, ISI, SVS, NA sub-dimension, and SI sub-dimension. We found significant positive correlations between SA, Type D personality traits, and the severity of insomnia. The correlation coefficients were 0.324 for DS-14 and SAS-SF, 0.336 for DS-14 and ISI, and 0.291 for SAS-SF and ISI. Additionally, we observed a statistically negative correlation between subjective vitality and the other scales. Figure 1 presents details of the correlations between the psychometric tools. Mediation of smartphone addiction on the relationship between Type D

Table 2: Results of scales of all participants

	Mean	Median	SD	Skewness	Kurtosis
SAS-SF	30.87	30.00	10.43	0.324	-0.378
DS-14	24.87	25.00	11.45	0.208	-0.599
ISI	8.70	8.00	5.05	0.591	0.084
SVS	28.98	29.00	8.95	-0.204	-0.515
NA	13.33	13.00	6.82	0.252	-0.761
SI	11.54	11.00	6.22	0.246	-0.531

SAS-SF: Smartphone Addiction Scale Short Form, **DS-14:** Type D personality scale, **ISI:** Insomnia Severity Index, **SVS:** Subjective Vitality Scale. **NA:** Negative Affect, **SI:** Social Inhibition, **SD:** Standart Deviation.

Table 3: Comparison of scale scores between those with and without Type D personality

	SAS-SF	ISI	SVS
D type (Mean ± SD)	33.7 ± 9.82	10.20 ± 5.14	25.0 ±7.72
Non-D type (Mean ± SD)	28.16 ±10.33	7.25 ± 4.53	32.91 ±8.31
p	0.001	0.001	0.001
Cohen's d	0.545	0.607	-0.991

SAS-SF: Smartphone Addiction Scale Short Form, **ISI:** Insomnia Severity Index, **SVS:** Subjective Vitality Scale. **SD:** Standard Deviation

Table 4: Mediation Pathways

				95% Confidence Interval			
		Estimate	SE	Lower	Upper	Z	*p*
DS-14 >> SAS-SF	a	0.295	0.0478	0.2001	0.387	6.17	0 .001
SAS-SF >> ISI	b	0.098	0.0262	0.0453	0.151	3.78	0 .001
DS-14 >> ISI	c	0.119	0.0213	0.0782	0.162	5.57	0.001

SAS-SF: Smartphone Addiction Scale Short Form, **DS-14:** Type D personality scale, **ISI:** Insomnia Severity Index.

Table 5: Mediation analysis

			95% Confidence Interval				
Mediation	Labels	Estimate	Lower	Upper	Z	*p*	% Mediation
Indirect effect	a x b	0.029	0.01	0.04	3.17	0.002	19.7
Direct effect	c	0.119	0.07	0.16	5.57	0.001	80.3
Total effect	c + a x b	0.148	0.10	0.19	7.07	0.001	100

personality and insomnia. The findings of the mediation model showed that the SAS-SF score was associated with both Type D personality traits (path a; $\beta = 0.295$; $p < 0.001$) and ISI scores (path b; $\beta = 0.098$; $p < 0.001$). Type D personality had a significant effect on ISI scores directly (path c; $\beta = 0.119$; $p < 0.001$; 95% CI = 0.07–0.16) and totally (path c + a x b; $\beta = 0.148$; $p < 0.001$; 95% CI = 0.10-0.19) as well. This elicited a partial mediating role of SA on the relationship between Type D personality and insomnia (Tables 4 and 5).

Discussion

In our research, we found that those with Type D personality had higher SA and insomnia severity scores. We found that SA partially mediates the

relationship between Type D personality traits and insomnia severity. The relationship between type D personality traits, SA, and insomnia has been examined for the first time in our study. The most important difference between our study and other studies is that it provides evidence that Type D personality traits can increase the severity of insomnia with a mediation role SA outside their core structure. Insomnia is a common problem in public health and a frequent complaint in medical practice (23). The disorder is defined by the presence of sleep disturbances, including challenges with the quality of sleep and initiating or sustaining sleep, as well as significant distress and impairments in daily functioning. Many studies have confirmed that insomnia is a highly prevalent illness, with symptoms observed in approximately 33–50% of the adult population. The prevalence of this condition varies from 10 to 15% in the general population (24). It is more common among females, divorced or separated individuals, those who have experienced the loss of loved ones, and university students (23). Insomnia reduces academic success among university students and causes many physical and psychological problems (25–27). The most important model explaining the development of insomnia is Spielman's 3P model (28). In this model, personality traits are included in the first P part, which creates a predisposition for insomnia (28). Previous studies have shown that people with Type D personality traits are more likely to develop insomnia (15,16). In addition, maladaptive behaviors about sleep are important for the maintenance of insomnia (29). Unhealthy behaviors such as smoking, alcohol consumption, and lack of exercise are common in individuals with Type D personality traits (14). The possibility that Type D individuals exhibit maladaptive behaviors related to sleep may also cause insomnia to be more severe in these individuals. In parallel with this, in our study, the severity of insomnia was higher in participants with Type D personality. In addition, there was a significant positive correlation between Type D personality and its subdimensions and insomnia severity. Insomnia has daytime effects, such as weakness and fatigue (30). Consistent with this, our study found a significant negative relationship between insomnia severity and subjective vitality. Type D personality have two subdimensions called negative affectivity and social inhibition. These traits are the combination of these two traits (10). Type D personality trait increases, difficulty coping with problems and introversion increases. The smartphone is a tool for individuals to express their emotions. It also allows them to communicate comfortably without feeling social anxiety (9). These possibilities explain the increase in SA scores as Type D personality traits increase. Many studies have found significant positive relationships between neuroticism, introversion, and SA (7,8). However, to date, there is no research examining the relationship between Type D personality and SA. In our research, we found a positive relationship between Type D personality traits and SA. Type D personality is also a combination of neuroticism and introversion (10). Therefore, the result we found is compatible with the literature. What processes may mediate the relationship between Type D personality and insomnia severity has been little investigated to date (10,16). As Type D personality traits increase, the individual's risk of SA increases. It has been found in many studies that SA delays bedtime and increases insomnia severity (5). Therefore, the relationship between Type D personality traits and insomnia severity may be mediated by SA. In our research, we found that 19.7% of SA mediated this relationship and that this mediation was at the partial mediator level.

Study limitations and future directions:

Our research has some limitations:

1. The study population consisted of university students.
2. Most of the participants were female.
3. We did not exclude those with psychiatric disorders from the study. Therefore, these participants may have affected the results.
4. Mediator analysis cannot fully reveal the causality relationship. It is recommended to perform different analyses for causality.

Notwithstanding these limitations, this study is the first to investigate the intermediary function of SA in the relationship between Type D personality traits and the severity of insomnia. Subsequent research should analyze this intermediary function in other populations. Future studies should examine the relationships between Type D personality, insomnia, and smartphone addiction with larger samples and more different populations. Additionally, stricter inclusion and exclusion criteria should be applied.

Conclusion

SA plays a partial mediator role between Type D personality and insomnia. The role of Type D personality traits and SA in the evaluation of insomnia among university students should be examined, and targeted therapies should be developed.

Ethical approval: The study was approved by the Ataturk University, Faculty of Medicine Clinical Research Ethics Committee (approval date: 26.10.2023, decision number: 14).
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