

Association between Smartphone Addiction and the Impact of Headaches Among Medical Students

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Abstract— Smartphone addiction may be considered one of the most prevalent habits in Saudi Arabia, with users ranging between 41 and 44 million. This addiction has an debilitating impact, including increase in headaches. We aim to determine the relationship between smartphone addiction and headaches among medical students at King Abdulaziz University, Jeddah, Saudi Arabia. This cross-sectional study involved 429 medical students of the faculty of Medicine at King Abdulaziz University. Data were collected by an electronic self-reported questionnaire containing demographic questions and scales for smartphone addiction (SAS-SV), headache impact on participants' lives (HIT-6), and headache assessment questions. Data were entered into Microsoft Excel and analyzed using SPSS version 21. Pearson's chi-square was used to determine the significance of the relationships. The results showed that more than half of the participants were addicted to using smartphones. Statistical analysis found no significant relation between smartphone addiction and headache frequency throughout students' lives. However, there is a significant relationship between headache impact and addiction. Furthermore, there is also a significant relationship between avoidance of activities and addiction. Smartphone addiction negatively affects medical students by increasing the impact of headaches on their lives, which is worse than addiction by nature. An alternative for the excessive use of smartphones, should be introduced, or proper counseling for students who overuse smartphones should be considered. These may decrease the impact of the headaches and increase students' productivity.

Keywords: Smartphone addiction, headaches, headache impact, medical students

1. Introduction

In the last ten years, the world has witnessed the evolution of mobile phones, for an easier life. Simple cellular phones have evolved into smartphones armed with computing powers, mobility, and downloadable applications. [1] The applications come in various categories such as utility (e.g., calculators, notepads, and weather apps), gaming (e.g., Angry Birds, Sudoku) and medical (e.g., medical dictionaries, anatomical applications, Medscape) applications. [2]

The International Telecommunication Union (ITU) statistics found that mobile phone subscriptions in Saudi Arabia have reached 47,932,521 in 2016, up from 1,375,881 in 2000. [3] As smartphones have advanced with the development of technology, teaching and studying in the medical field has also advanced. This has made life simpler and more innovative for students, doctors, and patients. Nevertheless, several studies show that smartphone use has advantages and disadvantages. Excessive

smartphone use may harm us through misuse and addiction, causing depression, nervousness, and eye and musculoskeletal problems. [4] In addition, smartphones are not used for educational purposes alone but also for social networking (e.g., WhatsApp, Twitter, and Facebook). Thus, smartphone addiction has significant impacts on academic and social life. [5]

Headache is a common health concern among people around the world. However, some studies suggest that headaches and other health issues can be related to the consistent misuse of technology. [6,7] Studies have found that headaches and stress were the most commonly experienced symptoms in relation to mobile phone use. [8] In 2004, a study from Saudi Arabia involving 437 participants found that health risks include the following: headaches (21.6%), sleep disturbances (4%), tension (3.9%), fatigue (3%), and dizziness (2.4%). [9]

According to our literature review, few studies have been conducted to determine the impacts of addiction on headaches. Additionally, medical students have not been given sufficient attention in these studies despite the stressful lifestyles they lead, owing to their career choice.

Our study aims to unveil the relationship between smartphone addiction and headaches among medical students at King Abdulaziz University (KAU), Jeddah, Saudi Arabia.

2. Methods

This cross-sectional study was conducted in both the male and female sections of the Faculty of Medicine at KAU, Jeddah, Saudi Arabia, from July 2017 to 2018. Ethical approval for this study was obtained from the Institutional Review Board of KAU. Our study included medical students of five academic years starting from the second year. However, it excluded first-year students because they are considered part of the preparatory year, which is not entirely related to the medical field.

The sample was randomly selected from the second to sixth academic years and divided into two subgroups: pre-clinical (including the second and third academic years) and clinical (including the fourth to sixth academic years). There were a total of 429 participants, they were obtained by electronic survey after explaining the study.

A population of 2,100 medical students with a confidence interval of 95% and a margin of error of 5% was calculated using an online sample size calculator. Therefore, the needed sample size was approximately 333 students. However, to avoid recall bias and improve the outcome and results, 429 participants were included in the study.

For data collection, we used a self-administered, anonymized questionnaire consisting of four sections:

- 1) The participant's consent and demographic data (gender, age, nationality, academic year, cumulative GPA, marital status, and monthly family income in Saudi Riyal),
- 2) The average sleeping hours per day and painkiller usage per month,
- 3) Smartphone Addiction Scale–Short Version (SAS-SV)[10] and the Headache Impact Test (HIT-6)[11–14], with additional questions included for headache assessment, particularly about headache attacks during the participant's life (duration, type, side, and severity), and

4)Data on headache frequency per month, duration of headaches when not taking any medications, whether daily activities are affected by the headaches, avoidance of activities due to headaches, and experiencing other symptoms during headache episodes(sensitivity to light and sound, nausea, vomiting, or others).

The SAS-SV is a shortversion of the original 40-item scale established by the Addiction Research Institute, Department of Psychiatry, Seoul St. Mary’s Hospital, The Catholic University of Korea, Seoul, South Korea. [15] Each answer on the scale has a score value (1-strongly disagree, 2-disagree, 3-weakly disagree, 4-weakly agree, 5-agree, 6-strongly agree). After answering the questions, all values are summed up to yield a score that describes the addiction status of the students. [16]The cutoff value for men is 31 and for women is 33. [10]

The Headache Impact Test-6 (HIT-6) is a test that consists of six multiple-choice questions related to how an individual describes their headaches. The response choices are “never (6 points)” “rarely (8 points),” “sometimes (10 points),” “very often (11 points),” and “always (13 points).” The sum of these points indicates how much of an impact the headaches have on the person’s life. If the total score is 60 or above, this indicates a severe impact. A score of 56–59 suggests a considerable impact, a score of 50–55 denotes little impact, and a score of 49 or below indicates no impact on the person’s life. [17]

The data were entered into a Microsoft Excel 2016 workbook, and statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) software package version 21.

3. Results

This study aimed to determine the impacts of addiction on headaches among medical students at the KAU Faculty of Medicine. Our study involved 429 students in two subgroups: the clinical subgroup (213; 49.7%) and pre-clinical subgroup (216; 50.3%). Demographic and academic data (Table 1) showed that more than half of the participants (220; 51.3%) were men. Ages ranged from 19–27 years, with a mean (SD) of 21.76 (1.58) years. A majority of the participants (415; 96.7%) were of Saudi nationality. The largest group of students (187; 43.6%) held a GPA above 4.5. Students with family incomes greater than 20,000 Saudi Riyals represented the bulk of the sample (222; 51.7%).

Table 1. Demographic and academic data and the percentage of addiction

Characteristics	No. (%) N=429	Addicted No. (%)	Non-Addicted No. (%)
Gender			
Male	220 (51.3)	126 (57.3)	94 (42.7)
Female	209 (48.7)	118 (56.5)	91 (43.5)
Age			
Mean (SD)	21.76 (1.58)	21.75 (1.619)	21.76 (1.54)
Mode	21	21	21

Range	8	8	7
Nationality			
Saudis	415 (96.7)	237 (57.1)	178 (42.9)
Non-Saudis	14 (3.3)	7 (50)	7 (50)
Academic subgroup			
Pre-Clinical	216 (50.3)	131 (60.6)	85 (39.4)
Clinical	213 (49.7)	113 (53.1)	100 (46.9)
Cumulative GPA			
4.5-5.0	187 (43.6)	107 (57.2)	80 (42.8)
4.0-4.49	147 (34.3)	74 (50.3)	73 (49.7)
3.5-3.99	71 (16.6)	44 (62.0)	27 (38.0)
3.0-3.49	19 (4.4)	16 (84.2)	3 (15.8)
2.5-2.99	5 (1.2)	3 (60.0)	2 (40.0)
Marital Status			
Single	409 (95.3)	232 (56.7)	177 (43.3)
Married	17 (4.0)	10 (58.8)	7 (41.2)
Divorced	2 (0.5)	1 (50.0)	1 (50.0)
Widow(er)	1 (0.2)	1 (100)	0 (0)
Family Income			
Below 5,000	13 (3.0)	8 (61.5)	5 (38.5)
5,000-10,000	53 (12.4)	21 (39.6)	32 (60.4)
10,000-15,000	62 (14.5)	35 (56.5)	27 (43.5)
15,000-20,000	79 (18.4)	43 (54.4)	36 (45.6)
> 20,000	222 (51.7)	137 (61.7)	85 (38.3)

According to the SAS-SV, students addicted to their smartphones represented over half of our sample (244; 56.9%), of whom nearly half were men (126; 51.64%). Non-addicted students represented the rest of the sample (185; 43.1%) and approximately half of the men (94; 50.8%). The mean (SD) of the SAS-SV scores was 34.18 (10.859). After using chi-square tests and categorizing scores, we found no significant relationship between SAS-SV scores and frequency of headaches in the students' lives ($P = .780573$) or headaches ($P = .240413$). However, there was a significant relationship between the HIT-6 scores and SAS-SV scores ($P = .003$). Thus, the more the students used their mobile phones, the heavier was the impact of the headaches. The smartphone-addicted students (244; 56.9%) who experienced headaches that severely impacted their lives represented the highest percentage (76; 31.1%). In contrast, a majority of the non-addicted students (185; 43.1%) experienced little to no impact (79; 42.7%), as shown in Table 2. The relationship between the scale results and gender was not significant ($P = .864984$). Moreover, there was no significant correlation between family income and scale results ($P = .064659$). However, it is worth mentioning that most of the smartphone-addicted students had a family income greater than 20,000 Saudi Riyals (137; 56.14%).

The students with more than six hours of sleep per day formed two-thirds of the sample size (270; 62.9%), and the remaining reported to have less than six hours of sleep (159; 37.1%). In addition, we found a

significant relationship between hours of sleep and SAS scores ($P = .046443$), indicating that most smartphone-addicted students (113; 46.3%) slept for six to eight hours.

In headache assessment, more than half of the students (229; 53.4%) experienced headaches ten or more times in their lives (136; 31.7%) reported having gone to four headache episodes, and 65 (15.2%) had episodes between four to ten times in their lives. Moreover, when asked how many headache episodes they would describe as a “headache attack,” the majority of the students (247; 57.6%) experienced zero to four episodes throughout their lives, 98 (22.8%) experienced five to nine episodes, and the remainder (84; 19.6%) experienced headache attacks ten times or more.

Of the students, 206 (48%) experienced headaches that lasted a day or more but less than 15 days per month. A minority (27; 6.3%) had a headache for 15 days or more, while 196 (45.7%) experienced them for less than a day per month. We found a significant relationship between gender and days with headaches per month ($P = .032907$). Most men (113 out of 220; 51.4%) reported headaches for less than a day per month, while nearly half of the women (109 out of 209; 52.2%) experienced headaches for a day or more, but less than 15 days per month.

Among the students, 235 (54.8%) stated that their headaches last from 30 minutes to 4 hours if they did not take any medication. A majority (307; 71.6%) also indicated that they did not use any medicines in the past month. Regarding the types of headaches, 218 students (50.8%) described their headaches as a tight or pressing feeling. In addition, a considerable number (177; 41.3%) said they had a pulsating-like feeling, and the remaining (34; 7.9%) mentioned other types or no headaches. Moreover, almost two-thirds of the participants reported having two-sided headaches (270; 62.9%).

When asked about the headache severity, most participants (214; 49.9%) stated they had moderate headaches, most of whom (117 out of 214; 54.7%) tended to avoid activities because of the headaches. We also assessed other experiences the participants had during a headache. More than half (227; 52.9%) said they experience sensitivity to light and sound (238; 55.5%), while others did experience nausea and vomiting (99; 33.1%).

According to the HIT-6 scores, we observed that for a greater percentage of students (143; 33.3%), the headaches had little to no impact, nearly a fourth (101; 23.5%) had some impact, a smaller percentage (68; 15.9%) showed substantial impact, and 117 (27.3%) had a very severe impact score. Comparing HIT-6 scores with the number of days per month for which students have a headache, we found a significant relationship ($P < .05$) where 63% of those who experience headaches on 15 days or more per month had *very severe impact scores*.

4. Discussion

The purpose of this study was to assess relationship between smartphone addiction and headaches among medical students in Saudi Arabia. Use of smartphones has become a way of life for everyone and in this study, we tried emphasize the importance of keeping a check on this usage.

4.1. Smartphone Addiction

We determined the percentage of smartphone addiction, and the results showed that over half of the students are addicted to their smartphones (56.9%). Using a scale other than SAS-SV, a study conducted at King Saud University, Saudi Arabia, showed that 200 students (48%) were addicted to smartphones. [18] Another study among the dental students of Qassim Private College using the SAS-SV found that 136 students (71.9%) were addicted to smartphone usage. [19] In contrast, a study from Switzerland, which also used the SAS-SV, found 257 out of 1,519 participants (16.9%) addicted to smartphones. [20] These findings may be contradictory to each other. However, this relatively significant difference could be due to multiple factors that may affect the time spent using smartphones, such as lifestyle, community activities, and available entertainment facilities.

4.2. Headaches and Smartphone addiction

We found an association between smartphone addiction and headaches. A study supporting this finding stated that those addicted versus not addicted to mobile phones and the Internet had equal chances of developing headaches. [21] We observed that the higher the addiction level, the more significant is the headaches' impact on students' lives. This leads us to infer that smartphones and headaches are related. The increased severity of headaches could be caused by the radiofrequency of the smartphone or due to the amount of strain caused by interactions on social media and texting applications. Whether the students use smartphones primarily for communication or studying purposes, the strain will have a different reason. It is difficult to determine the definite reason behind this relationship, as not many articles discuss this issue. Most studies on the subject discuss smartphone addiction and its health risks in general.

Table 2. Association between smartphone addiction and headaches' impact on participants' lives

SAS type	Addicted No. (%)	Non-Addicted No. (%)	Total No. (%)
HIT type	n=244	n=185	N=429
Little to no impact	64 (26.2)	79 (42.7)	143 (33.33)
Have some impact	60 (24.6)	41 (22.2)	101 (23.5)
Substantial impact	44 (18.0)	24 (13.0)	68 (15.9)
Very severe impact	76 (31.1)	41 (22.2)	117 (27.3)
Total	244 (100.0)	185 (100.0)	429 (100.0)

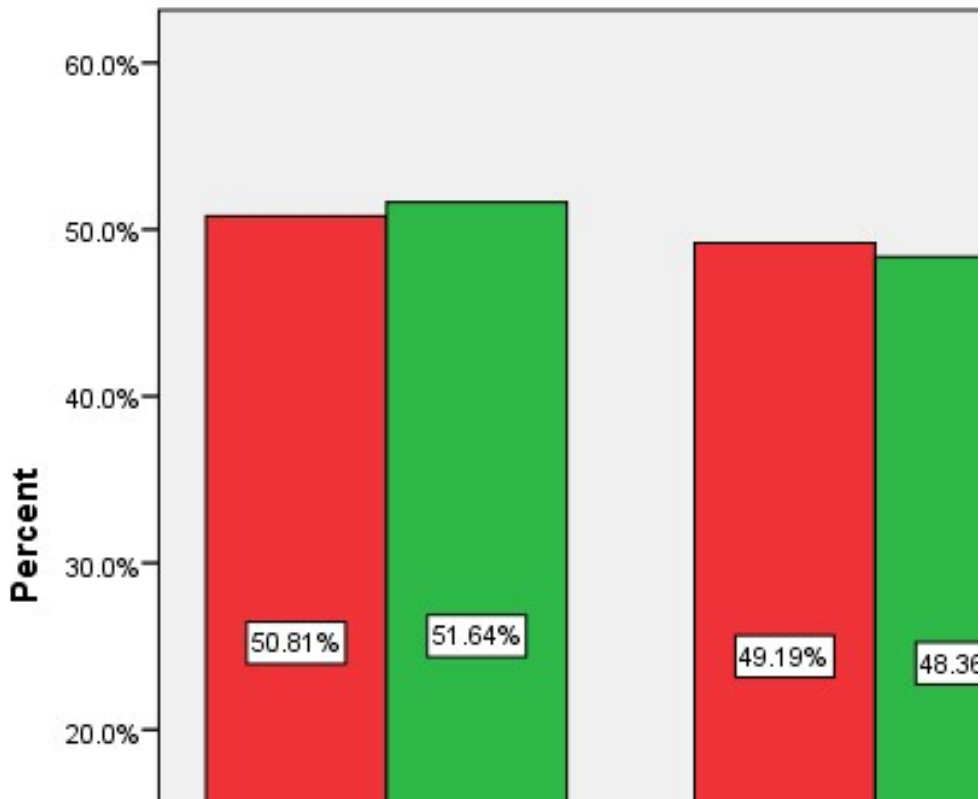
Note. SAS: Smartphone addiction scale; HIT: Headache impact scale

4.3. Gender and smartphone addiction

We found no significant relationship between smartphone addiction and gender ($P = .864984$), but men had a higher percentage of smartphone addiction among participants, as shown in Figure 1 (126; 51.6% men and 118; 48.4% women). This is comparable to results obtained from Wannan Medical College in China (30.3% in men and 29.3% in women, $P > .05$). [22] In contrast, we expected the women's scores to be higher based on the results of a study from Germany that found a significant difference between genders. The women's scores were significantly greater than those of men for smartphone addiction. [17] Similarly, Bianchi et al. found that women are more prone to rely on their phones for socializing and demonstrated

that social networking is a principal use of the devices nowadays. Thus, it was considered that women would score higher percentages in smartphone addiction. [23]

Figure 1. Association between smartphone addiction and gender



4.4. Family Income

Our study showed that 56.14% (137 out of 244) of smartphone-addicted students reported higher family incomes. In contrast, a study conducted in the United States found that most addicted teens are from lower-income families. [24] This contrast could be due to various factors such as having more friends, relationships, socializing, activities or volunteering opportunities, and online shopping that are characteristic of students from higher-income families.

4.5. Sleeping hours and Smartphone addiction

Our study showed a significant relation between sleeping hours and smartphone addiction; 46.3% of the addicted students slept between six to eight hours per day. Though this seems contradictory, these sleeping hours are closer to average. Similar results were found in a study involving 362 adolescents. [25]. Wood et al. found no change in melatonin secretion caused by smartphone usage. [26]

4.6. Smartphone addiction and GPA

While there was no significant correlation between smartphone addiction and GPA ($P = .057959$), a study from Riyadh, Saudi Arabia found a highly statistically significant positive correlation between a harmful lifestyle and poor academic achievement due to the excessive use of smartphones. [27] Samaha et al. found

a negative relationship between SAS-SV results and GPA. [28] We consider that the cause could be mobile phone usage for academic purposes, such as reading textbooks and medical journals or watching educational videos. This may not have been the case in earlier studies due to fewer students using their smartphones for academic purposes.

4.6. Headache intensity and Severity of Headaches

We found a significant relationship ($P < .05$), indicating that the greater the severity of headaches, the higher the score on the scale. Nachit-Ouinekh et al. used the Migraine Severity Scale questionnaire (MIGSEV) to measure the severity of headaches and found that the HIT-6 score was well correlated with headache severity. Not surprisingly, a “very severe” headache impact was associated with significant headache severity. [29] We believe that the pain the students experience prevents them from accurately performing their tasks. This could be due to the distraction caused by pain, which increases with the severity of their headaches.

4.7. Limitations

This study used self-report as the data collection method. Hence, the results may not represent the entire college community. Difficulty in recalling headache frequency may have introduced recall bias. Moreover, the male to female ratio was not equal, and the age range was limited. The cross-sectional study design cannot determine causality. The study was carried out in July (during summer vacation), which affects the sleeping hours of the students when they tend to sleep longer. It is important to highlight that the study focused on the subjective reporting of symptoms and not the actual disorders or diagnoses. Thus, we could not find a relationship between age and smartphone addiction or headaches.

4.8. Recommendations

We recommend that similar studies be conducted on medical students during the school semesters rather than during summer vacation. Moreover, increasing the population size by involving other colleges may improve the generalization of the results. Finally, other study designs (e.g., case-control or prospective cohort) would be beneficial.

5. Conclusion

In conclusion, smartphone addiction negatively affects medical students by increasing the impact of headaches on their lives, which worsens with the addiction. An alternative for the excessive use of smartphones should be introduced; proper counseling for students who overuse smartphones should be considered. This may decrease the impact of the headaches and increase students' productivity.

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7. Acknowledgments

The authors express their gratitude to all participants who took part in this work.

8. Abbreviations

International Telecommunication Union (ITU)

King Abdulaziz University (KAU)

Smartphone Addiction Scale–Short Version (SAS-SV)

Headache Impact Test (HIT-6)

Migraine Severity Scale questionnaire (MIGSEV)

Statistical Package for the Social Sciences (SPSS)



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