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Association between Digital Screen Time and Migraine Incidence in KAU Medical Students

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Abstract

Migraine is one of the most common neurological disorders, affecting nearly everyone at least once in their lifetime. Globally, medical students experience a high prevalence of migraines. This study aimed to investigate the relationship between the use of digital learning devices and migraine occurrence among medical students at King Abdulaziz University (KAU) in Jeddah, Saudi Arabia. A cross-sectional study was conducted with 398 male and female students in different academic years at the Faculty of Medicine of KAU. Data were collected through a structured and closed-ended questionnaire. Findings showed that more than half of the participants (52.5%) had experienced migraines at some point in their lives. Key migraine-associated factors included female gender (60.8%), school days (90.9%), a positive family history (76.6%), adolescence (54.1%), studying through electronic sources (52.2%), and screen exposure exceeding four hours per day (61.3%). A significant correlation was observed between the incidence of migraine and factors such as family history, gender, electronic study sources, duration of screen exposure, and adolescence. The study concluded that migraines among medical students could be related to prolonged use of digital study tools, such as laptops, computers, and tablets, which leads to extended screen exposure.

Keywords: Digital Learning, Migraine, Medical Students, Screen Exposure, Family History, Gender

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Introduction

Migraine is a widespread neurological disorder that affects a significant portion of the population at least once in their lifetime [1-3]. It is a complex condition influenced by multiple factors and can become chronic or worsen over time. The disorder is common among adults, with a higher prevalence in females due to hormonal fluctuations after puberty. Additionally, migraines are more frequently observed in individuals pursuing higher education [4, 5]. The peak of migraines is at the age of 25 to 55 years, coinciding with a person's most active years [6].

The impact of migraines extends beyond physical discomfort, often interfering with daily routines, reducing productivity, and lowering life quality [7, 8]. Typically, migraine episodes present as severe, throbbing headaches that affect one side of the head and can last anywhere from 4 to 72 hours [9, 10]. Other common symptoms include nausea, vomiting, sensitivity to light, and a significant decline in cognitive performance [8, 11-13]. Numerous factors can act as migraine triggers, including stress, insufficient sleep, infections, anxiety, weather fluctuations, unhealthy diets, specific foods, inactivity, hormonal shifts, and certain medications such as oral contraceptives [14-16].

With modern technological advancements, electronic devices like smartphones, laptops, and tablets have become integral to academic life. University students, particularly those in rigorous fields like medicine, often spend long hours using digital screens for study and research purposes [17]. Research suggests that prolonged screen exposure is linked to a greater risk of migraines [18, 19], with some studies directly associating frequent electronic device use with an increased likelihood of migraine episodes [20].

Furthermore, high academic pressure has been identified as a contributing factor to migraine occurrence and severity among students [21, 22]. A study conducted by Al-Hashel *et al.* [23] at Kuwait University found that medical students were more susceptible to migraines compared to their peers in other disciplines. It also revealed that the frequency and severity of migraines intensified during the final years of medical education. The study highlighted common migraine triggers, including academic stress, extended study sessions—especially involving digital screens—and irregular sleep schedules.

Across the globe, the prevalence of migraines among medical students has been reported to range from 11% to 40% [24, 25]. This condition can severely impact academic success by reducing focus, limiting daily activities, and hindering overall performance, which may also have long-term effects on professional careers [5, 19, 26].

Despite the increasing recognition of migraines as a significant issue among medical students, limited research has been conducted in Saudi Arabia. Medical students face intense academic workloads and are required to use electronic screens both during lectures and for independent study. Given these factors, this study wants to examine whether there is a connection between digital learning tools and migraine prevalence among medical students at King Abdulaziz University (KAU) in Jeddah, Saudi Arabia.

Methods

Study Design

A cross-sectional study was conducted at the Faculty of Medicine, King Abdulaziz University (KAU) Hospital, located in Jeddah, Saudi Arabia. The research took place over six months during the 2018–2019 academic year. Participants were chosen based on predefined eligibility criteria. Ethical approval for this study was obtained from the Unit of Biomedical Ethics, Research Ethics Committee at the Faculty of Medicine, KAU.

Sample Size Determination

The estimated population of medical students at KAU during the 2018–2019 academic year was approximately 2,500. Based on this population size, a confidence level (z) of 1.96, a margin of error (e) of 5%, and an assumed sample proportion of 5%, the required sample size was determined to be at least 343 students.

Eligibility Criteria

Inclusion Criteria

Medical students from various academic years and disciplines at KAU.

Exclusion Criteria

Students enrolled in non-medical programs at KAU.

Sampling and Recruitment

A total of 398 students from different academic levels participated in this study. The selection process included both male and female students. Before participation, each individual provided informed written consent.

Data Collection

Information was gathered through a structured, closed-ended questionnaire. The collected data included details such as gender, academic year, migraine history, family history of migraines, onset of headache symptoms, daily duration of screen exposure (tablets/computers), study materials used, headache frequency, associated symptoms, and potential migraine triggers. To ensure the questionnaire's validity, it was initially translated into Arabic and subsequently refined based on a pre-test for clarity and accuracy before being translated back into English. Participant confidentiality was strictly maintained, with no identifying personal details recorded. Participation was voluntary and anonymous.

Statistical Analysis

Data analysis was performed using GraphPad Prism (version 5). The results were expressed as frequencies and percentages for quantitative variables. The Chi-Square test was used to examine associations, with statistical significance set at $P < 0.05$.

Results

A total of 398 students participated in this study, comprising 188 males (47.2%) and 210 females (52.8%). The distribution of students across various academic levels was as follows: 84 students (21.1%) were in their second year, 67 students (16.8%) were resident doctors, 65 students (16.3%) were in their sixth year, 48 students (12.1%) were in their fifth year, 47 students (11.8%) were in their third year, 44 students (11.1%) were interns, and 43 students (10.8%) were in their fourth year.
Regarding migraine history, 209 students (52.5%) reported experiencing migraines at some point in their lives, while 189 students (47.5%) indicated they had never been diagnosed with migraines (**Table 1**).

Table 1. Characteristics of the participants according to gender, academic year, and history of migraine attacks

	Frequency (n)	Percent of total (%)
Gender		
Male	188	47.2
Female	210	52.8
Academic year		
2ND	84	21.1
3RD	47	11.8
4TH	43	10.8
5TH	48	12.1
6TH	65	16.3
Intern doctor	44	11.1
Resident doctor	67	16.8
Have you had a migraine beforehand?		
Yes	209	52.5
No	189	47.5

Total n = 398 students; data presented as number (n) and percent of total (%).

Among the 209 participants diagnosed with migraines, 82 (39.2%) participants were male, while 127 (60.8%) participants were female, indicating a higher prevalence of migraines among females.
Regarding the onset of headaches, the largest group (88 participants; 42.1%) reported experiencing migraines for over five years. Another 64 students (30.6%) had been dealing with migraines for 2 to 5 years, while 34 participants (16.3%) reported onset within 1 to 2 years. A smaller group of 23 students had migraines beginning within the past 6 to 12 months.
When examining headache frequency concerning academic schedules, 190 participants (90.9%) noted that their migraines worsened on school days, whereas only 19 students (9.1%) reported increased headaches during weekends.
A family history of migraines was prevalent among the majority, with 160 students (76.6%) reporting a family member with migraines, while 49 participants (23.4%) had no such history.
In terms of the age of migraine onset, over half (113 students; 54.1%) began experiencing headaches during adolescence, while 82 participants (39.2%) reported onset between 20 and 25 years of age. Only 14 individuals (6.7%) had migraines that started during childhood (**Table 2**).

Screen Exposure and Study Sources

When considering study materials, most participants relied on digital resources, with 109 students (52.2%) using electronic sources exclusively. Another 86 participants (41.1%) combined both electronic and print materials, while only 14 students (6.7%) used printed books alone.
Regarding screen exposure duration, a significant portion (128 students; 61.3%) used electronic devices for more than four hours daily. Others reported usage as follows: 41 students (19.6%) for 3-4 hours, 22 participants (10.5%) for 2-3 hours, and 18 students (8.6%) for 1-2 hours (**Table 2**).

Table 2. Migraine prevalence based on gender, headache onset, duration, family history, daily study habits, frequency of headaches, associated symptoms, and risk factors

Category	Frequency (n)	Percentage of total migraine cases (%)
Gender		
Male	82	39.2
Female	127	60.8
Headache onset		
6-12 months ago	23	11
1-2 years ago	34	16.3
2-5 years ago	64	30.6

Over 5 years ago	88	42.1
Headache frequency concerning days		
Increases during school days	190	90.9
Increases during weekends	19	9.1
Family history of migraines		
Yes	160	76.6
No	49	23.4
Daily study duration (using tablets/computers)		
1-2 hours	18	8.6
2-3 hours	22	10.5
3-4 hours	41	19.6
Over 4 hours	128	61.3
Study materials used		
Books only	14	6.7
Electronic sources only	109	52.2
Both books and electronics	86	41.1
Age at headache onset		
Childhood	14	6.7
Adolescence	113	54.1
20-25 years	82	39.2
Frequency of headaches		
Daily	11	5.3
Less than 3 times a week	64	30.6
More than 3 times a week	64	30.6
Less than 10 times a month	70	33.5
Headache associated symptoms		
Nausea	176	84.2
No nausea	33	15.8
Severe headache with sensitivity to light/sound	198	94.7
No sensitivity	11	5.3
Visual disturbances followed by severe headache	166	79.4
No visual disturbances	43	20.6
Headache triggers		
Lack of sleep	109	52.2
Excessive caffeine	17	8.1
Stress or exam-related stress	83	39.7

The total number of participants was n = 398. Data are expressed as frequency (n) and percentage of total cases (%).

Regarding the frequency of migraines, 70 participants (33.5%) experienced migraines less than 10 times per month, while 64 participants (30.6%) had migraines more than 3 times per week. Another 64 students (30.6%) had migraines less than 3 times per week, and 11 participants (5.3%) suffered from daily migraine attacks.

In terms of associated symptoms, 176 participants (84.2%) reported experiencing migraines accompanied by nausea, 198 participants (94.7%) experienced sensitivity to light or sound, and 166 participants (79.4%) experienced vision disturbances lasting 5 to 60 minutes before the migraine occurred.

As for the factors triggering migraines, over half of the participants (109 students; 52.2%) attributed their headaches to lack of sleep, while 83 students (39.7%) linked their migraines to stress or exam periods. Only 17 participants (8.1%) identified excessive caffeine consumption as a cause of their migraines (**Table 2**).

Association Between Gender and Migraine

The analysis of the relationship between gender and migraine revealed a statistically significant association (P = 0.0008). Migraines were notably more common in females than in males. Among the males, 82 had migraines and 106 did not, while 127 females experienced migraines and 83 females did not (**Figure 1**).

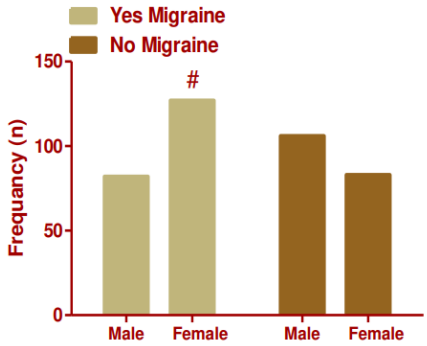

Table Analyzed	Data 3		
Chi-square			
Chi-square, df	11.31, 1		
P value	0.0008		
P value summary	***		
One- or two-sided	Two-sided		
Statistically significant? (alpha<0.05)	Yes		
Data analyzed	Yes Migraine	No Migraine	Total
Male	82	106	188
Female	127	83	210
Total	209	189	398

Figure 1. The relationship between gender and migraine occurrence; total participants = 398 students; # there is a significant correlation between migraine prevalence and gender.

Regarding the link between migraine occurrence and a family history of migraines, the analysis revealed an association ($P < 0.0001$). Migraines were more common in patients with a positive family history of migraines compared to those without such a history. Among the 160 participants who experienced migraines, it was also found that their family members had a history of migraines. In contrast, 125 patients who did not have migraines reported that their family members also did not have migraines, suggesting that heredity may play a role in the prevalence of migraines (**Figure 2**).

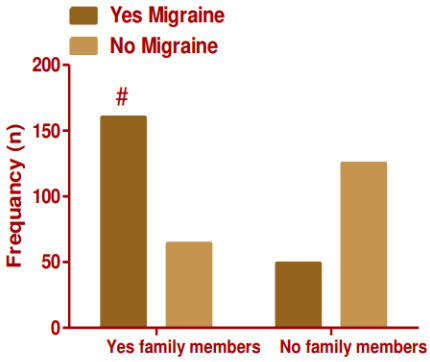

Table Analyzed	Data 8		
Chi-square			
Chi-square, df	73.52, 1		
P value	< 0.0001		
P value summary	***		
One- or two-sided	Two-sided		
Statistically significant? (alpha<0.05)	Yes		
Data analyzed	Yes Migraine	No Migraine	Total
Yes family members	160	64	224
No family members	49	125	174
Total	209	189	398

Figure 2. The relationship between a positive family history of migraines and migraine prevalence; total participants = 398 students; # a significant correlation exists between migraine occurrence and a family history of migraines.

Regarding the relationship between the study materials used and migraine occurrence, the results showed a significant association ($P < 0.0001$). Migraines were more common among participants who relied on electronic devices for their daily studies, followed by those who used both electronic devices and books, and least prevalent among participants who used only books. This suggests that frequent use of electronic devices may contribute to a higher incidence of migraines (**Figure 3**).

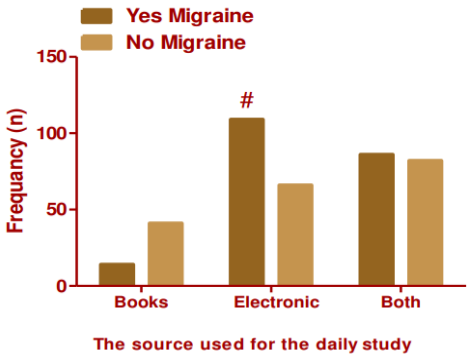

Table Analyzed	Data 10
Chi-square	
Chi-square, df	22.97, 2
P value	< 0.0001
P value summary	***
One- or two-sided	NA
Statistically significant? (alpha<0.05)	Yes
Data analyzed	
Number of rows	3
Number of columns	2

Figure 3. The relationship between study materials used and migraine occurrence; total participants = 398 students; # a significant correlation was found between migraine prevalence and the source used for daily studying.

Association Between Duration of Electronic Device Use for Study and Migraine

The analysis of the relationship between the duration of electronic device use for daily studying and migraine showed a huge association ($P < 0.0186$). Students who used devices for more than four hours daily had a higher incidence of migraines compared to those who used them for 1-2 hours daily. This indicates that longer exposure to electronic devices may contribute to an increased occurrence of migraines (**Figure 4**).

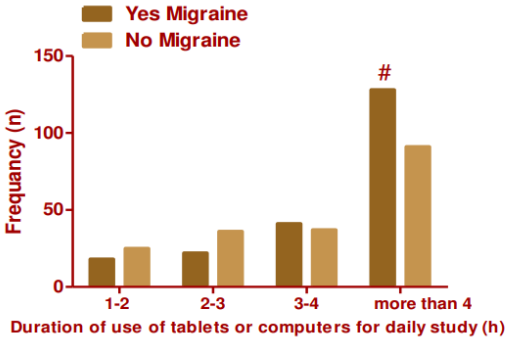

Table Analyzed	Data 9
Chi-square	
Chi-square, df	9.995, 3
P value	0.0186
P value summary	*
One- or two-sided	NA
Statistically significant? (alpha<0.05)	Yes
Data analyzed	
Number of rows	4
Number of columns	2

Figure 4. The connection between the duration of electronic device use for daily study and migraine prevalence; total participants = 398 students; # a significant correlation was observed between migraine occurrence and the duration of daily electronic device use.

Association Between Headache History and Migraine Development

The findings also revealed a significant association ($P = 0.0006$) between having a previous history of headaches and the development of migraines. Migraines were more common among participants with a history of headaches during adolescence, followed by those who had headaches between the ages of 20-25 years. These findings suggest that a prior history of headaches increases the likelihood of experiencing migraines (**Figure 5**).

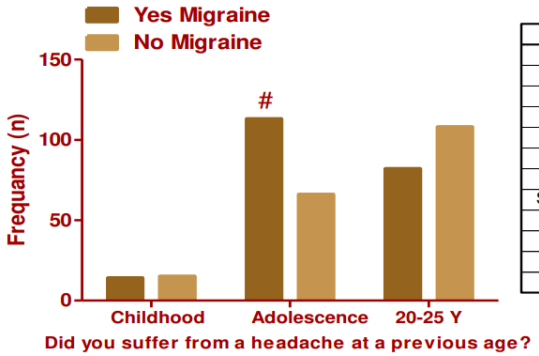

Table Analyzed	Data 11
Chi-square	
Chi-square, df	14.97, 2
P value	0.0006
P value summary	***
One- or two-sided	NA
Statistically significant? (alpha<0.05)	Yes
Data analyzed	
Number of rows	3
Number of columns	2

Figure 5. The relationship between a history of headaches and migraine occurrence; total participants = 398 students; # a significant association was found between migraine prevalence and the history of headaches.

Discussion

This study found that over half of the participants (52.5%) experienced migraines in the past. Additionally, 79.4% of those with migraines reported having vision disturbances lasting between 5 and 60 minutes before the onset of severe headaches (migraine with aura). A significant portion of the participants (54.1%) reported the onset of migraines during adolescence, a significant difference when compared to those without migraines. It was observed that migraine attacks in students occurred less than 10 times per month. Furthermore, the study revealed a significant association between migraine and gender, with a higher prevalence of migraines in females (62.8%) compared to males (39.2%) ($P < 0.001$).

Previous studies have also reported a notable gender difference in migraine prevalence, particularly in females [27-29]. Several theories attempt to explain these gender differences, including hormonal influences, receptor binding, genetic factors, sensitivity to environmental triggers, and varying responses to stress [30-34]. A key explanation for these differences could be the influence of estrogen, which contributes to menstrual migraines that occur without aura and tend to last longer, with reduced response to treatment [35].

The study also found a significant association between migraine occurrence and a family history of migraines, with a substantial number of migraine sufferers (76.6%) reporting a family history of the condition. This supports the idea that family history plays a significant role in migraine development ($P < 0.0001$). Genetic studies have long shown a hereditary aspect of

migraine, with an average familial prevalence of 30-60% [36-39]. The genetic basis of migraine has been demonstrated by specific conditions triggered by single gene mutations (monogenic), as well as by polymorphisms in multiple genes (polygenic) [40].

Additionally, the study highlighted that migraines were more common during school days, with 90.9% of participants reporting increased headaches during this time. In contrast, only 9.1% experienced migraines on weekends. The most prominent trigger of migraine, identified by 52.2% of participants, was lack of sleep, followed by stress during exams (39.7%). Interestingly, caffeine consumption was less commonly reported as a trigger (8.1%). Other studies have similarly pointed to stress at work or school (91.25%) and poor sleep (90%) as significant migraine triggers [41]. Stress and sleep disturbances have consistently been reported as key factors in triggering migraines, especially among medical students [23, 42-44]. As such, incorporating stress reduction strategies for students could help alleviate migraine triggers.

The primary objective of the study was to explore the relationship between the use of electronic study resources (such as laptops, tablets, and desktop computers) and the frequency of migraine attacks among medical students. The results revealed a strong association between the use of electronic devices for studying and an increase in migraine occurrences. Specifically, 52.2% of migraine sufferers relied solely on electronic study resources, while 41.1% used a combination of electronic devices and books, and only 6.7% relied exclusively on books for their studies. Previous research has suggested that patients with migraines are particularly sensitive to visual stimuli, which can trigger new episodes [45]. During migraine episodes, individuals are more likely to experience discomfort from visual stimuli, which can aggravate the headache [46]. As visual triggers play a significant role in migraines, healthcare providers are encouraged to consider potential visual stressors when evaluating migraine patients [47].

The findings of this study also indicated that using computers and tablets for more than four hours a day was associated with a higher incidence of migraines, with 61.3% of those participants reporting migraine attacks. This result displayed a significant difference compared to those without migraines. This observation aligns with previous research conducted on health students who study primarily using the Internet, which found a direct link between prolonged screen exposure and migraine occurrence [48]. Our findings are consistent with earlier studies involving children and adolescents, which identified a correlation between increased screen time and migraines in those who frequently use electronic devices [49-51]. Several studies have also explored the incidence of migraines in university and medical students relative to their computer usage time [19, 52, 53]. One theory to explain the potential link between screen time and migraines suggests that the brightness or radiance from the screen light could act as a trigger for migraines [48, 52].

Conclusion

This study concluded that the use of electronic devices, including desktop computers, laptops, and tablets, in medical students' daily studies and prolonged exposure to screen time are likely contributing factors to the prevalence of migraines among these students.

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Ethics statement: None

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