

# The association between smartphone addiction and thumb/wrist pain among medical students of Jazan University, Saudi Arabia, A cross-sectional study

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## ABSTRACT

**Background:** The past decade has witnessed a revolution in smartphones owing to their growing importance and various applications. However, excessive usage can lead to addiction and joint pain in the wrist/thumb area. Despite these negative effects, smartphones offer medical students access to the resources they need. **Objective:** To determine the association between smartphone addiction and thumb/wrist pain among undergraduate students of Jazan University. **Methods:** A cross-sectional self-administrated, online survey and online convenience sample technique was used. The collected data were analyzed using SPSS Software. **Results:** This survey included 337 participants, of which two-thirds were female (66.8%) and the rest male (33.2%); 32.6% of the respondents were studying in the College of Medicine. Of the 337 participants, 32% reported experiencing pain in their wrists or at the back of their neck while using a smartphone. The study found an average Smartphone Addition Scale-Short Version (SAS-SV) score of  $32.5 \pm 8.0$  out of 50 and a total Patient-Rated Wrist Evaluation score of  $48.8 \pm 14.7$ , with a pain score of  $13.3 \pm 11.0$  and a function score of  $35.5 \pm 11.7$ . The study also revealed a significant association between smartphone addiction and thumb/wrist pain ( $P$  value = 0.029), with females and students of the College of Applied Medical Science associated with higher SAS-SV scores, thereby indicating higher smartphone addiction. **Conclusion:** Significant correlation exists between smartphone addiction and thumb/wrist pain among medical students of Jazan University.

**Keywords:** Addiction, medical student, Saudi Arabia, smartphone, thumb/wrist pain

## Introduction

Smartphones are mobile phones that can connect to the Internet and function like a computer.<sup>[1]</sup> Furthermore, smartphones have undergone a huge revolution in the past decade in function and

propagation<sup>[2]</sup>; they are no longer limited to simple tasks and entertainment purposes. They become integral to daily living to meet basic and more sophisticated needs. They facilitate communication through email access and social media, mobility through Global Positioning System (GPS) navigation, and applications designed to improve the quality of lifestyle, such as mobile health technologies.<sup>[3,4]</sup>

As a result of its growing importance and various applications, the excessive use of smartphones has become like an addiction,

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which can be categorized as a type of behavioral addiction. Behavioral addiction describes how being constantly involved in certain activities leads to significant distress and harm; other examples of behavioral addiction that have recently become common include internet addiction, eating disorders, compulsive buying, and gambling.<sup>[5-7]</sup> As our hands are the primary body part that is involved in controlling these devices, many smartphone addicts experience joint pain involving mostly their wrist/thumb area.<sup>[8,9]</sup>

In addition, the prevalence of musculoskeletal disorders is higher in individuals involved in activities that increase the load on the thumb, for example, frequently moving the thumb while writing text messages.<sup>[10,11]</sup> Furthermore, joint inflammation has also been linked to prolonged use of smartphones.<sup>[12]</sup> In Turkey, a study was conducted in 2021 among university students. It showed that using smartphones for over 6 hours was positively related to wrist and hand pain.<sup>[13]</sup> Moreover, recent studies in Saudi Arabia among university students show a significant correlation between smartphone addiction and thumb/wrist pain and that repetitive use of smartphones might produce chronic wrist and finger pain and negatively impact daily activities.<sup>[8,14,15]</sup>

Besides, smartphones and tablets provide doctors with easy and efficient access to resources, including drug information and Electronic Books (eBooks) on anatomy.<sup>[16-18]</sup> The ownership of smartphones or tablets is almost universal, as some reports suggest, along with its positive impact on learning, according to reports on students.<sup>[19-21]</sup> A cross-sectional study was conducted in 2020 in Jeddah, Saudi Arabia, to evaluate the association between smartphone addiction and wrist/thumb pain. This study aimed to determine the severity of this pain and calculate the prevalence of De Quervain tenosynovitis among medical students. This study's total number of participants was 387, with a response rate of 84%, including 204 (52.3%) men and 183 (47.7%) women. Most of the participants were right-handed (92%). A total of 257 (66.4%) participants were considered to be smartphone addicts, while 130 (33.6%) were deemed to be non-addicts. In total, 20.4% of participants reported pain in the thumb/wrist; however, only 74 (19.1%) participants had a positive Finkelstein test, including 22 (10.8%) men and 52 (28.4%) women.

Nevertheless, the study found that students who are heavy users of smartphones have mild pain and stiffness in their thumb/wrist. Although the positive Finkelstein test was not associated with smartphone addiction, other clinical and sub-clinical changes in thumb/wrist soft tissues could cause pain.<sup>[8]</sup>

Similarly, another study was conducted in Makkah, Saudi Arabia, among students of Umm Al-Qura University. A total of 349 students completed the survey. Most of the participants were males, and most of them were in their third year of study. Most participants strongly agreed they could not tolerate not having their phones (33.2%) and used mobile phones more than expected daily (28.1%). The study found that prolonged use of smartphones resulted in the emerging smartphone-addiction

phenomena that have caused musculoskeletal discomfort in the hand, wrist, and thumb, a common risk factor of the repetitive use of smartphones. Repetitive use of smartphones negatively impacts dominant hand activities and daily duties. A significant association was recorded between the pain/difficulties while using hand and age, gender, and year of study.<sup>[14]</sup> Students who were addicted to their smartphones were experiencing hand problems. About 40% of the high-risk group reported having hand or wrist symptoms, according to a study conducted in Saudi Arabia in 2020.<sup>[22]</sup>

Therefore, the present study aims to assess and evaluate the association between smartphone addiction and thumb/wrist pain among patients in primary healthcare clinics. Additionally, the study seeks to determine the severity of the pain among medical students at Jazan University, Saudi Arabia.

## Methodology

### Type of the study

This was a cross-sectional, online survey study conducted among undergraduate students at Jazan University in Saudi Arabia.

### Study population

The study population comprised male and female medical students aged 18–30 years enrolled in various health science colleges at Jazan University. These included the colleges of Medicine, Nursing, Dental, Public Health and Tropical Medicine, Applied Medical Sciences, and Pharmacy.

### Sample size and sampling technique

A proposed sample size of 330 participants was determined for conducting this survey. The sample size estimation was based on the statistical equation of cross-sectional surveys: initial sample size =  $[(z^2 * p * q)] / d^2$ , where P represents the prevalence of the studied phenomenon (set of 50% due to the absence of related indicator information for sample size calculation), Z corresponds to a 95% confidence interval, d signifies an allowable error margin of no more than 5%, and accounting for a 10% non-response rate.

### Inclusion and exclusion criteria

Inclusion criteria were undergraduate students aged 18–30 years who regularly used smartphones, iPads, or iPods. Exclusion criteria were students with neuromuscular disorders, history of hand/wrist trauma or fracture in the past year, and those with neck pain and radiculopathy.

### Data collection method

Data were collected via an online self-administered structured questionnaire prepared in Arabic. The questionnaire was distributed through social media platforms. It employed several methodological tools and instruments to ensure the rigor and reliability of our findings. The primary instrument was a

self-administered, structured questionnaire designed to assess smartphone addiction levels and the prevalence of thumb/wrist pain among the participants. This questionnaire incorporated the Smartphone Addiction Scale-Short Version (SAS-SV) to quantitatively measure smartphone addiction and the Patient-Rated Wrist Evaluation (PRWHE) questionnaire to evaluate wrist/hand pain and functionality. These tools were chosen for their validated psychometric properties and their widespread use in similar research contexts. SAS-SV is a concise tool designed to measure levels of smartphone addiction. It includes questions that assess the degree of smartphone use in daily life, highlighting potential behavioral and psychological symptoms of addiction.

On the other hand, the PRWHE questionnaire is a self-administered survey that assesses pain levels and functionality in the wrist and hand. It is widely used to evaluate outcomes in patients with wrist conditions or injuries, providing valuable insights into how such conditions affect an individual’s daily activities and overall quality of life. The survey was distributed through an online platform to facilitate ease of access and participation, aiming to reach a broad cross-section of the student body at Jazan University.

**Data management**

Completed questionnaires were collected by designated data collectors and entered into the Statistical Package for Social Sciences (SPSS) software for analysis.

**Data analysis strategies**

Data analysis involved descriptive statistics (frequencies, percentages) and analytical statistics. Independent sample t-tests and one-way ANOVA were used to compare groups. Pearson’s correlation assessed relationships between quantitative variables. Statistical significance was set at  $P < 0.05$ .

**Ethical considerations**

The study adhered to the ethical standards and guidelines prevalent in Saudi Arabia, with approval from the Research Ethics Committee (REC) at Jazan University (HAPO-10-Z-001), REC-44/07/549. Informed consent was obtained from all participants prior to survey administration. The consent process highlighted the voluntary nature of participation, ensuring participants understood their right to withdraw at any stage without detriment. Additionally, measures were in place to safeguard participant confidentiality and ensure the secure handling of personal information.

**Results**

**Characteristics of the study participants**

A total of 337 participants were involved in this study. Nearly two-thirds of them (225, 66.8%) were female respondents, while 112 (33.2%) were males. Almost one-third (110, 32.6%) of the study population were studying in the College of Medicine,

followed by 71 (21.1%) in the faculty of Applied Medical Science, 67 (19.9%) in the College of Nursing, 31 (9.2%) in Pharmacy, 30 (8.9%) in Public health & Tropical medicine, and 28 (8.3%) in Dentistry. Regarding the academic year level of participants, we noted that most of them were in their fourth year (91, 27%), 74 (22%) were in their fifth year, and almost one-fifth of them were in their sixth year (69, 20.5%). Moreover, our results revealed that most of students were right handed 308 (91.4%) and only 29 (8.6%) were left handed [Table 1].

**Smartphone Addiction Scale- Short Version**

Our findings showed that the average SAS-SV score was  $32.5 \pm 8.0$  (Range 10 – 50) out of 50. The SAS-SV is a 10-item scale that assesses smartphone addiction behaviors and symptoms. Each item is scored on a 5-point Likert scale from 1 (strongly disagree) to 5 (strongly agree), with total scores ranging from 10 to 50. the SAS-SV to assess smartphone addiction was selected because it is a widely used and validated scale that comprehensively measures multiple dimensions of smartphone addiction with only 10 items.

A total of 135 (40.1%) of respondents agreed that they were missing planned work owing to smartphone use. In addition, more than one-third of students (116, 34.4%) reported having a hard time concentrating in class, while doing assignments, or while working owing to smartphone use. A total of 108 (32%) of respondents admitted that they had felt pain in their wrists or at their back of the neck while using a smartphone. Moreover, more than one-third of the participants (119, 35.3%) strongly agreed that they will be unable to bear not having a smartphone and 105 (31.2%) of students agreed that they felt impatient and fretful when they were not holding their smartphone. Our results found that almost half of the participants (170,50.4%) reported keeping their smartphone in their mind even when they were not using it. Only 43 (12.8%) strongly agreed that they will never give up using their smartphone even though their daily life was already getting greatly affected by it [Table 2].

**Table 1: Characteristics of the study participants (n=337)**

Variable	Categories	Frequency	Percentage
Gender	Male	112	33.2
	Female	225	66.8
College	Applied medical science	71	21.1
	Dentistry	28	8.3
	Medicine	110	32.6
	Nursing	67	19.9
	Pharmacy	31	9.2
	Public health and tropical medicine	30	8.9
Academic year level	2 <sup>nd</sup> year	45	13.4
	3 <sup>rd</sup> year	58	17.2
	4 <sup>th</sup> year	91	27
	5 <sup>th</sup> year	74	22
	6 <sup>th</sup> year	69	20.5
The hand used to write	Right hand	308	91.4
	Left hand	29	8.6

**Table 2: Smartphone Addiction Scale-Short Version (SAS-SV)**

Statement	n (%)				
	SA	A	N	D	SD
Missing planned work due to smartphone use	43 (12.8)	135 (40.1)	86 (25.5)	49 (14.5)	24 (7.1)
Having a hard time concentrating in class, while doing assignments, or while working due to smartphone use	48 (14.2)	116 (34.4)	70 (20.8)	72 (21.4)	31 (9.2)
Feeling pain in the wrists or at the back of the neck while using a smartphone	29 (8.6)	79 (23.4)	80 (23.7)	88 (26.1)	61 (18.1)
Will not be able to stand not having a smartphone	119 (35.3)	98 (29.1)	57 (16.9)	32 (9.5)	31 (9.2)
Feeling impatient and fretful when I am not holding my smartphone	69 (20.5)	105 (31.2)	66 (19.6)	62 (18.4)	35 (10.4)
Having my smartphone in my mind even when I am not using it	61 (18.1)	109 (32.3)	74 (22)	68 (20.2)	25 (7.4)
I will never give up using my smartphone even when my daily life is already greatly affected by it	43 (12.8)	68 (20.2)	79 (23.4)	101 (30)	46 (13.6)
Constantly checking my smartphone so as not to miss conversations between other people on Twitter or Facebook	59 (17.5)	113 (33.5)	68 (20.2)	62 (18.4)	35 (10.4)
Using my smartphone longer than I had intended to	87 (25.8)	123 (36.5)	86 (25.5)	25 (7.4)	16 (4.7)
The people around me tell me that I use my smartphone too much	35 (10.4)	71 (21.1)	77 (22.8)	106 (31.5)	48 (14.2)

\*SA=Strongly agree, A=Agree, N=Neutral, D=Disagree, SD=Strongly disagree

### Patient Rated Wrist/Hand Evaluation questionnaire

Our results revealed that the total PRWHE score was  $48.8 \pm 14.7$  (Range 9 – 94) out of 100. The PRWHE is a 15-item questionnaire used to measure wrist/hand pain and disability. It contains 2 subscales (pain and function), each scored from 0 to 50, with higher scores indicating greater pain and disability.

The PRWHE was chosen to evaluate wrist/hand pain and disability because it is reliable, valid, and responsive for assessing musculoskeletal disorders of the wrist and hand. Moreover, the results determined that PRWHE pain score was  $13.3 \pm 11.0$  (Range 0 – 46) out of 50 and PRWHE function score was  $35.5 \pm 11.7$  (Range 9 – 50) out of 50.

### Correlation between smartphone addiction and thumb/wrist pain

Our findings demonstrated that there was a significant association between smartphone addiction (SAS-SV score) and thumb/wrist pain ( $P$  value= 0.029) [Table 3].

### Factor associated with thumb/wrist pain

Our study found that female respondents and students of the College of Applied Medical Science, were associated with higher SAS-SV scores which indicated higher smartphone addiction. This association was significant with  $P$  values of (0.010 and 0.022, respectively). On the other hand, gender, college, academic year and the hand used to write did not show any significant correlation with PRWHE score ( $P$  value  $\geq$  0.05) [Table 4].

## Discussion

This study aimed to determine the association between smartphone addiction and thumb/wrist pain among undergraduate students of Jazan University, Jazan, KSA. In many countries, the number of smartphone users has increased in the recent decade, particularly among young adults.<sup>[23]</sup> The repeated usage of cellphones and the repetitive movement of the hands in a specific position were found to be the main contributors to musculoskeletal problems.<sup>[24]</sup>

**Table 3: Correlation between smartphone addiction and thumb/wrist pain**

Variable	Thumb/wrist pain (PRWHE score)
Smartphone addiction (SAS-SV score)	
Correlation Coefficient	0.119
$P$	0.029*

\*Significant  $P < 0.05$

Fingers, wrists, neck, back, and shoulders are the most usually afflicted body areas by pain complaints.<sup>[25,26]</sup>

The present study showed that the majority of the study population were females, and most of them were in their fourth year. The increased susceptibility of certain demographic groups to problematic smartphone use and associated musculoskeletal pain can be attributed to a variety of factors. For instance, females may be more prone to pain due to generally lower muscle mass and strength as well as the need to adopt awkward postures due to the smaller size of their hands. Additionally, social and psychological factors, such as higher engagement with social media apps and a dependency on smartphones for social connectivity, may foster addictive tendencies among females. Senior students, facing more significant academic pressures, rely more on smartphones for educational purposes, communication, and relief from academic stress, which may contribute to prolonged use and the development of addictive behaviors. The necessity of smartphones for networking, job searches, and career development as students approach graduation further reinforces this dependency. Moreover, seniors' tendency to multi-task with phones increases ergonomic strain due to improper postures, while the visual demands associated with academic progression may lead to exacerbated neck strain from positioning phones closer to the face.

However, this finding was inconsistent with another study in Makkah, which revealed that most of the participants were males, and most of them were in the third year of study.<sup>[14]</sup> Nevertheless, the latter study reported that 92% used their right

**Table 4: Factors associated with thumb/wrist pain**

Variable	Categories	PRWHE score mean (SD)	P	SAS-SV score mean (SD)	P
Gender	Male	48.3 (13.0)	0.616 <sup>T</sup>	30.9 (8.8)	0.010 <sup>1*</sup>
	Female	49.1 (15.5)		33.3 (7.4)	
College	Applied medical science	48.1 (16.3)	0.156	34.4 (5.7)	0.022*
	Dentistry	50.5 (15.0)		33.6 (8.3)	
	Medicine	50.4 (13.5)		30.6 (8.7)	
	Nursing	47.3 (15.4)		32.0 (7.7)	
	Pharmacy	43.5 (14.6)		32.7 (8.5)	
	Public health and tropical medicine	51.9 (12.4)		34.4 (8.4)	
Academic year level	2 <sup>nd</sup> year	48.4 (16.5)	0.872	33.9 (6.6)	0.543
	3 <sup>rd</sup> year	48.4 (13.1)		33.0 (7.4)	
	4 <sup>th</sup> year	50.3 (14.2)		32.5 (8.7)	
	5 <sup>th</sup> year	48.4 (15.1)		32.2 (8.2)	
	6 <sup>th</sup> year	48.0 (15.4)		31.4 (7.9)	
The hand used to write	Right hand	48.8 (14.4)	0.965 <sup>T</sup>	32.7 (7.9)	0.051 <sup>T</sup>
	Left hand	48.9 (18.3)		29.7 (8.1)	

T: P value calculated using t-test for independent samples; other P values calculated using one way ANOVA test. \*Significant P<0.05

hand as the dominant, which supports our results. In this study, more than one-third of students (34.4%) reported having a hard time concentrating in class, while doing assignments, or while working due to smartphone use. This was relatively higher than other observations made in Makkah; most participants slightly agreed to have difficulties in concentrations (27.8%).<sup>[14]</sup>

The current study showed that 32% of respondents admitted that they had felt pain in their wrists or at their back of the neck while using a smartphone. In a Pakistani study, 42% of teenagers experienced thumb/wrist pain as a result of smartphone use, which is higher than our data.<sup>[27]</sup> This may be explained by the assertion that persistent thumb movement increases the likelihood of thumb musculature damage.<sup>[28]</sup>

The discrepancy in findings between the Pakistani study, which focused exclusively on teenagers, and our research, encompassing undergraduate students up to 25 years of age, can be attributed to several factors. First, the difference in sample characteristics suggests that younger individuals may engage more intensively in gaming and social media activities on smartphones, potentially leading to increased musculoskeletal discomfort. Furthermore, cultural distinctions may influence patterns of smartphone usage and dependency, highlighting the necessity for further investigation into the cultural determinants of phone addiction. Additionally, the methodology employed plays a significant role; whereas the Pakistani study relied on interviews, our study utilized an online survey. The face-to-face nature of interviews might facilitate more detailed reporting of pain symptoms compared to the potentially more impersonal and brief nature of online survey questions. Moreover, the larger sample size in our study, consisting of 335 students as opposed to 100 teenagers in the Pakistani study, enhances the precision of our prevalence estimates. Finally, the context of data collection might contribute to reporting bias, with Pakistani teens possibly over-reporting pain during interviews, in contrast to the relative anonymity provided by online surveys, which could mitigate such bias.

An earlier study from Turkey found that the most commonly reported musculoskeletal system complaint is discomfort in numerous regions of the body, including the fingers, wrist, and shoulders.<sup>[29]</sup> According to a systematic research, neck symptoms had the highest prevalence of muscular-skeletal disorders.<sup>[30]</sup>

In this study, more than one third of participants [119 (35.3%)] strongly agreed that they will not be able to stand not having a smartphone. This indicated a high prevalence of smartphone addiction among our participants. Nearly equivalent results were observed in a study at Makkah.<sup>[14]</sup> A previous study in Brazil showed that 46.5% of participants were smartphone addicts.<sup>[31]</sup> Smartphone addiction among students is driven by several key factors, like the need for social connectivity, the ease of accessing information, the availability of entertainment, the use of smartphones as a coping mechanism for anxiety, and habit formation. Personality traits like extraversion, neuroticism, and impulsiveness further increase the risk of addiction. The consequences of excessive smartphone use include poor academic performance, sleep disturbances, anxiety, and musculoskeletal problems. Addressing these issues requires research into targeted interventions and promoting balanced smartphone use during key activities to reduce dependency.

Our results revealed that the total PRWHE score was  $48.8 \pm 14.7$  (range 9–94) out of 100, indicating moderate wrist/hand pain and dysfunction among the undergraduate sample. The pain score was  $13.3 \pm 11.0$ , suggesting mild to moderate levels of wrist/hand pain related to smartphone use. This pain could arise from repetitive loading and awkward postures of the delicate structures in the wrist and hand while using smartphones. Finally, the high function score of  $35.5 \pm 11.7$  indicates smartphone use is substantially impacting activities of daily living that involve gripping, carrying, and fine hand control.

Another study from Jeddah demonstrated that the median total pain and disability score of the PRWHE-A for addicts was

8.00 with an interquartile range of 0 to 20 (30). Furthermore, this survey found that there is a significant association between smartphone addiction (SAS-SV score) and thumb/wrist pain. This was confirmed by several studies in Egypt,<sup>[32]</sup> Brazil,<sup>[31]</sup> and Saudi Arabia.<sup>[8]</sup> Another study identified a strong correlation between smartphone addiction and aches in the thenar eminence of both hands. The opponens pollicis, adductor pollicis brevis, and abductor pollicis brevis muscles make up the thenar eminence.<sup>[33]</sup> This may be related to the prolonged use of smartphones, particularly when texting, which may result in soft tissue damage,<sup>[34]</sup> as well as other risk factors, including wrist tendonitis.<sup>[35]</sup>

The current study revealed that female respondents and students of the college of Applied Medical Science were associated with higher SAS-SV scores, which indicated higher smartphone addiction. This trend may stem from females' increased engagement with social media and communication applications, coupled with the integral role of smartphones in medical students' academic and clinical activities. The rigorous demands of the medical curriculum and the necessity for multi-tasking with smartphones contribute to this dependency. Additionally, personality traits such as neuroticism and impulsiveness, potentially more prevalent among medical students, may elevate the risk of addiction. Female medical students, in particular, might rely more on smartphones for maintaining support networks amid a competitive educational environment.

However, another study found a significant association between smartphone addiction and age and the academic year level.<sup>[5]</sup> Our study is in agreement with another study from Brazil which reported that there were no differences regarding wrist pain and sex, age, or dominant hand.<sup>[31]</sup> On the other side, another study from Makkah found a significant association was found between age, gender, and year of study and the pain while using the hand.<sup>[14]</sup>

Our research had some limitations. The modest geographic scope of the study population may have limited the generalizability of our findings. The amount of time spent using a smartphone, the location in which it was utilized, common daily routines, pastimes, and typical carrying and usage patterns were not recorded.

## Conclusion

The study concluded that there was significant correlation between smartphone addiction and thumb/wrist pain among medical students. More studies are needed to validate our results along with educational programs. A future research using cohort is recommended to assess the long-term impact of smartphone addiction on students as well as to raise public awareness about smartphone use. The excessive use of smartphones should be assessed to establish addiction prevention programs that include posture suggestions, stress-coping methods, and the development of positive mental health.

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## Conflicts of interest

There are no conflicts of interest.

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