RESEARCH PAPER

The association between electronic devices addiction and musculoskeletal pain among general population in Saudi Arabia

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ABSTRACT

Introduction: The widespread use of smartphones globally has raised concerns about addiction and its physical and mental health effects. Excessive smartphone usage can lead to problems like insomnia, blurred vision, anxiety, and musculoskeletal pain. The research aims to assess the prevalence of smartphone addiction-related musculoskeletal pain in Saudi Arabia and its impact on daily activities, as well as individuals' responses to such pain, whether they adapt or seek rehabilitation.

Methodology: Study used a cross-sectional study design to collect data using a self-administered survey questionnaire. Non-Probability convenience sampling technique was used. Data was analyzed using SPSS.

Results : A total of 1018 participants completed the survey. The majority 38.8% were between 18 to 24. years of age with females being dominant(71.1%). Respondents who lived in the Central Region constitute 39.4%. Respondents who were bachelor's degree holders constitute 66.6%. Regarding employment status, about half of the respondents (47.4%) were students, while 27.6% were employed. Nearly 60% used smartphones for ten years or more, with regular use of more than 6 hours per day (31%).the most common purpose of smartphone use was watching videos (75%), followed by text messaging (60.7%) and talking to someone (58.8%).the most common musculoskeletal pain experienced by the respondents was shoulder pain (61.1%), neck pain (59.8%), and lower back (53.4%).Respondents who experienced musculoskeletal pain that prevented them from doing work, those who experienced pain for the last 7 days, those who experienced associated tingling or numbness along with pain, and those who ever hurt their body in an accident constituted 32.5%, 48.2%, 37.7%, and 23.8%, respectively. Also, over half (50.3%) experienced trouble at least 1 to 7 days during the last 12 months. Of them, 34.2% visited a doctor because of trouble during the previous 12 months. In addition, 53.6% experienced pain when placing a thumb in their hand's palm, then grasping in and bending downwards.

Conclusion: This study findings suggest a significant impact of prolonged electronic device usage on physical health, particularly in the development of pain in various regions of the body. Our study urges the urgent need to raise awareness about the potential consequences of excessive smartphone use.

Keywords: De Quervain tenosynovitis (DQT) , problematic smartphone use (PSU)

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INTRODUCTION

Smartphone addiction is excessive usage of smartphones that affect the users lives [1]. According to statistics, smartphone users worldwide has reached to 6.92 billion in 2023 [(2)]. The prevalence of smartphone usage has increased due to educational need, information, communication, personal assistant, and entertainment[1]. Smart devices contain numerous apps for shopping, social media, browsing the internet, playing games, listening to music, and writing notes for studying. Even though it is very useful cause it helps people to communicate, study, work, and entertain them, they can be very susceptible to addiction when they use it excessively [3]. Addiction to smart devices can carry negative effects on health physically, mentally, socially, and academically [4,5]. Addiction to smartphones carries high risk for drivers who use their phone while driving which increases the risk of having accidents. Also, it can cause insomnia, interrupted sleep, blurred vision, anxiety, depression, carpal tunnel syndrome, and musculoskeletal pain including neck, shoulder, and wrist/hand pain [1,4]. A recent study done in Saudi Arabia revealed that the participant uses smartphone for more than 7 hours daily with text neck posture to be more prevalent among them [6]. Setting without supporting the arms and bending the head forward during phone usage can develop neck and shoulder pain[3]. Persistent contraction of neck muscle can cause microscopic damage and neck disabilities among smartphone users. It can cause persistent flexion of the neck which alters the normal posture and curvature of neck. In addition, it can affect the nearby muscle and irritate them which ultimately can cause proprioception deficits in cervical vertebra[3].

The overuse of smartphone on the hand and thumb can

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cause irritation and increase pressure in the Capel tunnel region leading to compression to the content and result in musculoskeletal symptoms such as pain and numbness [7]. Numerous studies found the prevalence of forearm tendonitis that known with De Quervain tenosynovitis (DQT) among smartphones users. DQT characterized by painful wrist condition, with localization of pain over thumb side on the radio styloid process [4,8]. An updated study that was done in Saudi Arabia found that most of addicted smartphone users' compline of stiffness and mild pain in thumb/wrist that could be associated with clinical and subclinical soft tissues changes in thumb/wrist cause pain [9].

Our study aims to evaluates the prevalence of smartphones addiction induced musculoskeletal pain among Saudi Arabia population and to measure their impacts on daytime's activity. Furthermore, to evaluate users who develop musculoskeletal response toward the pain if they are getting adapted or seeking rehabilitation or physiotherapy centers.

Materials and Methods:

Objectives:

Primary

- Evaluates the prevalence of smartphones addiction induced musculoskeletal pain among Saudi population in Saudi Arabia.

Secondary

- To measure the impact of smartphones addiction induced musculoskeletal pain on daytime activity.
- To evaluate users who develop musculoskeletal response toward the pain if they are getting adapted or seeking rehabilitation or physiotherapy centers.

Study Methodology:

Study design

cross-sectional research design to collect data on the prevalence of smartphone addiction-induced musculoskeletal pain in Saudi Arabia.

Data Collection Tool:

Data collected using a self-administered survey questionnaire. The questionnaire developed based on previous research studies and include questions on demographics, smartphone usage patterns, and musculoskeletal pain symptoms. The questionnaire translated into Arabic, the official language of Saudi Arabia, to ensure that all participants can understand and answer the questions. Data collected electronically via an online survey platform.

Sample Size:

The sample collected from Saudi population aged 18 years old and above. With an anticipate absolute error 5% and a 95% confidence interval (CI), and 10,402,379 population. The required sample size was determined using Kish formula (n=z2pq\d2), resulting in a minimum required sample size of 385.

Sample technique :

The sampling technique that used in our research is non-Probability convenience sampling technique in which it will be conducted among Saudi population.

Inclusion criteria:

- All participants who agree to the consent.
- Only Saudi participants.
- Both genders male and female.
- Adults who are 18 years old and above
- Adults who own smartphone and have used it for more than one year.

Exclusion criteria:

- Any participant below 18 years old
- Any participant not living in Saudi Arabia
- Non-Saudi participants.
- Any participant who doesn’t own a smartphone.
- Any participant who hasn’t used a smartphone for more than one year.
- Patients with already existing symptoms because of a diagnosed chronic disease in which their symptoms don't correlate with smartphone usage.

Study Procedure

Risk/Benefits:

There is no risk to the participants because it is a cross sectional study that helps to evaluate prevalence of smartphone addiction-induced musculoskeletal pain in Saudi Arabia. There is no direct benefit to the participants; however, the study findings may contribute to the development of public health interventions aimed at reducing the prevalence of musculoskeletal pain symptoms among smartphone users in Saudi Arabia.

Data Management:

The data will be in SPSS and stored with no attempts to identify the subjects because the questionnaire does not include any personal information such as name, ID number, or any specific information that could lead the person.

Ethical aspects :

Anonymity and confidentiality were guaranteed at all times when answering the questionnaire. Before completing the questionnaire, participants were informed about the study's aims and asked for their agreement to participate in the survey with their data. The participants provided all of the information. Clearance from the ethical committee was obtained from the dean of scientific research at King Faisal University on 31/05/2023 (KFU-REC-2023-MAY-ETHICS898), and the validity is for 24 months.

RESULTS

Questionnaire criteria

The electronic device addiction has been assessed using the "Short version of the Smartphone Addiction Scale (SAS-SV), developed by Kwon et al. (2013)[10]. The SAS-SV contains 10 items, each scored on a Likert scale of 1 (strongly disagree) to 6 (strongly agree). The sum of these items gives an overall SAS-SV score (range: 10–60), with a higher score indicating Problematic Smartphone Use (PSU). The ROC analysis results showed an area under a curve (AUC) value of 0.963(0.888–1.000), a cut-off value of 31, sensitivity value of 0.867 and specificity value of 0.893 in males, while an AUC value of 0.947(0.887–1.000), a cut-off value of 33, sensitivity value of 0.875, and a specificity value of 0.886 in females.[10-11]

The experienced musculoskeletal pain has been using "The Nordic musculoskeletal questionnaire (NMQ)." Respondents were asked if they had any musculoskeletal pain trouble in the last 12 months that prevented them from doing normal activities. A body map aids completion in indicating nine symptoms such as neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, and ankles, feet.[12]

Statistical Analysis

The data were analyzed using the software program Statistical Packages for Software Sciences (SPSS) version 26 (Armonk, New York, IBM Corporation, USA). Descriptive statistics were given as numbers and percentages (%) for all categorical variables, while continuous variables were calculated and summarized as mean and standard deviation. Univariate analyses were performed to determine the association between problematic smartphone use and the experienced musculoskeletal pain with a corresponding odds ratio as well as a 95% confidence interval. Also, the relationship between experienced musculoskeletal pain and problematic smartphone use was conducted using the Chi-square test. Values were considered significant with a p-value of less than 0.05.

RESULTS

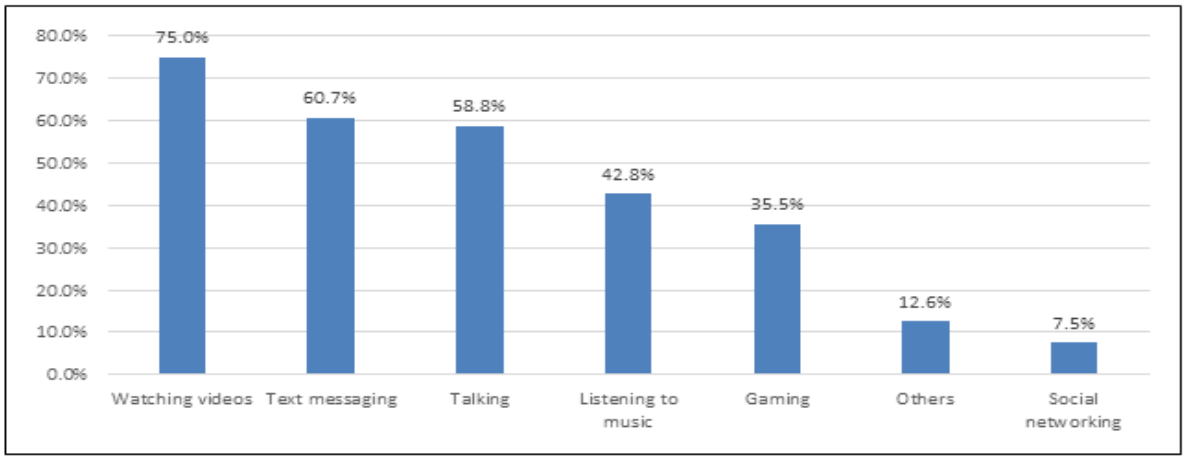
Table 1: Socio-demographic characteristics of participants (n=1018)

Study variables	N (%)
Age group	
• 18 – 24 years	395 (38.8%)
• 25 – 34 years	294 (28.9%)
• 35 – 44 years	145 (14.2%)
• 45 – 54 years	127 (12.5%)
• ≥55 years	57 (05.6%)
Gender	
• Male	294 (28.9%)
• Female	724 (71.1%)
Region	
• Central Region	401 (39.4%)
• Eastern Region	298 (29.3%)
• Western Region	100 (09.8%)
• Northern Region	135 (13.3%)
• Southern Region	84 (08.3%)
Education level	
• Primary school	11 (01.1%)
• Secondary school	38 (03.7%)
• High school	238 (23.4%)
• Bachelor degree	678 (66.6%)
• Master or PhD	53 (05.2%)
Employment status	
• Employed	281 (27.6%)
• Unemployed	160 (15.7%)
• Student	483 (47.4%)
• Retired	64 (06.3%)
• Housewife	30 (02.9%)
How long have you been using a smartphone?	
• <1 years	17 (01.7%)
• 1 – 3 years	53 (05.2%)
• 4 – 6 years	120 (11.8%)

• 7 – 9 years	218 (21.4%)
• ≥10 years	610 (59.9%)
How many hours per day do you spend on your smartphone?	
• <1 hour	24 (02.4%)
• 1 – 2 hours	87 (08.5%)
• 3 – 4 hours	315 (30.9%)
• 5 – 6 hours	276 (27.1%)
• >6 hours	316 (31.0%)

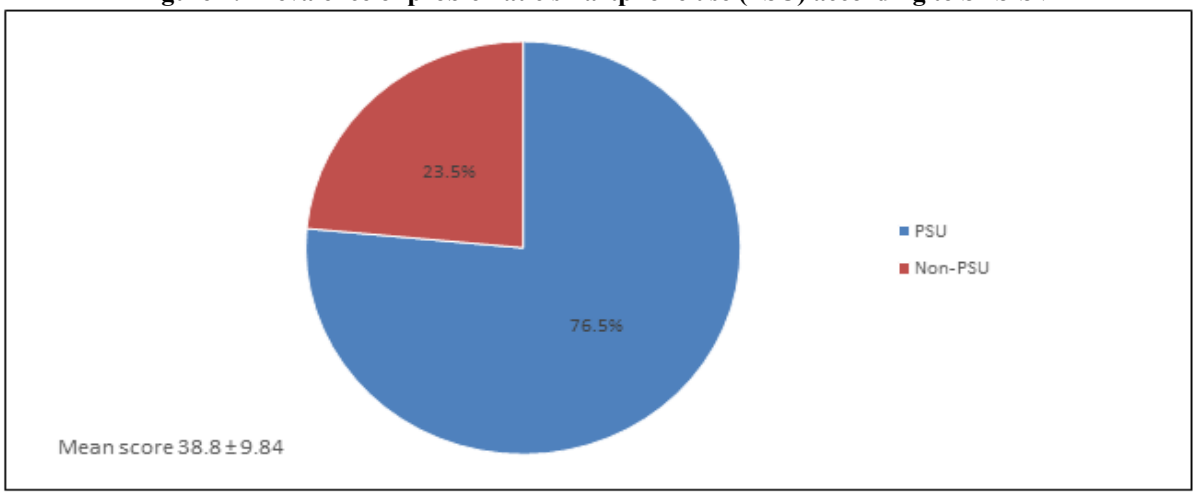
In total, one thousand and eighteen participants were recruited. Table 1 presents the socio-demographic characteristics of participants. 38.8% were aged between 18 and 24 years old, with females being dominant (71.1%). Respondents who lived in the Central Region constitute 39.4%. Respondents who were bachelor's degree holders constitute 66.6%. Regarding employment status, about half of the respondents (47.4%) were students, while 27.6% were employed. Nearly 60% used smartphones for ten years or more, with regular use of more than 6 hours per day (31%).

Figure 1: Purpose of smartphone use on a typical day



In Figure 1, the most common purpose of smartphone use was watching videos (75%), followed by text messaging (60.7%) and talking to someone (58.8%).

Figure 2: Prevalence of problematic smartphone use (PSU) according to SAS-SV



In Figure 2, the prevalence of problematic smartphone use based on the SAS-SV questionnaire was 76.5%, and the rest were non-PSU (23.5%).

Table 2: Experienced musculoskeletal pain during the last 12 months according to gender

Factor	Overall	Male	Female	P-value §

	N (%) (n=1018)	**N (%)** (n=294)	**N (%)** (n=724)	
Musculoskeletal pain †				
• Neck	609 (59.8%)	207 (70.4%)	402 (55.5%)	**<0.001** **
• Shoulders	622 (61.1%)	185 (62.9%)	437 (60.4%)	0.447
• Elbows	394 (38.7%)	131 (44.6%)	263 (36.3%)	**0.015** **
• Wrists/Hands	498 (48.9%)	113 (38.4%)	385 (53.2%)	**<0.001** **
• Upper back	533 (52.4%)	124 (42.2%)	409 (56.5%)	**<0.001** **
• Lower back	544 (53.4%)	128 (43.5%)	416 (57.5%)	**<0.001** **
• Hips/Thighs	353 (34.7%)	113 (38.4%)	240 (33.1%)	0.108
• Knees	379 (37.2%)	68 (23.1%)	311 (43.0%)	**<0.001** **
• Ankles/feet	359 (35.3%)	116 (39.5%)	243 (33.6%)	0.075
Been prevented from doing work because of the trouble?				
• Yes	331 (32.5%)	134 (45.6%)	197 (27.2%)	**<0.001** **
• No	687 (67.5%)	160 (54.4%)	527 (72.8%)	
Had trouble at any time during the last 7 days?				
• Yes	491 (48.2%)	169 (57.5%)	322 (44.5%)	**<0.001** **
• No	527 (51.8%)	125 (42.5%)	402 (55.5%)	
Any associated tingling or numbness?				
• Yes	384 (37.7%)	54 (18.4%)	330 (45.6%)	**<0.001** **
• No	634 (62.3%)	240 (81.6%)	394 (54.4%)	
Ever hurt body part in an accident?				
• Yes	242 (23.8%)	130 (44.2%)	112 (15.5%)	**<0.001** **
• No	776 (76.2%)	164 (55.8%)	612 (84.5%)	
Total length of time that had trouble during the last 12 months				
• 1 - 7 days	512 (50.3%)	124 (42.2%)	388 (53.6%)	**<0.001** **
• 8 - 30 days	250 (24.6%)	129 (43.9%)	121 (16.7%)	
• >30 days	157 (15.4%)	26 (08.8%)	131 (18.1%)	
• Every day	99 (09.7%)	15 (05.1%)	84 (11.6%)	
Visited a doctor because of trouble during the last 12 months				
• Yes	348 (34.2%)	134 (45.6%)	214 (29.6%)	**<0.001** **
• No	670 (65.8%)	160 (54.4%)	510 (70.4%)	
If you place your thumb in the palm of your hand, then grasp it and bend your hand downwards, is there any pain in the area marked in red?				
• Yes	546 (53.6%)	182 (61.9%)	364 (50.3%)	**0.001** **
• No	472 (46.4%)	112 (38.1%)	360 (49.7%)	

† Some respondents experienced multiple musculoskeletal pains.
§ P-value has been calculated using Chi-square test.
** Significant at $p<0.05$ level.

In Table 2, the most common musculoskeletal pain experienced by the respondents was shoulder pain (61.1%), neck pain (59.8%), and lower back (53.4%). Respondents who experienced musculoskeletal pain that prevented them from doing work, those who experienced pain for the last 7 days, those who experienced associated tingling or numbness along with pain, and those who ever hurt their body in an accident constituted 32.5%, 48.2%, 37.7%, and 23.8%, respectively. Also, over half (50.3%) experienced trouble at least 1 to 7 days during the last 12 months. Of them, 34.2% visited a doctor because of trouble during the previous 12 months. In addition, 53.6% experienced pain when placing a thumb in their hand's palm, then grasping in and bending downwards. When comparing males and females, it was observed that the prevalence of neck pain ($p<0.001$), elbow pain ($p=0.015$), experienced trouble that prevented them from doing work ($p<0.001$), had trouble anytime during the last 7 days ($p<0.001$), experienced pain between 8 to 30 days during the last 12 months ($p<0.001$), visited a doctor due to pain during the last 12 months ($p<0.001$) and experienced pain when placing the thumb in the palm of hand ($p=0.001$). On the other hand, females were more

associated with wrist/hand pain (p<0.001), upper back pain (p<0.001), lower back pain (p<0.001), knee pain (p<0.001) and associated tingling or numbness (p<0.001).

Table 3: Association between problematic smartphone use and the experienced musculoskeletal pain during the last 12 months according to gender

Musculoskeletal pain	Problematic smartphone use		OR (95% CI)	P-value
	PSU N (%) (n=724)	Non-PSU N (%) (n=294)		
Neck	506 (65.0%)	103 (43.1%)	2.447 (1.822 – 3.288)	**<0.001** **
Shoulders	506 (65.0%)	116 (48.5%)	1.965 (1.466 – 2.635)	**<0.001** **
Elbows	351 (45.1%)	43 (18.0%)	3.738 (2.611 – 5.352)	**<0.001** **
Wrists/Hands	409 (52.5%)	89 (37.2%)	1.863 (1.384 – 2.509)	**<0.001** **
Upper back	432 (55.5%)	101 (42.3%)	1.701 (1.269 – 2.280)	**<0.001** **
Lower back	440 (56.5%)	104 (43.5%)	1.685 (1.258 – 2.257)	**<0.001** **
Hips/Thighs	299 (38.4%)	54 (22.6%)	2.134 (1.525 – 2.986)	**<0.001** **
Knees	301 (38.6%)	78 (32.6%)	1.300 (0.957 – 1.766)	0.094
Ankles/feet	302 (38.8%)	57 (23.8%)	2.022 (1.453 – 2.814)	**<0.001** **

OR – Odds Ratio; CI – Confidence Interval.
** Significant at p<0.05 level.

In Table 3, it was observed that PSU had an increased risk of neck pain by at least 2.45 times higher (OR=2.447; 95% CI=1.822 – 3.288; p<0.001), shoulder pain by at least 1.96 times higher (OR=1.965; 95% CI=1.466 – 2.635; p<0.001), elbow pain by at least 3.74-fold higher (OR=3.738; 95% CI=2.611 – 5.352; p<0.001), wrist/hand pain by at least 1.86 times higher (OR=1.863; 95% CI=1.384 – 2.509; p<0.001), upper back pain by at least 1.70 times higher (OR=1.701; 95% CI=1.269 – 2.280; p<0.001), lower back pain by at least 1.68-fold higher (OR=1.685; 95% CI=1.258 – 2.257; p<0.001), hip/thigh by at least 2.13 times higher (OR=1.525 – 2.986; p<0.001) and ankle/feet by at least 2.02 times higher (OR=2.022; 95% CI=1.453 – 2.814; p<0.001).

Table 4: Musculoskeletal pain in relation to age group (n=1018)

Musculoskeletal pain	Age group		P-value §
	<35 years N (%) (n=689)	≥35 years N (%) (n=329)	
Neck	431 (62.6%)	178 (54.1%)	**0.010** **
Shoulders	422 (61.2%)	200 (60.8%)	0.889
Elbows	263 (38.2%)	131 (39.8%)	0.614
Wrists/Hands	317 (46.0%)	181 (55.0%)	**0.007** **
Upper back	360 (52.2%)	173 (52.6%)	0.921
Lower back	356 (51.7%)	188 (57.1%)	0.102
Hips/Thighs	244 (35.4%)	109 (33.1%)	0.474
Knees	213 (30.9%)	166 (50.5%)	**<0.001** **
Ankles/feet	460 (66.8%)	199 (60.5%)	**0.050** **

§ P-value has been calculated using Chi-square test.
** Significant at p<0.05 level.

In Table 4, the younger age group was more associated with neck pain (p=0.010) and ankle/feet pain (p=0.050), while the older age group was more associated with wrist/hand pain (p=0.007) and knee pain (p<0.001).

Table 5: Musculoskeletal pain in relation to employment status (n=1018)

Musculoskeletal pain	Employment status	P-value §

	Employed N (%) (n=281)	**Unemployed N (%)** (n=254)	**Student N (%)** (n=483)	
Neck	162 (57.7%)	125 (49.2%)	322 (66.7%)	**<0.001** **
Shoulders	175 (62.3%)	144 (56.7%)	303 (62.7%)	0.249
Elbows	112 (39.9%)	95 (37.4%)	187 (38.7%)	0.844
Wrists/Hands	153 (54.4%)	134 (52.8%)	211 (43.7%)	**0.006** **
Upper back	146 (52.0%)	127 (50.0%)	260 (53.8%)	0.605
Lower back	168 (59.8%)	133 (52.4%)	243 (50.3%)	**0.037** **
Hips/Thighs	90 (32.0%)	83 (32.7%)	180 (37.3%)	0.253
Knees	130 (46.3%)	109 (42.9%)	140 (29.0%)	**<0.001** **
Ankles/feet	112 (39.9%)	76 (29.9%)	171 (35.4%)	0.056

§ P-value has been calculated using Chi-square test.
** Significant at p<0.05 level.

In Table 5, employed participants were more associated with wrist/hand pain (p=0.006), lower back pain (p=0.037), and knee pain (p<0.001), while student participants were more associated with neck pain (p<0.001).

Table 6: Relationship between problematic smartphone use and the socio-demographic characteristics of participants (n=1018)

Factor	**Problematic smartphone use**		**P-value** §
	PSU N (%) (n=724)	**Non-PSU N (%)** (n=294)	
Age group			
• <35 years	529 (67.9%)	160 (66.9%)	0.781
• ≥35 years	250 (32.1%)	79 (33.1%)	
Gender			
• Male	242 (31.1%)	52 (21.8%)	**0.005** **
• Female	537 (68.9%)	187 (78.2%)	
Educational level			
• High school or below	211 (27.1%)	76 (31.8%)	0.157
• Bachelor or higher	568 (72.9%)	163 (68.2%)	
Employment status			
• Employed	221 (28.4%)	60 (25.1%)	0.072
• Unemployed	181 (23.2%)	73 (30.8%)	
• Student	377 (48.4%)	106 (44.4%)	
How long have you been using a smartphone?			
• <10 years	296 (38.0%)	112 (46.9%)	**0.014** **
• ≥10 years	483 (62.0%)	127 (53.1%)	
How many hours per day do you spend on your smartphone?			
• ≤4 hours	298 (38.3%)	128 (53.6%)	**<0.001** **
• >4 hours	481 (61.7%)	111 (46.4%)	

§ P-value has been calculated using Chi-square test.
** Significant at p<0.05 level.

In Table 6, the prevalence of PSU was significantly more common among the male gender (p=0.005), had a duration of smartphone use for ten years or more (p=0.014), and used smartphones for more than 4 hours per day (p<0.001).

DISCUSSION

Our study reveals a compelling association between the prevalence of problematic smartphone use (PSU) and the incidence of musculoskeletal pain among the general population in Saudi Arabia. This study findings suggest a significant impact of prolonged electronic device usage on physical health, particularly in the development of pain in various regions of the body.

We found that, 60% of participants have used smartphones for over ten years and 31% use them for more than 6 hours daily, is a significant indicator of the deep integration of smartphones into daily life. The high prevalence of PSU (76.5%) is alarming and suggests a behavioral pattern that could have various health implications. This is supported by studies that have

found a strong correlation between smartphone usage duration and musculoskeletal pain, particularly in the neck and upper extremities [1, 2].

The prevalence of shoulder, neck, and lower back pain among participants is consistent with global trends of musculoskeletal discomfort associated with prolonged use of electronic devices [3]. The fact that over half of the respondents experienced trouble due to pain at some point in the last year underscores the potential public health impact of this issue, as similar studies have reported significant associations between electronic device use and musculoskeletal symptoms [4].

Our observation of gender-specific differences in pain prevalence aligns with literature that suggests varying patterns of musculoskeletal pain between males and females. Studies have shown that women are more likely to report pain in the wrist/hand, upper back, lower back, knee, and experience tingling or numbness, which may be due to both biological and psychosocial factors [5, 6].

The increased risk of neck pain, shoulder pain, elbow pain, wrist/hand pain, upper back pain, lower back pain, hip/thigh, and ankle/feet pain among PSU individuals is a critical finding. It highlights the ergonomic risks associated with excessive smartphone use, which has been corroborated by other research indicating that smartphone addiction is positively related to musculoskeletal pain in various body parts [7, 8].

The association between younger age groups with neck and ankle/feet pain, and older age groups with wrist/hand and knee pain, may reflect the different physical vulnerabilities and smartphone usage patterns across age groups. This is in line with studies that have found lifestyle factors to be associated with musculoskeletal pain intensity, with age being a significant factor in the type and prevalence of pain [9].

The link between employment status and musculoskeletal pain, where employed participants reported more wrist/hand, lower back, and knee pain, while students reported more neck pain, suggests that occupational activities may influence the development of musculoskeletal disorders. This is supported by research indicating that employment status can affect the age of retirement and the risk of work cessation among individuals with chronic musculoskeletal pain [10].

Clinical Implications and future Research

Study findings suggest the need for targeted interventions and public health campaigns to raise awareness about the potential consequences of excessive smartphone use. Healthcare providers should consider screening patients for PSU, especially those reporting musculoskeletal pain, and provide education on ergonomic practices and regular breaks to mitigate these issues [11]. Gender-specific differences in pain prevalence highlight the importance of tailored interventions based on gender, age group, and occupation [12].

Future research could explore the underlying mechanisms linking PSU and musculoskeletal pain to develop more effective preventive strategies and interventions. Longitudinal studies could explore the temporal relationship between smartphone use patterns and the onset of musculoskeletal pain to better understand causality. Investigating specific ergonomic factors related to smartphone use, such as posture and typing behaviors, could provide insights into modifiable risk factors. Qualitative studies exploring the psychosocial aspects of smartphone addiction and its impact on daily functioning and quality of life could offer a holistic understanding of this phenomenon. Examining the effectiveness of interventions, such as ergonomic education programs or digital detox initiatives, in reducing PSU and associated musculoskeletal pain could guide evidence-based practices in clinical settings and public health campaigns.

Limitations

Several limitations should be considered when interpreting the findings of this study. The cross-sectional design of the study limits the ability to establish causality, as it does not allow for the determination of the temporal sequence between problematic smartphone use (PSU) and musculoskeletal pain. The reliance on self-reported data introduces the possibility of recall bias and social desirability bias, where participants may underreport or overreport their smartphone usage and pain experiences. The study's sample, although sizeable with 1,018 participants, may not fully represent the entire population of Saudi Arabia, potentially limiting the generalizability of the findings. The use of a convenience sampling method could introduce selection bias, as individuals with more severe musculoskeletal pain or PSU may have been more likely to participate. The study also focused on smartphone use specifically and did not explore other electronic devices, such as tablets or laptops, which could be relevant to musculoskeletal pain. These limitations highlight the need for caution when interpreting the results and suggest avenues for further research with more robust study designs and diverse populations.

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