MEDICAL SCIENCE

The relationship between smartphone addiction/overuse and musculoskeletal pain in Saudi Arabia

Abdulmalik B Albaker[1*], **Saud M Alzahrani**[2], **Farah Alnasser**[3], **Abdullah F Al Mula**[4], **Muath Alghamdi**[5], **Aljohrah Mohammed Al-Hunaif**[6], **Ali Hassan Siddiq Alkhaldi**[2], **Nouf Ali Abdullah Asiri**[6], **Ibrahim Adel Hassan Al-Hajji**[4], **Razan Ali S Alshehri**[6]

To Cite:
Albaker AB, Alzahrani SM, Alnasser F, Al-Mula AF, Alghamdi M, Al-Hunaif AM, Alkhaldi AHS, Asiri NAA, Al-Hajji IAH, Alshehri RAS. The relationship between smartphone addiction/overuse and musculoskeletal pain in Saudi Arabia. *Medical Science* 2023; 27: e238ms3009.
doi: https://doi.org/10.54905/disssi/v27i135/e238ms3009

Authors' Affiliation:
[1]Associate Professor, Department of Orthopaedics, College of Medicine, Majmaah University, Majmaah 11952, Saudi Arabia
[2]Medical Intern, College of Medicine, Umm Al-Qura University, Al-Qundufah, Saudi Arabia
[3]Medical Intern, College of Medicine, Majmaah University, Majmaah 11952, Saudi Arabia
[4]Medical Intern, College of Medicine, King Faisal University, Al-Ahsa, Saudi Arabia
[5]Medical Intern, College of Medicine, King Abdulaziz University, Jeddah, Saudi Arabia
[6]Medical Student, College of Medicine, King Khalid University, Abha, Saudi Arabia

Contact List

Abdulmalik B Albaker	a.albaker@mu.edu.sa
Saud M Alzahrani	saudl.com@hotmail.com
Farah Alnasser	frhalnasser@gmail.com
Abdullah F Al Mula	abdullah.f.a.almulla@gmail.com
Muath Alghamdi	malghamdi1252@stu.kau.edu.sa
Aljohrah Mohammed Al-Hunaif	aljohrah_moh99@hotmail.com
Ali Hassan Siddiq Alkhaldi	ali.halkhaldi97@gmail.com
Nouf Ali Abdullah Asiri	Noufali.a99@gmail.com
Ibrahim Adel Hassan Al-Hajji	Ibrahim17alhajji@hotmail.com
Razan Ali S Alshehri	438800364@kku.edu.sa

[*]**Corresponding author**
Associate Professor, Department of Orthopaedics, College of Medicine, Majmaah University, Majmaah 11952,
Saudi Arabia
Email: a.albaker@mu.edu.sa

Peer-Review History
Received: 23 April 2023
Reviewed & Revised: 27/April/2023 to 19/May/2023
Accepted: 23 May 2023
Published: 27 May 2023

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

DISCOVERY SCIENTIFIC SOCIETY

ABSTRACT

Background: Although the smartphone with the latest advancement of technology has made many aspects of human existence more convenient and quick, providing us several advantages, the usage of the smartphone has several negative impacts on physical or mental health that might generally be resulted in behavioral alterations and posture or musculoskeletal changes. As a result, the purpose of this study was to examine whether or not prolonged exposure to smartphones increases the risk of developing musculoskeletal discomfort. *Methods*: A questionnaire (containing sociodemographic data, musculoskeletal pain and their relationship with smartphone usage) using social media distributed pre-designed Google form was employed for performing this cross-sectional study. SPSS v.22.0 was utilized for statistical analysis. Data were considered statistically significant at $P < 0.05$. *Results*: Study revealed that addiction or smartphone dependency presented a significantly association of smartphone usage with musculoskeletal pain (45% - neck pain; 33% - shoulder and hand pain). *Conclusion*: The above results suggested that neck pain is the most prevalent smartphone-associated musculoskeletal pain that could be prevented by good posture maintenance.

Keywords: Smartphone, Addiction, Overuse, Musculoskeletal Pain, Relationship, Saudi Arabia

1. INTRODUCTION

Particularly for younger people, the smartphone quickly becomes an essential piece of technological equipment. The smartphone evolution and/or revolution with the advancement in technology make it more attractive for youth by providing multidimensional and multitasking applications like high-resolution camera, desktop synchronization, global positioning system

(GPS) navigation, global networking and socialization, voice recognition, fast and easy access to email or messages, motion sensor, mobile gaming, health care apps, etc. (Choi et al., 2011; Baabdullah et al., 2020). Due to its alluring apps, smartphones first become a fascination, then addiction and obsession for youngsters. The global usage of smartphones increased rapidly in the last decade.

In 2014, 1.85 billion individuals used cell phones globally which was reach 2.32 billion in 2017 and 6.52 billion in 2021 and is predicted to exceed 7.5 billion in the next 5 years (Statista, 2022). The latest findings from the United States revealed that 46% of smartphone users assume their smartphone as a necessity of life and believe that "they cannot live without it" (Ahmed et al., 2022; Hall and Henningsen, 2008).

Smartphone dependency and addiction cause several behavioral changes including the lack of concentration and lack of self-awareness leading to poor sitting, standing and lying posture maintenance when using the smartphone and potentially increasing the risk of chronic musculoskeletal pain (Al-Abdulwahab et al., 2017; Eitivipart et al., 2008). Smartphones use provokes musculoskeletal system (elbow, neck, numbness, hands pain and shoulder) by negatively impacting the posture.

The latest findings revealed that prolonged usage of smartphones and the musculoskeletal system resulting in. Overuse of smartphones caused joint inflammation and musculoskeletal abnormalities (Ahmed et al., 2022). Thumb and wrist pain was one of the commonest reported musculoskeletal pains among mobile phone users. During working on smartphones or hand devices, peoples generally have flexion head posture placing the device below eye level, holding in one hand cause neck and arm pain. The severity of pain depends on the usage time.

Several previous studies lightened some associations between intense smartphone use and its impact on the musculoskeletal system. However, there is still a need to explore the link between mobile usage and its physical and behavioral impact on human health. Therefore, this research intended to assess the relationship of smartphones with musculoskeletal pain and evaluate its severity.

2. MATERIALS AND METHODS

Study design

This cross-sectional observational study was carried out from August 2022 to September 2022 among the general population and included adult males and females residing in Saudi Arabia.

Study Population and Sampling Technique

Both male and female adults living in Riyadh kingdom Sadia Arabia will be the study population. The study sample will be selected by using random sampling technique.

Study sample

The sample size calculation was based on estimating the prevalence of musculoskeletal pain among smart phone usage among general population. The sample size of 385 participants was calculated by Raosoft Calculator based on the size of the adult male and female population in Saudi Arabia (approximately 27,136,977) with 95% confidence interval and 5% margin of error. The sample was representative of the population at large and included adult males and females residing in Saudi Arabia.

Data collection

The target audience was reached through online and social media distribution of a predesigned, edited and validated Arabic questionnaire developed on Google Form. The questionnaire consists of three (3) sections: Section 1 comprised socio-demographic information about the individuals and section 2 and section 3 appraised the incidences and relationship of smartphone usage with musculoskeletal pain and its extent and sternness.

Statistical analysis

Data was retrieved on an excel file and analyzed using IBM SPSS Statistics 24. Mean & SD will be estimated for quantitative variables. Frequencies and percentages were utilized for qualitative variables. Pearson chi-square test was applied to observe associations between qualitative variables. A p-value of <0.05 will be considered statistically significant.

3. RESULTS

Among the 399-study participant, 57.14% were females and 42.86% were males, predominately (75.19%) belonging to the age group 18 – 30 years. Most of the participants were university students (41%). The average height and weight of participants were 16.89 ±

12.17 cm and 66.3 ± 16.56 kg. Among all, 67% of participants have a bachelor's degree. The socio-demographic characters were summarized (Table 1).

Table 1 Socio-demographic characteristics of the Study Participants (N = 399)

Characteristic		N (%)
Gender	Female	228 (57.14)
	Male	171 (42.86)
Age	18-30	300 (75.19)
	31-40	59 (14.79)
	41-50	32 (8.02)
	51 or more	8 (2.01)
Nationality	Non-Saudi	10 (2.51)
	Saudi	389 (97.49)
Region	East	91 (22.81)
	Middle	67 (16.79)
	North	5 (1.25)
	South	165 (41.35)
	West	71 (17.79)
Marital status	Divorced	7 (1.75)
	Married	127 (31.83)
	Single	260 (65.16)
	Widowed	5 (1.25)
Educational level	Bachelors	271 (67.92)
	diploma	33 (8.27)
	High school	80 (20.05)
	Higher education	11 (2.76)
	Intermediate school	4 (1)
Occupation	Not an employee	100 (25.06)
	On the job	117 (29.32)
	Retired	15 (3.76)
	University student	167 (41.85)
Height (cm)		16.89 ± 12.17
Weight (kg)		66.3 ± 16.56

In the next section, smartphone usage status was determined. In this section, the response rate was reduced approximately 20 – 40%, varying for all questions. Among all the respondents, 24.1% of participants have missed their planned target due to the overuse of smartphones while, 58% of participants have reported a lack of concentration in routine life due to smartphone addiction. It was observed that 40 – 60% of participants were smartphone addicts and cannot balance the routine life due to their addiction (Figure 1).

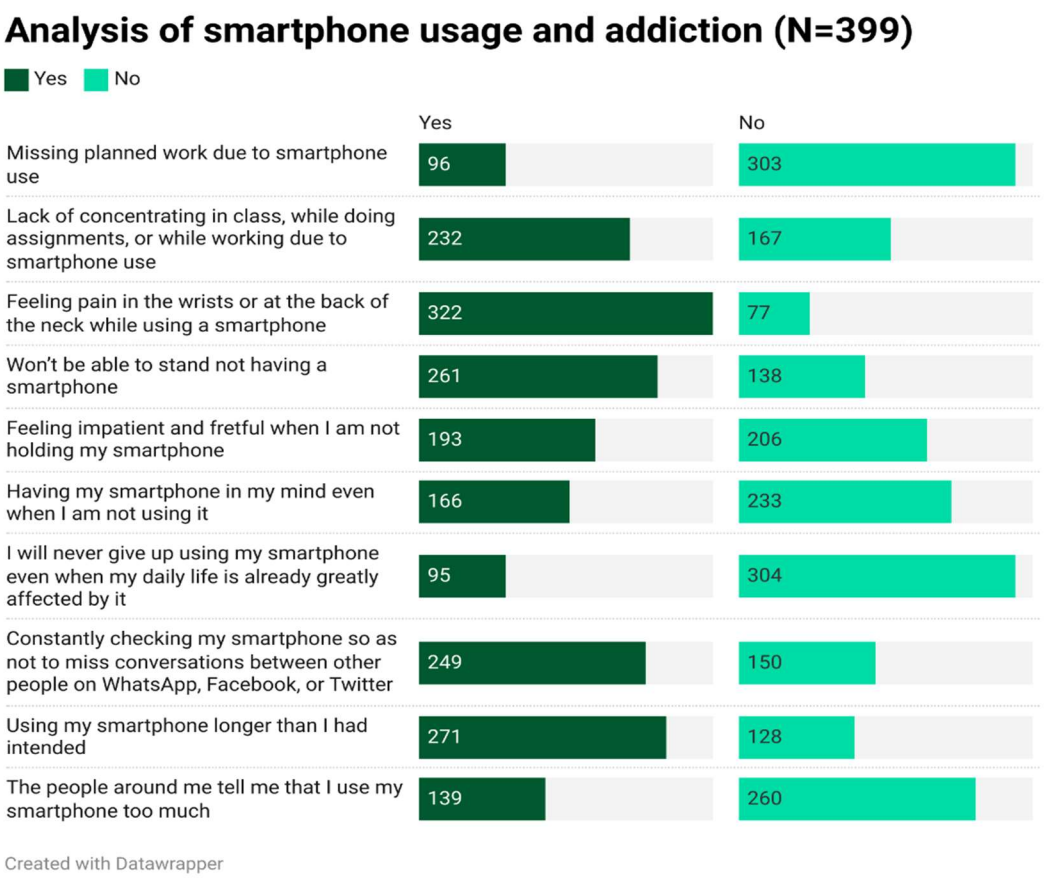

Figure 1 Analysis of Smartphone Usage and Addiction

Among all participants, 60% participants reported that they experienced pain or numbness due to over usage of the smartphone. Neck pain (45%) was the highest reported pain in the current study, followed by the shoulder (33.6%) and wrist/hand (33.8%) pain. Figure 2 summarizes the pain status of the participants. A strong relationship among the intensive use of a smartphone and musculoskeletal pain was observed in this study (Table 2).

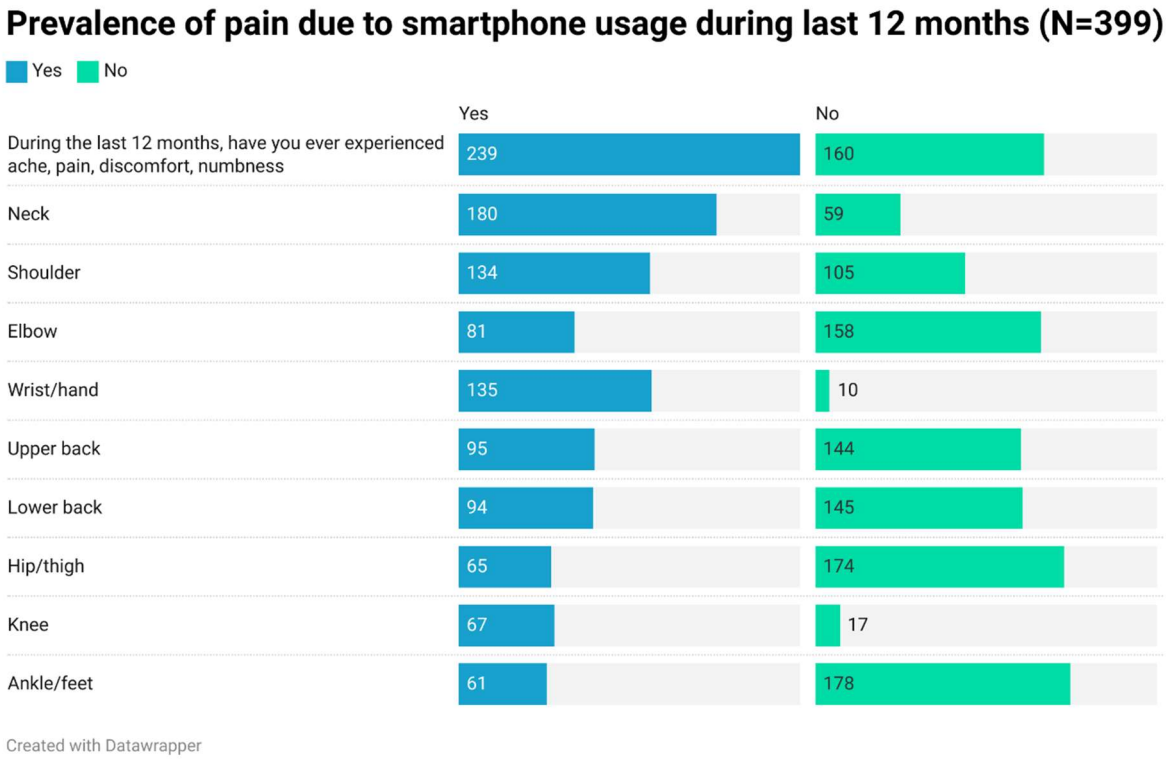

Figure 2 Prevalence of pain due to Smartphone usage during last 12 months

Table 2 Association of musculoskeletal pain with smartphone usage (N=399)

Intensive mobile use and muscles pain	Yes	No	Chi Square	P-Value
During the last 12 months, have you ever experienced ache, pain, discomfort, numbness	239 (59.9)	160 (40.1)	20.4	< 0.001
Neck	180 (45.1)	59 (14.8)	23.2	< 0.001
Shoulder	134 (33.6)	105 (26.3)	22.1	< 0.001
Elbow	81 (20.3)	158 (39.6)	20.5	< 0.001
Wrist/hand	135 (33.8)	104 (26.1)	20.4	< 0.001
Upper back	95 (23.4)	144 (36.1)	23.1	< 0.001
Lower back	94 (23.6)	145 (36.3)	20.5	< 0.001
Hip/thigh	65 (16.3)	174 (43.6)	24.2	< 0.001
Knee	67 (16.8)	172 (43.1)	21.5	< 0.001
Ankle/feet	61 (15.3)	178 (44.6)	21.8	< 0.001

50 – 60% response rate was recorded. 7 – 14% of prevalent cases were found to be life-hindering musculoskeletal pain. Severe neck pain (14%), shoulder pain (10%) and lower back pain (10.8%) were reported among participants owing to smartphone utility in daily life activities (Figure 3).

Among the studied samples, 10% of individuals need a medical consultant for the treatment of severe neck pain. The prevalence of severe musculoskeletal pain that required a medical consultant ranged between 3 – 10%, with the highest prevalence rate of neck pain (10%), followed by lower back pain (6.3%) and shoulder pain (6.3%) (Table 3).

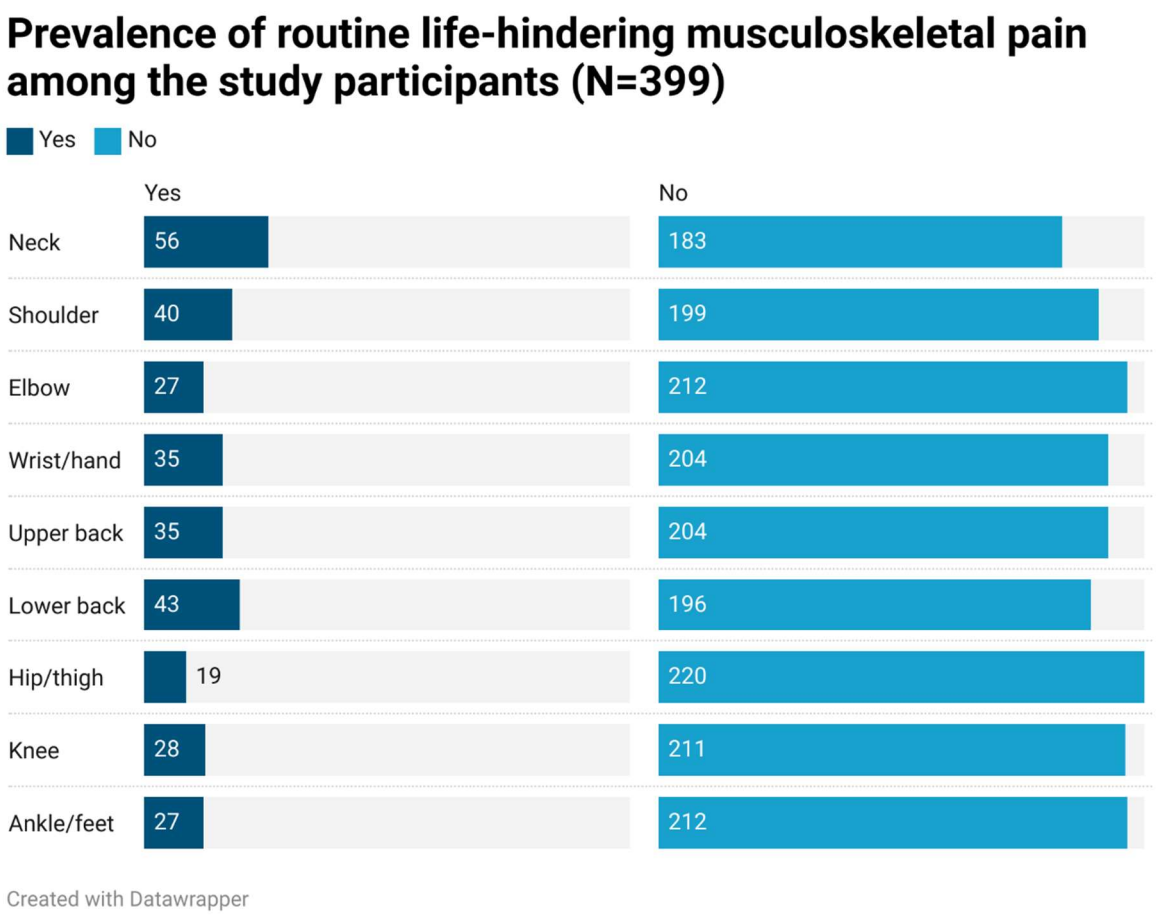

Figure 3 Prevalence of routine life-hindering musculoskeletal pain among the study participants

Table 3 Prevalence of medical consultant and treatment for smartphone associated musculoskeletal pain among study participants (N=399)

Need medical consultant during last 12 months due to severe pain	Yes	No
Neck	40 (10)	199 (49.9)
Shoulder	25 (6.3)	214 (53.6)
Elbow	20 (5)	219 (54.9)
Wrist/hand	22 (5.5)	217 (54.4)
Upper back	21 (5.3)	218 (54.6)
Lower back	25 (6.3)	214 (53.6)
Hip/thigh	11 (2.8)	228 (57.1)
Knee	20 (5)	219 (54.9)
Ankle/feet	17 (4.3)	222 (55.6)

4. DISCUSSION

The mobile phone has great importance in our daily life as it is not only used as a communication device, but advancements in technology make it an indispensable device equipped with fast, easy to use and most convenient technology. Despite all, the mobile phone has some severe health impacts. Over utilization of smartphone leads to musculoskeletal pain and behavioral changes (Ahmed et al., 2022). The purpose of this research was to examine the possible link between excessive smartphone use and musculoskeletal discomfort among Saudi Arabians.

In the present study, 59.9% of participants have been reported musculoskeletal pain. The most common site of muscle pain was the neck followed by the shoulder, wrist/hand and back (upper and lower). Neck pain presented the most common symptom

associated with increased smartphone usage; however, its prevalence was varied among different studies and reported as 26.3% to 60% (Toh et al., 2017). According to the survey study conducted on university students in Canada, the neck, upper back and shoulders were the most prevalent site of pain. Furthermore, sum total of smartphone use time was shown to be strongly related to neck and shoulder pain (Berolo et al., 2011).

Studies revealed that the head is flexed 33–45 degrees from vertical while using a smartphone which was found to be a significant risk factor for neck pain when the head is flexed repeatedly and for an extended period (Lee et al., 2015). Using a smartphone is associated with a slouched posture, forwards head posture and rounded shoulders in students, all of which may put strain on the cervical and lumbar spines and their ligaments (Bonney and Corlett, 2002; Janwantanakul et al., 2012). The flexed head increased the burden on cervical spines which may cause loss of curvature and accelerates the deterioration of ligaments (Hansraj, 2014).

Poor posture alters the length-tension association between the cervical spine and muscles of the shoulder girdle, thus affecting the pattern of muscle activation. When using a mobile phone, there is increased muscular activity in the shoulder and neck muscles that cause muscle fatigue and reduce the pain pressure threshold (Lee et al., 2015; Kim et al., 2012). Youngsters maintain the incorrect posture for extended periods, which may be a contributing factor to neck pain.

The study on Thailand population presented musculoskeletal morbidities such as shoulder protraction and flexions (wrist, neck, lower back, hand, upper back and elbow) among smartphone users. These uncomfortable poses have a damaging effect on soft tissues, causing musculoskeletal pain (Namwongsa et al., 2018). The musculoskeletal pain interrelated amid smartphone convenience is an adaptable aspect and can be secluded by retaining a fine stance which can assist to prevent stress on the musculoskeletal structures and reduce the incidence of smartphone-associated pain.

There are several caveats to this research. The use of a self-administered questionnaire raises the possibility of bias in this cross-sectional research. Furthermore, assuming a causal connection between exposure and result is problematic. Further research employing a longitudinal study design is recommended to explore the unanswered questions. Additionally, awareness, education and training for good posture maintenance can be implemented as preventative strategies to lower the incidence of musculoskeletal illnesses.

5. CONCLUSION

In conclusion, this cross-sectional study revealed the pervasiveness of smartphone-associated musculoskeletal pain among Saudi Arabians. Neck pain was most prevalent smartphone-associated muscle pain and the sternness of pain is associated with poor posture and the amount of time spent on smartphone usage.

Acknowledgment

The author would like to thank Deanship of research at Majmaah University for this opportunity.

Author Contributions

Conceptualization: Abdulmalik B Albaker and Saud M Alzahrani; Methods: Abdullah F Al Mula and Muath Alghamdi; Data collection: Farah Alnasser; Data analysis: Aljohrah Mohammed Al-Hunaif and Ali Hassan Siddiq Alkhaldi, Manuscript original draft preparation: Abdulmalik B Albaker and Nouf Ali Abdullah Asiri; Manuscript review: Abdulmalik B Albaker and Ibrahim Adel Hassan Al-Hajji; Supervision: Abdulmalik B Albaker

Ethical approval

The IRB approval was obtained from Majmaah University for Research Ethics committee (MUREC) (HA-01-R-088) with IRB approval number MUREC-May.22 / COM-2022 / 6-2.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript. Data was kept confidential and was used only for this study.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

The data will be available with the corresponding author and can be accessed on request via email.

REFERENCES AND NOTES

1. Ahmed S, Mishra A, Akter R, Shah M, Sadia AA. Smartphone addiction and its impact on musculoskeletal pain in neck, shoulder, elbow and hand among college going students: A cross-sectional study. Bull Fac Phys Ther 2022; 27(1):1-8. doi: 10.1186/s43161-021-00067-3
2. Al-Abdulwahab SS, Kachanathu SJ, Al-Motairi MS. Smartphone use addiction can cause neck disability. Musculoskeletal Care 2017; 15(1):10-12. doi: 10.1002/msc.1170
3. Baabdullah A, Bokhary D, Kabli Y, Saggaf O, Daiwali M, Hamdi A. The association between smartphone addiction and thumb/wrist pain: A cross-sectional study. Medicine (Baltimore) 2020; 99(10):e19124. doi: 10.1097/MD.0000000000019124
4. Berolo S, Wells RP, Amick BC 3rd. Musculoskeletal symptoms among mobile hand-held device users and their relationship to device use: A preliminary study in a Canadian university population. Appl Ergon 2011; 42(2):371-378. doi: 10.1016/j.apergo.2010.08.010
5. Bonney RA, Corlett EN. Head posture and loading of the cervical spine. Appl Ergon 2002; 33(5):415-417. doi: 10.1016/S0003-6870(02)00036-4
6. Choi JS, Yi B, Park JH, Choi K, Jung J, Park SW, Rhee PL. The uses of the smartphone for doctors: An empirical study from Samsung medical center. Healthc Inform Res 2011; 17(2):131-138. doi: 10.4258/hir.2011.17.2.131
7. Eitivipart AC, Viriyarojanakul S, Redhead L. Musculoskeletal disorder and pain associated with smartphone use: A systematic review of biomechanical evidence. Hong Kong Physiother J 2018; 38(2):77-90. doi: 10.1142/S1013702518300010
8. Hall B, Henningsen DD. Social facilitation and human–computer interaction. Comput Hum Behav 2008; 24(6):2965-2971. doi: 10.1016/j.chb.2008.05.003
9. Hansraj KK. Assessment of stresses in the cervical spine caused by posture and position of the head. Surg Technol Int 2014; 25(25):277-279.
10. Janwantanakul P, Sitthipornvorakul E, Paksaichol A. Risk factors for the onset of nonspecific low back pain in office workers: A systematic review of prospective cohort studies. J Manipulative Physiol Ther 2012; 35(7):568-577. doi: 10.1016/j.jmpt.2012.07.008
11. Kim GY, Ahn CS, Jeon HW, Lee CR. Effects of the use of smartphones on pain and muscle fatigue in the upper extremity. J Phys Ther Sci 2012; 24(12):1255-1258. doi: 10.1589/jpts.24.1255
12. Lee M, Hong Y, Lee S, Won J, Yang J, Park S, Chang KT, Hong Y. The effects of smartphone use on upper extremity muscle activity and pain threshold. J Phys Ther Sci 2015; 27(6):1743-1745. doi: 10.1589/jpts.27.1743
13. Lee S, Kang H, Shin G. Head flexion angle while using a smartphone. Ergonomics 2015; 58(2):220-226. doi: 10.1080/00140139.2014.967311
14. Namwongsa S, Puntumetakul R, Neubert MS, Boucaut R. Factors associated with neck disorders among university student smartphone users. Work 2018; 61(3):367-378. doi: 10.3233/WOR-182819
15. Statista. Number of smartphone mobile network subscriptions worldwide from 2016 to 2022, with forecasts from 2023 to 2028. Statista 2022. https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/
16. Toh SH, Coenen P, Howie EK, Straker LM. The associations of mobile touch screen device use with musculoskeletal symptoms and exposures: A systematic review. PLoS One 2017; 12(8):e0181220. doi: 10.1371/journal.pone.0181220