

## RESEARCH ARTICLE

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## Prevalence and risk factors associated with neck pain among smartphone users at the University of Balochistan, Pakistan: a cross-sectional study

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### Abstract

**Background** Shoulder and neck pain is a highly prevalent musculoskeletal disorder. Different factors have been associated with it; among these factors some common are the use of a computer and smartphones without a break, sitting in an uncomfortable position. It has been reported that the prevalence of neck pain among smartphone users ranges from 20.0%-73%. This study will evaluate the prevalence of neck pain among smartphone users and the risk factors associated with it at the University of Balochistan Quetta Pakistan.

**Method** This cross-sectional study was conducted from September to October 2022 at the University of Balochistan Quetta to find out the prevalence of neck pain and its risk factors. Data were collected randomly by distributing 500 questionnaires among the students irrespective of age, gender, department, and year of study. Data were analyzed using SPSS Version 23. Continuous variables were presented as mean  $\pm$  SD, and categorical variables as frequencies and percentages. Univariate and multivariate binary logistic regression analysis were used to find out the risk factors associated with neck pain and a p-value  $<0.05$  was considered significant.

**Results** The results revealed that the prevalence of neck pain was 73%. In MVBLR analysis, male gender (OR=0.360, p-value=0.000), students in 4th year (OR=3.281, p-value=0.002), Left handed (OR=0.395, p-value=0.002), the habit of physical exercise (OR=0.594, p-value=0.032), number of social media used in a day (OR=2.414, p-value=0.039), use of other electronic devices (OR=1.858, p-value=0.010), style of holding (OR=3.289, p-value=0.008) and posture adopted during smartphones use (OR=0.614, p-value=0.050) had a significant association with the neck pain during smartphone use among university students.

**Conclusion** In the current study high number of study, participants reported neck pain. Female gender, students in 4th year, left-handed, the habit of physical exercise, use of five or more social media applications, use of other electronic devices, and posture adopted on laying back were the risk factors associated with neck pain.

**Key words** neck pain, shoulder pain, smartphones, text syndrome

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## Introduction

Shoulder and neck pain is one of the most common musculoskeletal disorders. However, it is highly prevalent in community and associated with severe disability. Numerous factors, including high levels of physical activity and sports engagement, are linked with shoulder and neck pain [1]. Psychological issues and a negative self-evaluation of health contribute to the propagation of shoulder and neck pain [2]. Additionally shoulder and neck pain have also been linked to prolonged use computer or smartphone without a break or sitting in uncomfortable position [3, 4].

Smartphone technology has rapidly spread worldwide, with over 5 billion individuals having mobile devices, primarily smartphones for communication and entertainment [5]. Today's young adults have grown up with smartphones as integral parts of their lives. There is an observed increase in ownership and use of electronic devices among young adults, as these devices have gained significance due to their diverse capabilities [5-7]. A study reported that in the United States, 92% and in Australia, 95% of people aged 18 to 34 owned smartphones. However, as of January 2022, 82.90 million (36.5%) of Pakistan's total population were connected to the internet. This number of internet users in Pakistan increased by 22 million (35.9%) between 2021 and 2022 [8].

Globally, young adults aged 18-34 more regularly use smartphones and the internet than those aged 35 and above. There is also evidence that younger individuals are more likely to access the internet daily and engage in social networking. This regular use of smartphones can cause musculoskeletal disorders. Previous studies have reported a high prevalence range (20-82%) of shoulder and neck pain among college and university students related to smartphone and electronic device usage [9-15]. Few studies have reported the prevalence and risk factors associated with neck pain among smartphone users in Pakistan. This study

will evaluate the prevalence of neck pain among smartphone users and the associated risk factors among students at the University of Balochistan, Quetta, Pakistan.

## Methodology

### *Study design and study settings*

This cross-sectional study was conducted from September to October 2022 at the University of Balochistan (UOB) Quetta, Balochistan, Pakistan. The University of Balochistan is the province's first and oldest university, providing graduate and postgraduate courses in biological, health, social, computer and management sciences.

### *Study population*

The undergraduate students who were enrolled and studying in different departments at UOB Quetta and were using smartphones were approach and randomly selected after inclusion and exclusion criteria. The UOB has different campuses, but the data was collected at the main campus situated on Seryab road Quetta. The number of students enrolled in different departments at the campus are 11000+, and the sample was selected using simple random sampling.

### *Inclusion and exclusion criteria*

All the students who were regular and had been using the smartphone for the last one year and above were included, and those students who had a previous or recent history of musculoskeletal disorder, head or neck surgery, or any disc problem were excluded from the study.

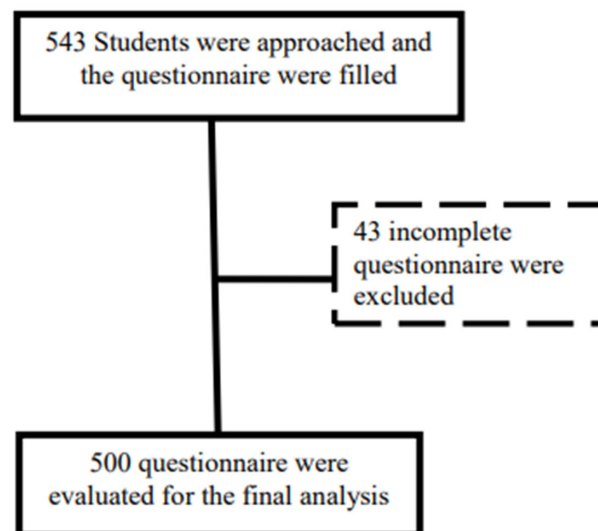


Figure 1. Flow chart of study participants evaluated for neck pain among smartphone users.

**Table 1. Socio demographic characteristics and pain prevalence among the study participants.**

Items	Variable	Frequency (%)	Pain, NO (%)	Pain, Yes (%)	P-value
Gender	Female	342 (68.4)	74 (21.6)	268 (78.4)	0.00
	Male	158 (31.6)	62 (39.2)	96 (60.8)	
Age(Mean=21.98 ±1.72)	18-22	328 (65.6)	92 (28.0)	236 (72.0)	0.454
	23-26	168 (33.6)	42 (25.0)	126 (75.0)	
	27-30	4 (0.8)	2 (50.0)	2 (50.0)	
Marital status	Unmarried	462 (92.4)	124 (26.8)	338 (73.2)	0.570
	Married	38 (7.6)	12 (31.6)	26 (68.4)	
Residence	Urban	362 (72.4)	102 (28.2)	260 (71.8)	0.427
	Rural	138 (27.6)	34 (24.6)	104 (75.4)	
Study Year	1 <sup>st</sup>	70 (14.0)	24 (34.3)	46 (65.7)	0.086
	2 <sup>nd</sup>	124 (24.8)	40 (32.3)	84 (67.7)	
	3 <sup>rd</sup>	112 (22.4)	30 (26.8)	82 (73.2)	
	4 <sup>th</sup>	120 (24.0)	22 (18.3)	98 (81.7)	
	5 <sup>th</sup>	74 (14.8)	20 (27.0)	54 (73.0)	
Handedness	Right-handed	422 (84.4)	106 (25.1)	316 (74.9)	0.015
	Left-handed	78 (15.6)	30 (38.5)	48 (61.5)	
Habit of Smoking	No	452 (90.4)	120 (26.5)	332 (73.5)	0.315
	Yes	48 (9.6)	16 (33.3)	32 (66.7)	
Habit of Physical Exercise	No	210 (42.0)	42 (20.0)	168 (80.0)	0.002
	Yes	290 (58.0)	94 (32.4)	196 (67.6)	

*Data collection*

A questionnaire was designed by adapting a standardized Nordic questionnaire used for analyzing neck pain. The questionnaire was divided into three sections. The first section comprised socio-demographic questions, while the next section examined behavioral characteristics such as smoking and physical exercise routines. The final section addressed smartphone use and postural characteristics, including the purpose of smartphone use, total daily usage time, frequency of social media use, breaks while using the smartphone, frequently adopted postures while using the smartphone, smartphone position during use, style of holding the smartphone, and incidence of neck pain.

Before data collection, five students were briefed on the study's methodology, purpose, and ethical considerations. Written informed consent was obtained from all participants after briefly explaining the study's objectives, purpose, benefits, and risks. Suitable precautions were taken to protect the privacy of information during and after data collection.

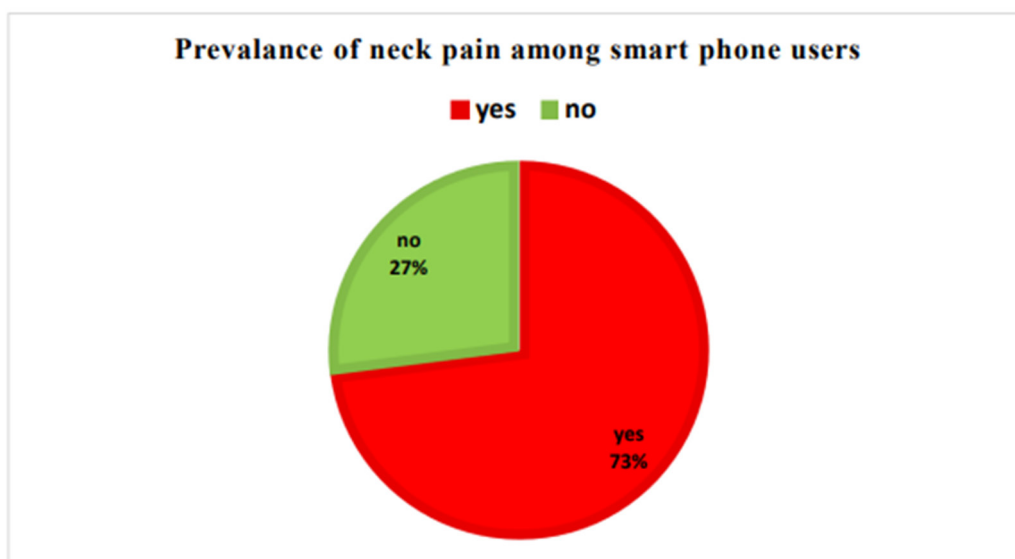
*Data Analysis*

The data were analyzed using the Statistical Package for the Social Sciences (SPSS) Version 23. Continuous variables were presented as mean ± standard deviations (SD), while categorical variables were expressed as frequencies and percentages. Univariate analysis was performed to identify associations between independent variables and neck pain. All independent variables included in the univariate analysis were selected based on the literature review and their reasonable association with neck pain. Independent variables with a univariate analysis p-value of less than 0.2 were included in a multivariate binary logistic regression (MVBLR) analysis to obtain the final model of variables with a statistically significant association (p-value <0.05) with neck pain.

**Results**

*Socio-demographic characteristics*

In order to find pertinent research, we conducted an extensive



**Figure 2. Prevalence of neck pain among smart phone users.**

literature search using electronic databases (PubMed, Embase, Google Scholar, and Cochrane Library). Relevant keywords including "TAU protein antibodies," "Alzheimer's disease," "therapeutics," and "clinical trials" were used in the search strategy. Only English-language articles published between the start of the search and the present were included. **Figure 1** is the flowchart outlines for the reviews.

#### *Inclusion and Exclusion Criteria*

The respondents filled out a total of 543 questionnaires out of which 43 incomplete questionnaire were excluded as shown in **Figure 1**. The socio-demographic characteristics of study respondents are given in **Table 1**. The mean age of the study respondents was 21.98±1.72, the majority of them were females 342 (68.4%), and 328 (65.6%) belonged to the age group 18-22 years, 462 (92.4%) of the respondents were unmarried, 362 (72.4%) from urban areas, 124 (24.8%) were enrolled in 2nd year and 120 (24.0) in the 4th academic year, while 422 (84.4%) were right-handed, 452 (90.4%) were non-smokers, and 290 (58.0) were having the habit of exercise.

#### *Smartphone usage and posture characteristics of the study participants*

The study respondents' smartphone usage and posture characteristics are discussed in **Table 2**. The majority of the study participants, 370 (74.0%) and 462 (92.4%) use smartphones daily for reading, texting, chatting, or other purposes on social media, respectively. 316 (63.2%) of the study participants do not use a smartphone daily for playing games, 130 (26.0%) participants use at least three social media apps on a typical day, and 432 (86.4%) use a smartphone daily for watching. For most participants, 304 (60.8%) spend 1-6 hours in a day on smartphones for texting and chatting, gaming, watching videos, reading, and other activities. 436 (87.2%) of the participants take a break while using the smartphone for different activities, and 298 (59.6%) participants use other devices like tablets, laptops, or desktops or others for

playing games, chatting, reading, watching videos, browsing the internet or other activities along with smartphones. However, most of the participants, 348 (69.6%), do not use a desktop, 288 (57.6%) hold their smartphone below eye level, 250 (50.0%) participants use both hands while using their smartphone, 240 (48.0%) participants adopt sitting posture while using a smartphone.

#### *Prevalence of neck pain in smartphones users*

Three-hundred-sixty-four students (73%) experienced neck pain within the last 12 months, has been shown in **Figure 2**. Female students reported a higher incidence of neck pain (78.4%) than male students (60.8%). The prevalence of neck pain was higher among those aged 23-26 years (75.0%) and those aged 18-22 (72.0%). The prevalence of neck pain was higher among the students of 4th (81.7%), 5th (73.0%) and 3rd (73.2%) year, unmarried students (73.2%), students from rural regions (75.4%), non-smokers (66.7%), right-handed (74.9%) and students who were not having physical exercises (80.0%) as compared those who were having the habit of physical exercises (67.6%) as shown in **Table 1**.

#### *Risk factors associated with neck pain in smartphones users*

Different socio-demographic variables such as gender, age, marital status, residence, year of study, handedness, smoking, physical exercise and different variables related to smartphone use such as used smartphone for reading, used smartphone for watching video, used smartphone for gaming, used other electronic devices, number of social media used daily and total time per day on smartphone. The posture such as the position of the phone while using, style of holding smartphone, frequent posture adopted and taking break during smartphone use. All the above-mentioned variables were evaluated through univariate analysis, among them gender, year of study, handedness, the habit of physical exercise, used smartphones for reading, number of social media used in a day, hours spent in a day on smartphones, use of other electronic devices, hold, style of holding and posture adopted while using smartphone had a p-value <0.2 and entered to multivariate

**Table 2. Smartphone usage and posture characteristics of the study participants.**

Items	Variables	Frequency (%)
Do you use smartphone daily for reading?	No	130 (26.0)
	Yes	370 (74.0)
Do you use smartphone daily for playing games?	No	316 (63.2)
	Yes	184 (36.8)
Do you use smartphone daily for texting or chatting or other purpose on social media?	No	38 (7.6)
	Yes	231 (92.4)
How many social media (like FB, telegram, WhatsApp, imo etc) do you use in a typical day?	One	50 (10.0)
	Two	90 (18.0)
	Three	130 (26.0)
	Four	114 (22.8)
	Five or more	116 (23.2)
Do you use your smartphone daily for watching video?	No	68 (13.6)
	Yes	432 (86.4)
How many hours do you spend on typical day on your smartphone for texting and chat, gaming, watching videos, reading and other activities?	1-6 hrs.	304 (60.8)
	7-12 hrs.	136 (27.2)
	13-18 hrs.	60 (12.0)
While you are using the smartphone for above activities, do you take breaks?	No-brake	64 (12.8)
	Take-brake	436 (87.2)
Have you been using other electronic devices like tablet, laptop or desktop or others for playing game, chatting, reading, watching video, browsing internet or other activities in addition to smartphone?	No	202(40.4)
	Yes	298 (59.9)
Do you use laptop/Tablet?	No	214 (42.8)
	Yes	246 (57.2)
Do you use desktop?	No	348 (69.6)
	Yes	152 (30.4)
How do you hold your smartphone while you are using it?	Below eye level	288 (57.6)
	At eye level	158 (31.6)
	Above eye level	54 (10.8)
How is your style of holding (hand in use) your smartphone while you are using it?	Use right hand only	194 (38.8)
	Use left hand only	56 (11.2)
	Use both Hands	250 (50.0)
	Standing	24 (4.8)
What is the frequent posture you adopted during the use of smartphone?	Sitting	240 (48.0)
	Laying on back	216 (43.2)
	Laying on chest	20 (4.0)

**Table 3. Univariate analysis of factors associated with neck pain among smartphone users.**

Items	Variable	Pain Yes (%)	Univariate analysis (95% CI)	p-value
Gender	Female	268 (78.4)	1	
	Male	96 (60.8)	0.428 (0.284-0.644)	0.000
Study Year	1 <sup>st</sup>	46 (65.7)	1	
	2 <sup>nd</sup>	84 (67.7)	1.096 (0.589-2.038)	0.773
	3 <sup>rd</sup>	82 (73.2)	1.426 (0.747-2.723)	0.282
	4 <sup>th</sup>	98 (81.7)	2.324 (1.182-4.571)	0.015
	5 <sup>th</sup>	54 (73.0)	1.409 (0.691-2.871)	0.345
Handedness	Right-handed	316 (74.9)	1	
	Left-handed	48 (61.5)	0.537 (0.323-0.891)	0.016
Habit of Physical Exercise	No	168 (80.0)	1	
	Yes	196 (67.6)	0.521 (0.343-0.792)	0.002
Do you use smartphone daily for reading?	No	102 (78.5)	1	
	Yes	262 (70.8)	0.666 (0.414-1.070)	0.093
How many social media (like FB, telegram, WhatsApp, imo etc) do you use in a day	One	30 (60.0)	1	
	Two	66 (73.3)	1.833 (0.880-3.819)	0.105
	Three	94 (72.3)	1.741 (0.878-3.449)	0.112
	Four	86 (75.4)	2.048 (1.008-4.159)	0.047
	Five or more	88 (75.9)	2.095 (1.032-4.252)	0.041
How many hours do you spend on typical day on your smartphone	1-6 hrs.	210 (69.1)	1	
	7-12 hrs.	107 (78.1)	1.597 (0.995-2.560)	0.052
	13-18 hrs	47 (79.7)	1.753 (0.889-3.457)	0.105
Have you been using other electronic devices like tablet, laptop or desktop or others	No	136 (67.3)	1	
	Yes	228 (76.5)	1.581 (1.062-2.353)	0.024
How do you hold your smartphone while you are using it?	Below eye level	206 (71.5)	1	
	At eye level	122 (77.2)	1.349 (0.859-2.118)	0.194
	Above eye level	36 (66.7)	0.796 (0.428-1.481)	0.472
How is your style of holding (hand in use) your smartphone while you are using it?	Use right hand only	132 (68.0)	1	
	Use left hand only	46 (82.1)	2.161 (1.023-4.562)	0.043
	Use both Hands	186 (74.4)	1.365 (0.902-2.066)	0.141
What is the frequent posture you adopted during the use of smartphone?	Standing	180 (75.0)	1	
	Sitting	14 (58.3)	0.467 (0.197-1.106)	0.083
	Laying on back	154 (71.3)	0.828 (0.547-1.254)	0.373
	Laying on chest	16 (80.0)	1.333 (0.429-4.144)	0.619

**Table 4. Multivariate analysis of factors associated with neck pain among smartphone users.**

Items	Variable	B	SE	Multivariate analysis (95% CI)	p-value
Gender	Male	-1.022	0.251	0.360 (0.220-0.589)	0.000
	2 <sup>nd</sup>	0.373	0.365	1.453 (0.711-2.969)	0.306
	3 <sup>rd</sup>	0.717	0.383	2.048 (0.967-4.337)	0.061
Study Year	4 <sup>th</sup>	1.188	0.389	3.281 (1.530-7.037)	0.002
	5 <sup>th</sup>	0.477	0.413	1.611 (0.718-3.618)	0.248
	Left-handed	-0.929	0.299	0.395 (0.220-0.710)	0.002
Habit of Physical Exercise	Yes	-0.521	0.243	0.594 (0.369-0.957)	0.032
	Two	0.415	0.430	1.515 (0.652-3.520)	0.334
How many social media do you use in a day	Three	0.530	0.402	1.698 (0.772-3.737)	0.188
	Four	0.568	0.425	1.764 (0.767-4.057)	0.181
	Five or more	0.881	0.426	2.414 (1.048-5.564)	0.039
How many hours do you spend on typical day on your smartphone	7-12 hrs.	0.420	0.275	1.522 (0.888-2.611)	0.127
	13-18 hrs.	0.349	0.391	1.418 (0.658-3.054)	0.372
Have you been using other electronic devices like tablet, laptop or desktop or others	Yes	0.619	0.239	1.858 (1.163-2.969)	0.010
How do you hold your smartphone while you are using it?	At eye level	0.384	0.260	1.468 (0.882-2.441)	0.139
	Above eye level	-0.203	0.363	0.816 (0.401-1.662)	0.576
How is your style of holding (hand in use) your smartphone while you are using it?	Use left hand only	1.191	0.446	3.289 (1.374-7.877)	0.008
	Use both Hands	0.203	0.252	1.225 (0.747-2.009)	0.420
	Sitting	-0.910	0.499	0.403 (0.151-1.071)	0.068
What is the frequent posture you adopted during the use of smartphone?	Laying on back	-0.487	0.249	0.614 (0.377-1.001)	0.050
	Laying on chest	-0.483	0.645	0.617 (0.174-2.181)	0.453

binary logistic regression (MVBLR) analysis as shown in **Table 3**. In the final MVBLR analysis, male gender (OR=0.360, p-value=0.000), students of 4th year (OR=3.281, p-value=0.002), Left handed (OR=0.395, p-value=0.002), the habit of physical exercise (OR=0.594, p-value=0.032), number of social media used in a day (OR=2.414, p-value=0.039), use of other electronic devices (OR=1.858, p-value=0.010), style of holding (OR=3.289, p-value=0.008) and posture adopted during smartphones use (OR=0.614, p-value=0.050) had a significant association with the neck pain during smartphone use among university students as shown in **Table 4**. This model fit was based on a non-significant Hosmer Lemeshow test (p-value=0.136) and an overall percentage of 72.8% from the classification table.

**Discussion**

To the best of our knowledge, this is the first study conducted in Balochistan, Pakistan, to determine the prevalence of neck pain

and its risk factors among smartphone users. In the current study, the prevalence of neck pain among smartphone users was 73.0%. This finding shows that neck pain is very common in smartphone users. The prevalence of this study was similar to the findings of other studies conducted in Singapore 74% [16], China 72.9% [17], and Saudi Arabia 71.2% [18] while higher than the other studies conducted in India 46.9% [19], Ethiopia 47.4% [20], Taiwan 52% [21] and Brazil 66.7% [22]. This high prevalence may be due to different reasons, such as the sample collection method and data collection procedure. Besides these, during COVID-19, classes were shifted from physical to online, increasing students' use of smartphones for their studies. The potential causes of neck pain are most often because of prolonged sitting. When seated for a longer period the neck muscles may be subjected to a sciatic load. Which can cause biomechanical stress, resulting in an increase in muscle tone. There are also conceivable relationships between neck position, rotation, and sitting position that, over time, lead to neck pain [23, 24]. In MVBLR different factors have been identified as

risk factors. Male gender had negative association with (p-value 0.000) which shows that neck pain was more among females than males, this can be that females use smartphones more than in male for their studies and other activities other reasons could be because, in general, women tend to have more musculoskeletal pain and more chronic pain conditions than men. This could be because women have a lower pain threshold than men [25], because they have natural differences in their somatic and visceral perception [26], and females are less physically active than men in our society, as well as because women tend to have more mental and psychological stress than men [27].

In the current study, the students of 4th year were (OR=3.281, p-value=0.002) more likely to experience neck pain than the first-year students. Similar findings were reported in other studies conducted in Ethiopia and China [20, 28]. These students had online classes during the period of COVID-19 which led them to long-term use of electronic devices, long practice hours, use of different social media platforms, and regular use of smartphones for longer period of timesm this suggests that neck pain may develop throughout the study. The current study also found that students who did not exercise regularly were more likely to get neck pain (p-value=0.032) than those who did exercise regularly. Similar findings were reported by other studies conducted in Ethiopia and China [20, 29]. This could be because muscles that aren't as strong or flexible can cause the structures of the neck to be out of place, which can lead to neck pain. While the students who exercised regularly were able to strengthen, lengthen, improve their flexibility, and make their muscles and ligaments strong enough to support and keep their necks in the appropriate posture so they could function effectively and avoid injury [30].

The current study also found that students who used five or more social media applications every day were (OD=2.414, p-value=0.039) at graeater risk to develop neck pain. Simillar results have been reported by other studies conducted elsewhere [16, 31]. This could be because they spend more time on social media platforms and do it all the time. Those students who were using other electronic devices with smartphones were (OR=1.858, p-value=0.010) at greater risk to develop neck pain than those students who were only using smartphones. Similar findings were reported in a study conducted in Singapore, which found that people who used different communication devices besides smartphones are 1.61 times more likely to get neck pain [21]. This means that when students use more devices daily, they also spend more time using them each day, which could make them more likely to get neck pain. Those students who were using the left hand to hold and those who were laying on their back position were more likely to develop neck pain with p-value=0.008 and p-value=0.050 respectively. This could be because their steady hand may not be left hand, and its muscles are not as flexible or strong which can cause misalignment of the neck's structures and causes neck and shoulder pain.

The study was limited because it was a cross-sectional convenience sampling study that only looked at university students. This research could not assess the intensity, duration, and nature of neck pain among the study participants. In addition, no suitable posture assessment technique was used.

## Conclusion

In the current study high number of study participants reported neck pain. Female gender, students of 4th year, left-handed, the habit of physical exercise, use of five or more social media applications, use of other electronic devices, and posture adopted on laying back were the risk factors associated with neck pain. The university should provide awareness regarding the proper use and duration of smartphones; also, universities should encourage

students to exercise regularly and provide the facilities they need to do.

## Acknowledgments

We extend our gratitude to all the students who participated in this research.

## Ethics approval

The Research and Ethics Committee of the Faculty of Pharmacy and Health Sciences, University of Balochistan, Quetta, approved the study. Informed consent was obtained from all study participants.

## Data availability

All relevant data are within the paper.

## Funding

The authors did not receive any funding or support to report.

## Authors' contribution

Syed Anayat Ullah conceptualized and supervised the study. Amna Bibi, Kainat Kasi, Laiba Iqbal, Muhammad Talha, and Gulzar Ahmed collected the data, while Jain Qasim, Muhammad Junaid, and Syed Bayazeed Roshan entered it. Abdul Wahid analyzed the data, and Syed Anayat Ullah critically reviewed it.

## Competing interests


The authors have declared that no competing interest exist.

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