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Original Research Article

The Relationship Between Smartphone Use and Musculoskeletal Disorders Among People in a Local Area in Bangladesh

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Abstract: Background: The widespread use of smartphones has become an integral part of daily life, but prolonged and improper use has been associated with an increased risk of musculoskeletal disorders (MSDs). Extended smartphone use may contribute to neck, shoulder, back, wrist, and hand pain due to poor posture and repetitive movements. This study aimed to investigate the relationship between smartphone use and musculoskeletal disorders among people in a local community in Bangladesh.

Methods: A cross-sectional study was conducted among 60 smartphone users aged 20–60 years in the Savar Thana area of Dhaka, Bangladesh, between August and November 2025. Participants were selected using a non-randomized purposive sampling technique. Data were collected through a pretested semi-structured questionnaire administered both face-to-face and online via Google Forms. Descriptive statistics and chi-square tests were performed using SPSS version 23.0 to analyze the data, with statistical significance set at $p < 0.05$.

Results: The majority of participants (56.7%) reported using smartphones for more than five hours per day, and 53.3% had been using smartphones for more than five years. Back pain (25.0%) was the most frequently reported musculoskeletal symptom, followed by neck pain (18.3%) and thumb pain (16.7%). Moderate pain was reported by 58.3% of respondents, while 66.7% experienced sleep disturbances associated with smartphone use. Significant associations were observed between smartphone usage patterns and musculoskeletal outcomes, including time spent using smartphones for non-calling activities ($p = 0.038$), pain type and physical symptoms ($p = 0.028$), duration of smartphone use and posture ($p = 0.037$), educational background and smartphone use ($p = 0.027$), and body weight and pain severity ($p = 0.013$).

Conclusion: Prolonged smartphone use is associated with an increased prevalence of musculoskeletal disorders, particularly back, neck, and upper extremity pain. Promoting ergonomic smartphone use, maintaining proper posture, limiting continuous screen time, and increasing public awareness may help reduce the burden of smartphone-related musculoskeletal disorders.

Keywords: *Smartphone use; Musculoskeletal disorders; Neck pain; Back pain; Ergonomics; Cross-sectional study; Bangladesh.*

1. INTRODUCTION

Technological advances, particularly the invention of smartphones, have revolutionized our way of modern life. A smartphone is operated analogously to a computer with an operating system and numerous software applications. It is not only used for communication but also for entertainment purposes, such as messages, music, media, internet access, photos, and games (Arslan & Tutgun Ünal, 2013; Demirci et al., 2014). In our digital society, the use of smartphones has increased rapidly. Parallel with the growing use of smartphones, musculoskeletal problems associated with intensive smartphone use have also been increased. Neck flexion is the most commonly adopted posture by smartphone

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users while looking at the visual display terminals of smartphones for extended periods; this posture may lead to neck disorders or postural deformity (Namwongsa et al., 2018).

The smartphone is a popular device that can perform complicated tasks, which typically have a touchscreen interface, Internet access, social network, and gaming applications (apps). In recent years, smartphones kept evolving to be multitasking, complete, and on many occasions displace electronic devices such as a computer, cameras, and many others, making us use them more often (Oxford Dictionaries, 2019). Smartphone use has greatly increased in recent days, and most of the daily tasks are done through these devices. As a result, long-time use may involve bad posture which causing musculoskeletal pain. Therefore, it is important to evaluate the association between addiction/overuse of smartphones and musculoskeletal pain (Alsalameh et al., 2019).

In the literature, there have been debates as to whether smartphone use has negative effects on physical and mental health. The present study investigated the extent to which smartphone addiction impacts musculoskeletal pain (Mustafaoglu et al., 2021). Most mobile device tasks require users to look sharply downwards or to hold their arms out in front of them to read the screen; this could lead to fatigue and pain in the neck and shoulders (Berolo et al., 2011). The musculoskeletal disorders related to smartphone use include muscle fatigue and loading of the neck and shoulder muscles. As a result, pain, stiffness, insensitivity to pain, and spasms in the neck, shoulders, and arms may appear (Rossignol et al., 1987).

While few studies examined the independent predictive effect of depression and anxiety on smartphone addiction in college students, they fell short of control; at the same time, for multiple socio-demographic, academic, lifestyle, personality traits, religious practice, and smartphone-related variables (age at first use, duration of use per weekday, purpose of using smartphone) in the studied sample (Demirci et al., 2015; Kim et al., 2015; Toda et al., 2015; Zhang et al., 2014) developed to assess problematic smartphone use or "addiction" in recent years (Lin et al., 2017; Foerster et al., 2015; Kwon et al., 2013). Research demonstrated that larger displays and holding designs of mobile devices are associated with increased neck flexion and wrist extension (Young et al., 2012). The specific issues arising from overuse of smartphones and the internet are not fully understood but includes (a) psychological effects such as poor memory, concentration and decision-making; anxiety, procrastination, and sleep disturbance (b) social effects such as the negative impact on relationships and loss of sense of community (c) physical effects such as harm from accidents, repetitive strain injury (RSI) and posture (Van Velthoven et al., 2018).

2. BACKGROUND

Musculoskeletal disorders (MSDs) in the adult population have increased significantly over the past decade. Evidence suggests that, due to the rapid development and usage of computer technology and personal electronic devices, duration, type of device used, and positions of people using them resulting musculoskeletal (MSK) pain (Clark et al., 2020). The incidence of musculoskeletal disorders of the hand, wrist, forearm, arm, and neck has been increasing worldwide due to the prolonged, forceful, low amplitude, repetitive use of hand-held devices. Continuous repetitive movements with the thumb and fingers have been identified as risk factors that may lead to disorders of the thumb and its musculatures such as tendinosis of the extensor pollicis longus, or myofascial pain syndrome in the hand.

In the literature, several studies have examined the impact of smartphone usage on the musculoskeletal system (AlAbdulwahab et al., 2017; Sharan et al., 2014; Kim & Kim, 2015; Queiroz et al., 2018; Alruzayhi et al., 2018). Orthopedists and physicians have long been dealing with these patients under the name of 'Repetitive Strain Injury' or 'overuse injury'. However, these names are also labeled as 'Nintenditis', 'Wii injury', 'SMS thumb', 'blackberry thumb', 'iPod finger' just because of their catchiness of trendy association. Sustained and prolonged gripping, repetitive pushing, and repetitive movements with the thumb and fingers have all been identified as risk factors that may lead to disorders of the thumb and extrinsic thumb musculature in the forearm (Gustafsson et al., 2003).

It is necessary to evaluate the physical changes that occur during the use of smartphones, especially during repeated movements in smartphone use, and to determine whether their usage is a risk factor that can induce musculoskeletal disorders. To date, no comprehensive study studies evaluating musculoskeletal problems using standardized assessment tools has directly focused on the adverse musculoskeletal health effects of problematic smartphone use. Therefore, the aim of this study was to investigate smartphone addiction levels and their impact on musculoskeletal pain prevalent among university students (Mustafaoglu et al., 2021).

2.1 Understanding Musculoskeletal Disorders

Definition and Types: Musculoskeletal disorders (MSDs) are injuries or disorders of the muscles, nerves, tendons, joints, cartilage, and spinal discs (Wikipedia, 2025). Work-related MSDs (WMSDs) are conditions in which the work environment and performance of work contribute significantly to their causation, but also can occur outside of work (Medical News Today, 2025).

Common MSDs Associated with Smartphone Use:

1. **Tendinitis:** Inflammation or irritation of a tendon, a thick cord that attaches bone to muscle (Almekinders, 1998)
2. **Myofascial Pain Syndrome:** Chronic pain disorder caused by sensitivity and tightness in the myofascial tissues
3. **Fibromyalgia:** A disorder characterized by widespread musculoskeletal pain accompanied by fatigue, sleep, memory, and mood issues
4. **Thoracic Outlet Syndrome:** A group of disorders that occur when blood vessels or nerves in the space between the collarbone and the first rib become compressed
5. **De Quervain's Syndrome:** Painful condition affecting the tendons on the thumb side of the wrist
6. **Text Neck Syndrome:** Neck pain and damage sustained from looking down at a mobile device for extended periods
7. **SMS Thumb:** Repetitive strain injury of the thumb caused by excessive texting

3. LITERATURE REVIEW

The study of Ahmed et al. (2021) reported that prolonged smartphone use may cause neck pain (46.9% cases), thumb pain (29.2% cases), mild to severe neck disability (42.5% cases) and other musculoskeletal problems may initially be short-term but can lead to long-term disabilities if proper caution is not taken.

Berolo et al. (2011) stated that most participants (84%) of their study reported pain in at least one body part, among them right-hand pain was most common at the base of the thumb. The authors also found significant associations between time spent on internet browsing and pain in the base of the right thumb, and total time spent using a mobile device and pain in the right shoulder and neck.

Legan and Zupan (2022) found that the prevalence of Musculoskeletal pain (MSP) was 39.6%, the most common musculoskeletal symptoms were in the back (57.1%) and shoulder (50%). This study emphasized the importance of knowledge of mobile device ergonomics among working students.

Sharan et al. (2014) exclaimed that all 70 subjects in their study had pain in the thumb and forearm with associated burning, numbness and tingling around the thenar aspect of the hand, and stiffness of wrist and hand following extensive usage of handheld devises (HHD). Among them, 61% had symptoms on the right side; 13% on left and 26% had bilateral symptoms. 47% complained of onset of symptoms following extensive text messaging. All the subjects were diagnosed to have either tendinosis of Extensor Pollicis Longus or Myofascial Pain Syndrome affecting the 1st interossei, thenar group of muscles and Extensor Digitorum Communis. Surprisingly, 100% of the subjects recovered completely following rehabilitation using a sequenced protocol.

Khan and Ambati (2022) described significant relationships between musculoskeletal neck and shoulder pain with time spent (typically 6-9 hours a day) on smartphone texting. The authors also mentioned that excessive flexed neck-trunk posture during smartphone texting, causing pain symptoms, and are mostly of major concern to heavy users.

The review of Zirak et al. (2020) demonstrated that the prevalence of MSK complaints among mobile phone users ranged 8.2%–89.9%, and neck and upper back complaints had the highest prevalence rates ranging from 55.8% to 89.9%. The most common MSK pain symptoms and pathologies associated to mobile phone use were Myofascial syndrome, Fibromyalgia, Thoracic outlet syndrome, Tendonitis, and De Quervain's syndrome.

A biomechanical analysis of thumb motion conducted by Ong (2009) using a 6-camera reflective marker based motion capture (MOCAP) system (Vicon MX13) at a frame rate of 120Hz revealed that during messaging on a mobile phone thumb flexion-extension occurred mainly in the IP and MCP joints and the maximum flexion for IP joint was 20.2º at key *'' and was 18.3º at key '#' for MCP joint. In addition, Abduction-adduction of MCP and CMC joints were smaller than flexion-extension and thumb opposition. Moreover, the maximum abduction for MCP and CMC joints were 7.2º and 8.7º respectively at key "* and the maximum thumb opposition for MCP and CMC joints were 17.0º at key '4' and 13.5º at key '9' respectively. They found the incidence of peak force was shown to link to high flexion angle of the IP joint and in thumb opposition of the MCP joint.

Priyal and Megha (2018) showed that musculoskeletal problems in neck and hand (predominantly thumb) can be seen in smartphone addicted students which may be short term initially but may later lead to long term disability.

Minkyung Lee et al. (2015) showed that smartphone operation with one hand caused greater upper trapezius (UT) pain and induced increased upper extremity muscle activity.

Biomechanical measures of Ko et al. (2013) demonstrated that person with short limb length developed more severe signs of thenar fatigue. On the other hand, person with longer arms may develop greater discomfort in the neck, shoulder, and back.

Chany et al. (2007) stated that biomechanical measures demonstrated people with short limb lengths developed more severe signs of thenar fatigue. Person with longer arms developed greater discomfort in the neck, shoulder, and back.

The Journal of Korean Physical Therapy (2016) stated that people with neck pain had significantly higher disability scores than those of no neck pain.

Qasim et al. (2017) conducted a study to investigate the effect of the excessive use of smartphones. They mentioned that the results showed significant visual problems caused by smartphone use and border line significant ear problems due to headsets use.

Samaha and Hawi (2016) mentioned that the results showed that smartphone addiction risk was positively related to perceived stress, but negatively related to satisfaction with life. Additionally, they found a smartphone addiction risk was negatively related to academic performance.

4. METHODOLOGY

4.1 Objectives

The main objective of the study was to find out the prevalence of musculoskeletal disorders among smartphone users. The specific objectives were:

- To determine the prevalence of musculoskeletal disorders among smartphone users in the study area
- To identify the association between smartphone usage patterns and musculoskeletal disorders
- To examine the socio-demographic factors associated with smartphone-related musculoskeletal disorders
- To assess the posture and duration of smartphone use among participants
- To identify the most common musculoskeletal symptoms experienced by smartphone users

4.2 Study Design

It was a cross-sectional study.

4.3 Study Area

Most of the participants were from a local regional area of Savar Thana, Dhaka, Bangladesh.

4.4 Study Period

The study was conducted from 1st August to 15th November 2025.

4.5 Sampling Technique

A non-randomized purposive sampling technique was used to reach out the potential participants.

4.6 Sample Size

Out of them 60 subjects with musculoskeletal problems responded and returned the completed questionnaire who were eventually selected for this study.

4.7 Inclusion Criteria

- Subjects who were 20 to 60 years of age
- Both male and female participants were included in this study
- Subjects who were using smartphones
- Who were willing to give consent to participate in this study
- Who had musculoskeletal problems

4.8 Exclusion Criteria

- Subjects who are under 20 years of age
- Persons who are psychologically disturbed
- Subjects who are not willing to participate in this study

4.9 Data Collection Tools

A pretested, Microsoft Excel, modified, interviewer administration, and semi-structured questionnaire were used to collect the data. A set of questionnaires about smartphone uses was prepared to collect data for this study. Some of the subjects were interviewed face to face and other people were invited in social media with a request to answer the questionnaire via a Google Form to collect data.

4.10 Data Management and Analysis Plan

After the collection of data, the respondents were organized. Data was entered into the computer into a database in the software package. Statistical Package for the Social Sciences (SPSS) Version 23.0 (Polar engineering and consulting, Chicago) using descriptive statistics such as frequency, distribution, range, mean, and percentage. All scores and percentages were computed and presented in tabular form, charts, and graphs as appropriate. Further, it was analyzed with the help of the chi-square test and P-value. Finally, the data was interpreted on the basis of the study findings.

4.11 Quality Control and Quality Assurance

This preliminary study had a number of limitations. The experimental study was a risk for the respondents. The sample size was comparatively small due to the shortage of time and financial constraints of the research period and thus the result could not be generalized.

4.12 Ethical Considerations

Prior to the commencement of this study, the research protocol was approved by the research committee of the academic institution. The aims and objectives of the study along with its procedure, risks, and benefits were explained to the respondents in an easily understandable local language and then informed consent was taken from each. Then it was assured that all information and records will be kept confidential and used only for research purposes.

4.13 Limitations of the Study

The study was conducted within a short period which is the main limitation of the study. Most previous studies of musculoskeletal disorders have been based on students' use of computers. However, these days, many students use smartphones for longer periods and more frequently than computers because they are small, easily portable, and accessible. Despite this, there has been little research on the relationship between their use, pain, and posture or smartphone use's effects on the musculoskeletal structure of each body region.

5. RESULTS

Section A: Socio-demographic Information

Table 01: Distribution of the study subjects by age (n=60)

Age in years	Frequency	Percentage (%)
20-30 years	26	43.3
31-40 years	12	20.0
41-50 years	13	21.7
51-60 years	9	15.0
Total	**60**	**100.0**
Mean ± SD	**28.3333 ± 7.21502**	

Table 01 revealed that the mean age of the respondents were 28.3333 ± 7.21502 years with a range from 20 to 60 years. It was found that 43.3%, 20.0%, 21.7% and 15.0% of the respondents belonged to age group 20-30 years, 31-40 years, 41-50, and 51-60. Table 1 found that 20-30 years age group were more used smart phone.

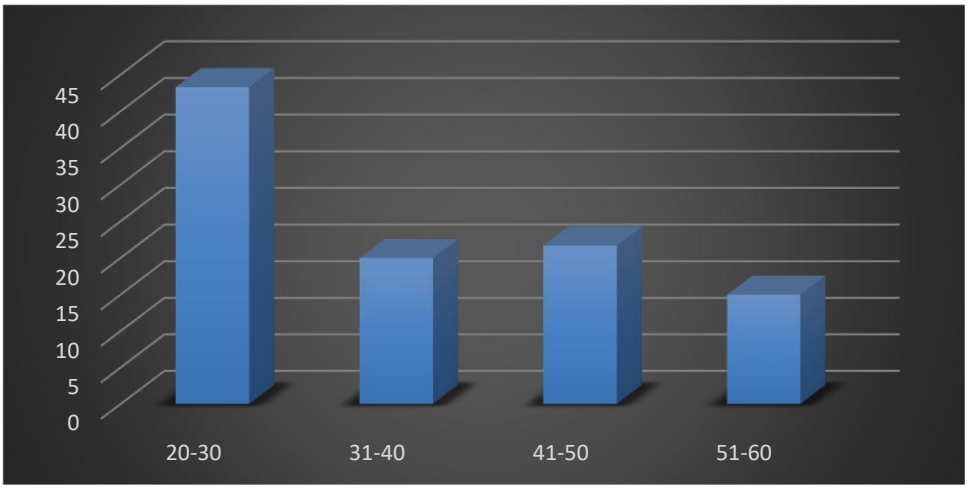

Figure-01: Distribution of respondents by age

Table 02: Distribution of respondents by gender (n=60)

Gender	Frequency	Percentage (%)
Male	32	53.3
Female	28	46.7
Total	**60**	**100.0**
Mean ± SD	**1.4667 ± 0.50310**	

The table-2 revealed that the mean gender of the respondents were 1.4667±0.50310 with a range of 53.3%, 46.7% male & female. It was found that of the respondents belonged to male & female. Table-2 found that male groups were more used smart phone.

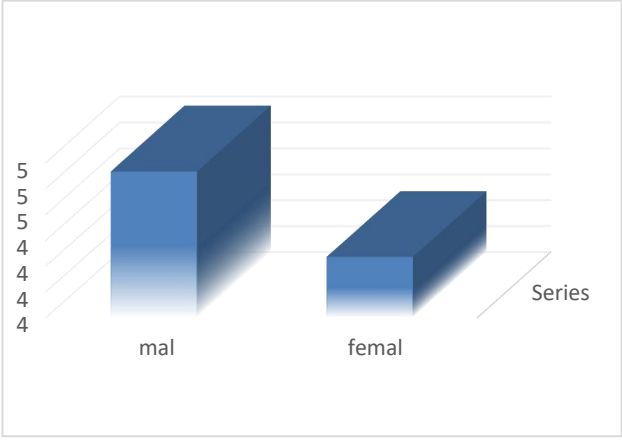

Figure-02: Distribution of respondents by gender

Table 03: Distribution of respondents by Marital Status (n=60)

Marital Status	Frequency	Percentage (%)
Married	21	35.0
Unmarried	29	48.3
Divorce	6	10.0
Widow	4	6.7
Total	**60**	**100.0**
Mean ± SD	**1.8833 ± 0.84556**	

The table-3 revealed that the mean marital status of the respondents were 1.8833 ± 0.84556 with a range from married, unmarried, divorce & widow. It was found that 35%, 48.3%, 10.0%, 6.7% of the respondents belonged to married, unmarried, divorce & widow. Table-3 found that unmarried groups were more used smart phone.

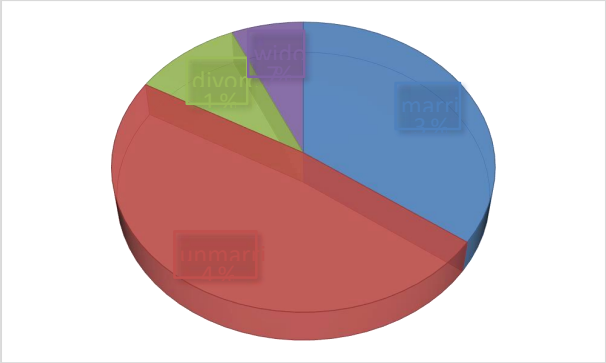

Figure-03: Distribution of respondents by marital status

Table 04: Distribution of respondents by Educational Background (n=60)

Educational Background	Frequency
Below SSC	10
HSC	18
Graduate	32
Total	**60**
Mean ± SD	**2.3667 ± 0.75838**

The table-4 revealed that the mean educational background of the respondents were 2.3667 ± 0.75838. It was found that 16.7%, 30.0%, 53.3% of the respondents belonged to educational background group Below SSC, HSC, Graduate. Table-4 found that graduate background groups were more used smart phone.

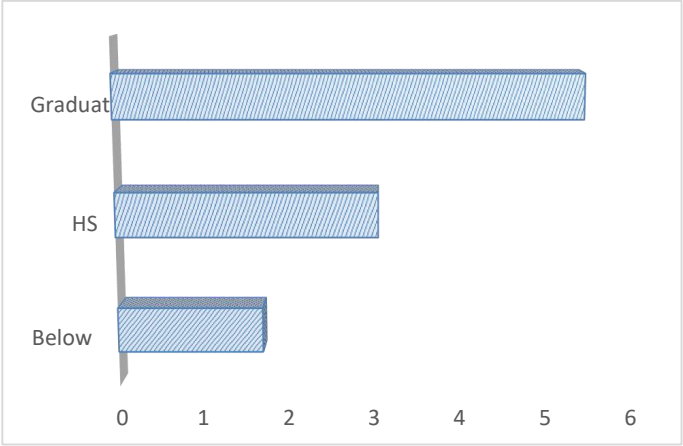

Figure-04: Distribution of respondents by educational background

Table 05: Distribution of respondents by Occupation (n=60)

Occupation	Frequency	Percentage (%)
Students	30	50.0
Housewife	13	21.3
Worker	2	3.3
Service Holder	5	8.7
Business	7	11.7
Retired person	3	5.0
Total	**60**	**100.0**
Mean ± SD	**2.2500 ± 1.64291**	

The table-5 revealed that the mean occupation of the respondents were 2.2500 ± 1.64291. It was found that 50%, 21.3%, 3.3%, 8.7%, 11.7%, and 5.0% of the respondents belonged to occupational group Students, Housewife, worker, service holder, Business, retired person. Table-5 found that students groups were more used smart phone.

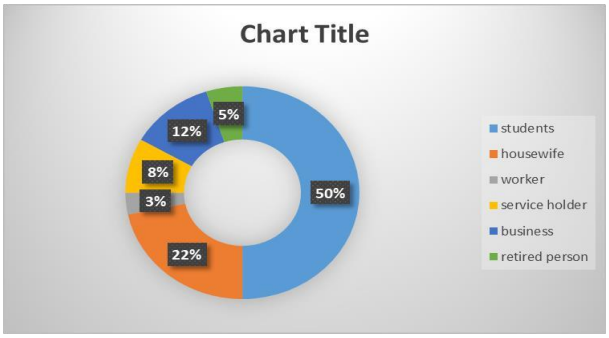

Figure-05: Distribution of respondents by occupation

Table 06: Distribution of respondents by Body weight (n=60)

Body weight (kg)	Frequency	Percentage (%)
40-50	5	8.3
51-60	11	18.3
61-70	19	31.7
71-80	17	28.3
81-90	8	13.3
Total	**60**	**100.0**
Mean ± SD	**63.3667 ± 8.35843**	

Table 06 revealed that the mean weight of the respondents were 63.3667 ± 8.35843 with a range from 40 to above 90 years. It was found that 8.3%, 18.3%, 31.7%, 28.3% and 13.3% of the respondents belonged to weight group 40-50 kg, 51-60 kg, 61-70 kg, 71-80 kg, 81-90 kg. Table-6 found that 61-70 kg weight group were more used smart phone.

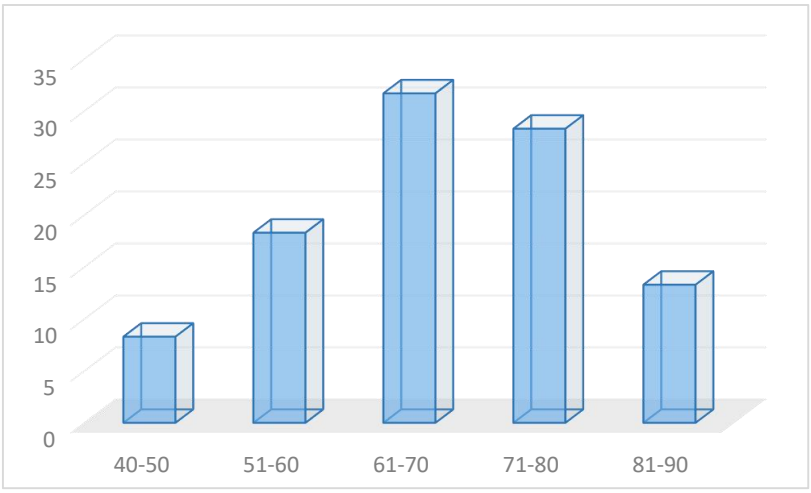

Figure-06: Distribution of respondents by body weight

Section B: Smartphone Related Variables

Table 07: Distribution of respondents by use of smartphone in time (n=60)

Use of smartphone in time	Frequency	Percentage (%)
Less than 1 hour	9	15.0
1 to 3 hours	7	11.7
3 to 5 hours	10	16.7
More than 5 hours	34	56.7
Total	**60**	**100.0**
Mean ± SD	**3.1500 ± 1.13234**	

Table 07 revealed that the mean use of smartphone in times of the respondents were 3.1500 ± 1.13234 with a range from less than 1 hour to more than 5 hours. It was found that 15.0%, 11.7%, 16.7%, and 56.7% of the respondents. Table-7 found that more than 5 hours group were more used smart phone.

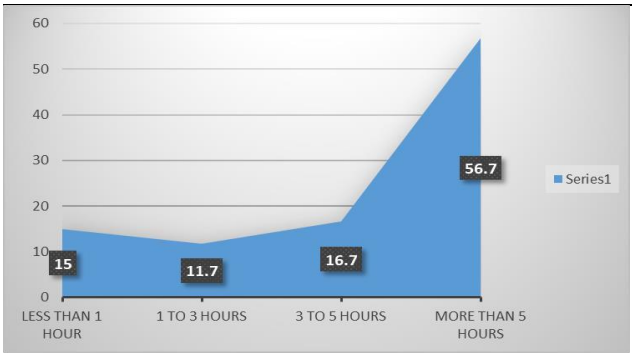

Figure-07: Distribution of respondents by use of smartphone in time

Table 08: Distribution of respondents by years of smartphone use (n=60)

Years of smartphone use	Frequency	Percentage (%)
Less than 1 year	6	10.0
1 to 3 years	12	20.7
3 to 5 years	10	16.7
More than 5 years	32	53.3
Total	**60**	**100.0**
Mean ± SD	**3.1333 ± 1.06511**	

Table 08 revealed that the mean years of smartphone use of the respondents were 3.1333 ± 1.06511 with a range from less than 1 hour to more than 5 hours. It was found that 10.0%, 20.7%, 16.7%, and 53.3% of the respondents. Table-8 found that more than 5 years group were more used smart phone.

Figure-08: Distribution of respondents by years of smartphone use

Table 09: Distribution of respondents by times to talk in smartphone (n=60)

Time to talk in smartphone	Frequency	Percentage (%)
Less than 10 minutes	16	26.7
10 to 30 min	17	28.3
More than 30 min	27	45.7
Total	**60**	**100.0**
Mean ± SD	**2.1833 ± 0.83345**	

Table 09 revealed that the mean times to talk in smartphone of the respondents were 2.1833 ± 0.83345 with a range from less than 10 minutes to more than 30 minutes. It was found that 26.7%, 28.3%, 45.7% of the respondents. Table-9 found that more than 30 minutes group were more used smart phone.

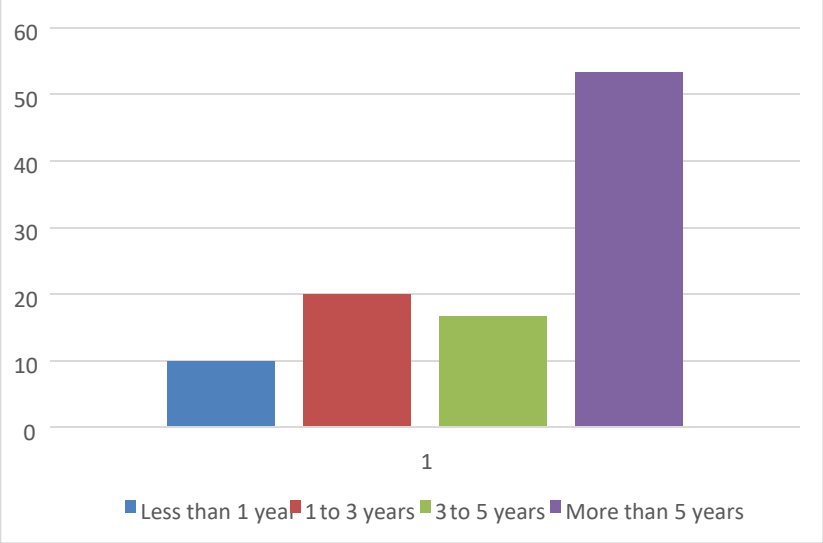

Figure-09: Distribution of respondents by times to talk in smartphone

Table 10: Distribution of respondents by times use of smartphone other than talking (n=60)

Time use of smartphone other than talking	Frequency	Percentage (%)
Less than 1 hour	5	8.3
1 to 2 hours	7	11.7
2 to 3 hours	16	26.7
More than 3 hours	32	53.3
Total	**60**	**100.0**
Mean ± SD	**3.2500 ± 0.96770**	

Table 10 revealed that the mean times use of smartphone other than talking of the respondents were 3.2500 ± 0.96770 with a range from less than 1 hour to more than 3 hours. It was found that 8.3%, 11.7%, 26.7% and 53.3% of the respondents. Table-10 found that more than 3 hours group were more used smart phone.

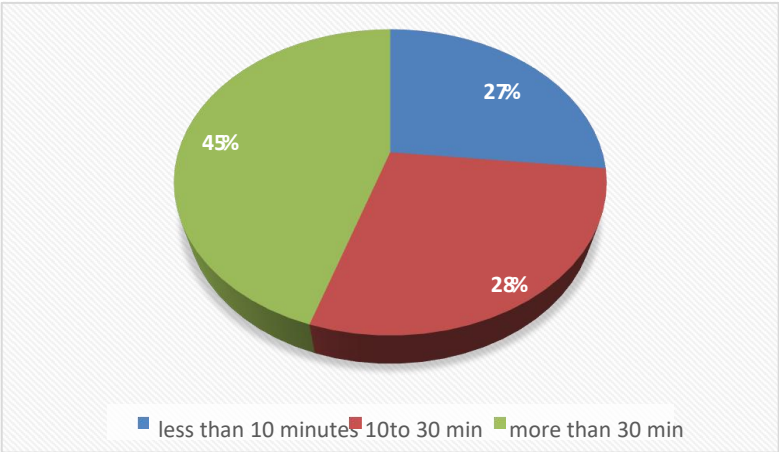

Figure-10: Distribution of respondents by times use of smartphone other than talking

Table 11: Distribution of respondents by times play games in smartphone (n=60)

Time play games in smartphone	Frequency	Percentage (%)
Less than 1 hour	15	25.0
1 to 3 hours	10	16.7
More than 3 hours	30	50.0
None of them	5	8.3
Total	**60**	**100.0**
Mean ± SD	**2.4167 ± 0.96184**	

Table 11 revealed that the mean times play games in smartphone of the respondents were 2.4167 ± 0.96184 with a range from less than 1 hour to more than 3 hours. It was found that 25.0%, 16.7%, 50.0% and 8.3% of the respondents. Table-11 found that more than 3 hours group were more used smart phone.

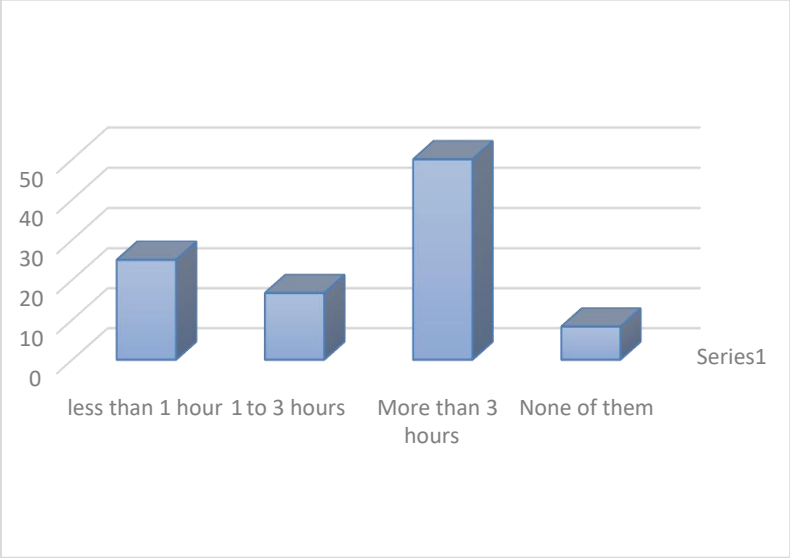

Figure-11: Distribution of respondents by times play games in smartphone

Table 12: Distribution of respondents by posture of smartphone use (n=60)

Posture of smartphone use	Frequency	Percentage (%)
Standing	9	15.0
Sitting	35	58.3
Lying	16	26.7
Total	**60**	**100.0**
Mean ± SD	**2.1167 ± 0.64022**	

Table 12 revealed that the mean posture of smartphone use of the respondents were 2.1167 ± 0.64022. It was found that 15.0%, 58.37%, 26.7% of the respondents. Table-12 found that sitting posture group were more used smart phone.

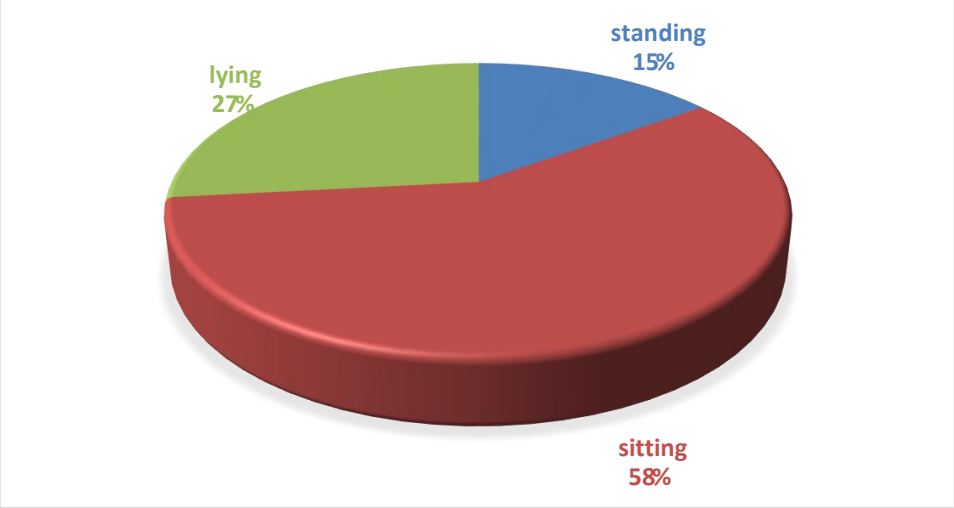

Figure-12: Distribution of respondents by posture of smartphone use

Section C: Disease-related Variables

Table 13: Distribution of respondents by symptoms after use of smartphone (n=60)

Symptoms after use of smartphone	Frequency	Percentage (%)
Back pain	15	25.0
Neck pain	11	18.3
Wrist pain	4	6.7
Shoulder pain	5	8.3
Pain in the Small joint of the hand thumb	10	16.7
Numbness in the hand	7	11.7
Weakness in the arm	8	13.3
Total	**60**	**100.0**
Mean ± SD	**3.6167 ± 2.19469**	

Table 13 revealed that the mean symptoms after use of smartphone of the respondents were 3.6167 ± 2.19469. It was found that 25.0%, 18.3%, 6.7%, 8.3%, 16.7%, 11.7%, and 13.3% of the respondents. Table-13 found that more respondents suffering from back pain after use smart phone.

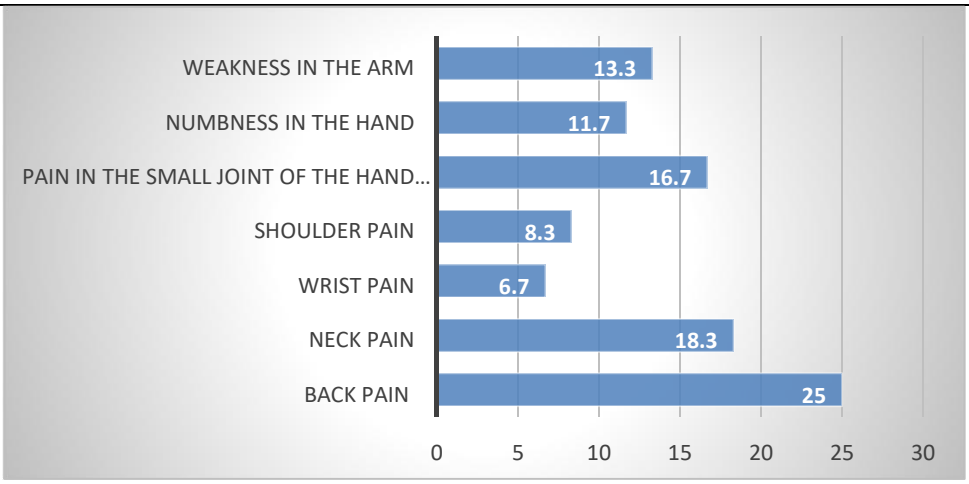

Figure-13: Distribution of respondents by symptoms after using smartphone

Table 14: Distribution of respondents by types of pain (n=60)

Types of pain	Frequency	Percentage (%)
Mild	15	25.0
Moderate	35	58.3
Severe	10	16.7
Total	**60**	**100.0**
Mean ± SD	**1.9167 ± 0.64550**	

Table 14 revealed that the mean types of pain of the respondents were 1.9167 ± 0.64550. It was found that 25.0%, 58.3%, 16.7% of the respondents. Table-14 found that most of the respondents are feel moderate pain.

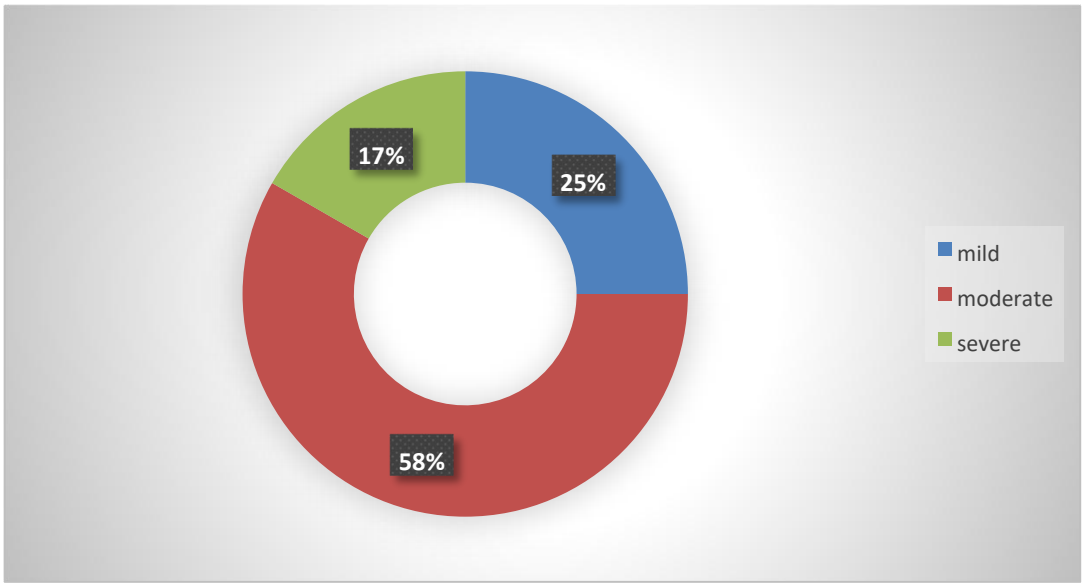

Figure-14: Distribution of respondents by types of pain

Table 15: Distribution of respondents by hand use smartphone (n=60)

Hand use smartphone	Frequency	Percentage (%)
One	18	30
Two	42	70
Total	**60**	**100.0**
Mean ± SD	**1.7000 ± 0.46212**	

Table 15 revealed that the mean hand use of smartphone of the respondents were 1.7000 ± 0.46212. It was found that 30.0%, 70.0% of the respondents. Table-15 found two hand respondents were more used smart phone.

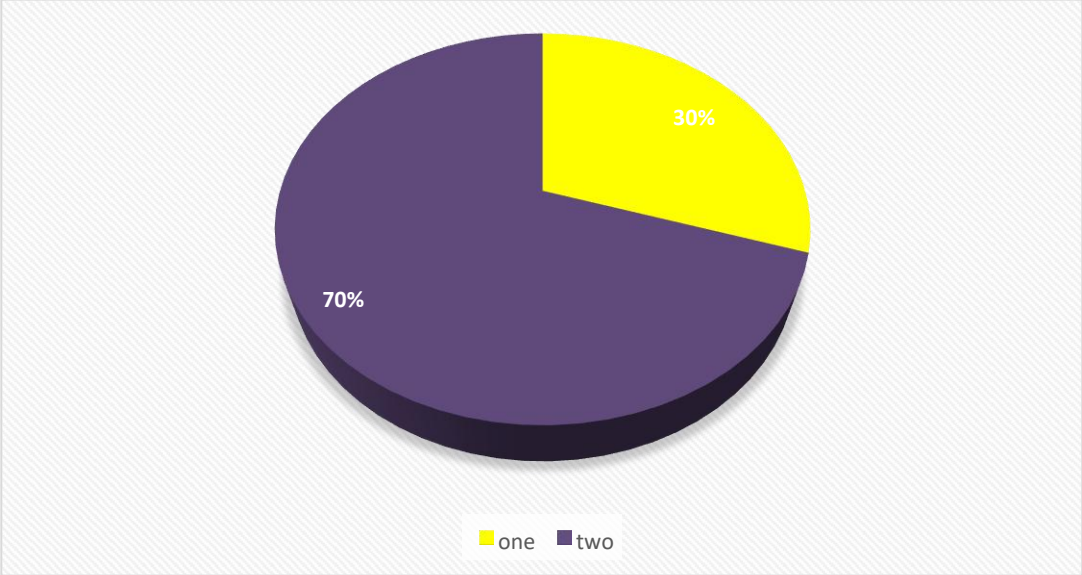

Figure-15: Distribution of respondents by hand use smart phone

Table 16: Distribution of respondents by problem existed (n=60)

Problem existed	Frequency	Percentage (%)
Less than 3 months	11	18.3
3 months	20	33.3
More than 3 months	29	48.3
Total	**60**	**100.0**
Mean ± SD	**2.3000 ± 0.76579**	

Table 16 revealed that the mean problem existed of the respondents were 2.3000 ± 0.76579. It was found that 18.3%, 33.3%, and 48.3% of the respondents. Table-16 found that more than 3 months respondents were more affected.

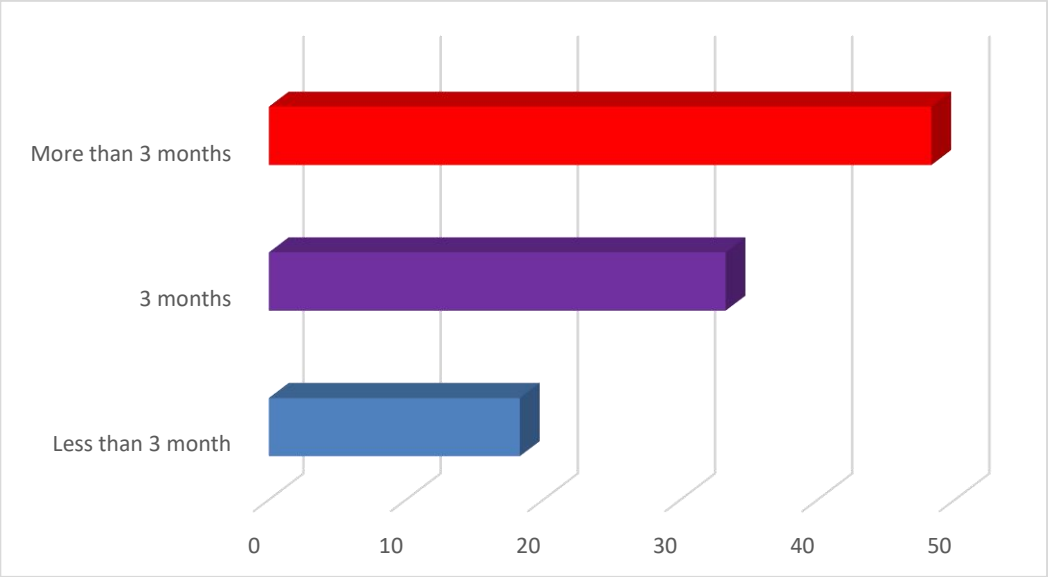

Figure-16: Distribution of respondents by problem existed

Table 17: Distribution of respondents by make problem better (n=60)

Make problem better	Frequency	Percentage (%)
Continue using the phone	6	10
Stop using the phone	32	53.3
Rest	22	36.7
Total	**60**	**100.0**
Mean ± SD	**2.2667 ± 0.63424**	

Table 17 revealed that the mean problem existed of the respondents were 2.2667 ± 0.63424. It was found that 10%, 53.3%, and 36.7% of the respondents. Table-17 found that stop using phone respondents were more.

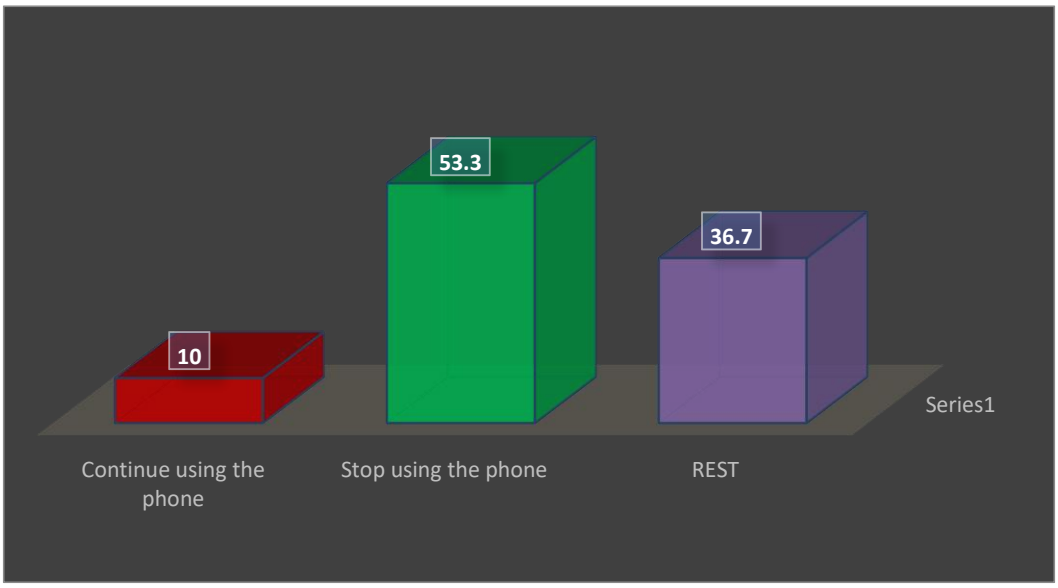

Figure-17: Distribution of respondents by make problem better

Table 18: Distribution of respondents by sleep problem (n=60)

Sleep Problem	Frequency	Percentage (%)
Yes	40	66.7
No	20	33.3
Total	**60**	**100.0**
Mean ± SD	**1.3333 ± 0.47538**	

Table 18 revealed that the mean sleep problem respondents were 1.3333 ± 0.47538. It was found that 66.7%, 33.3% of the respondents. Table-18 found that sleep problem respondents were more.

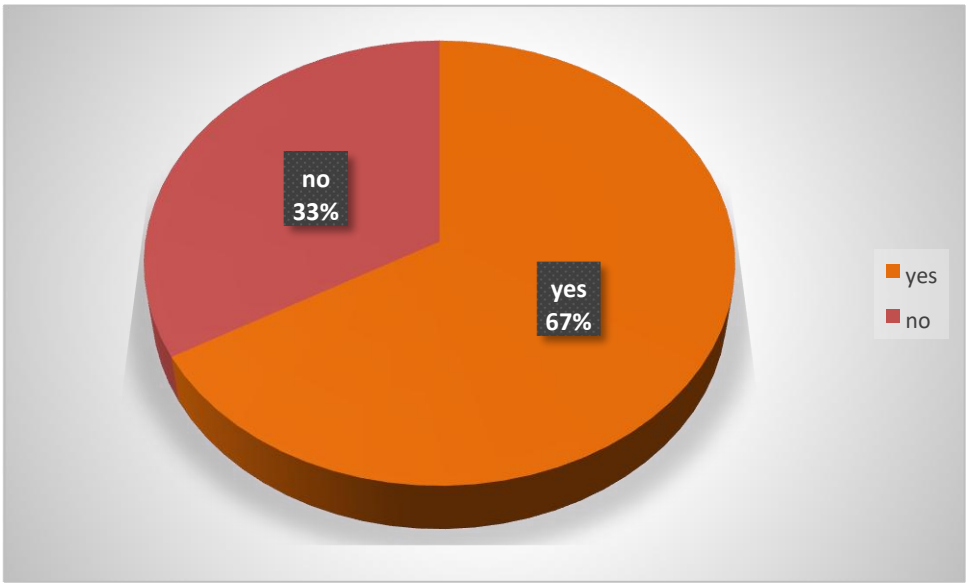

Figure-18: Distribution of respondents by sleep problem

Section D: Association Analysis

Table 19: Distribution and Association between how much time use and how much time other than talking in smartphone

How much time use than talk	Less than 1 hour	1 to 3 hours	3 to 5 hours	More than 5 hours	Total	P-value
Less than 1 hour	5	0	0	0	5	
1 to 2 hours	4	3	0	0	7	
2 to 3 hours	0	3	10	3	16	
More than 3 hours	0	0	0	32	32	
Total	**9**	**6**	**10**	**35**	**60**	**0.038**

The table 19 found that the p-value was 0.038 which was less than 0.05 that was statistically significant association found between how much times other than talking and how much time other than talking in the smartphone.

Table 20: Distribution and Association between types of pain and physical symptoms using smartphone

Types of pain	Back pain	Neck pain	Wrist pain	Shoulder pain	Hand and thumb	Numbness hand	Weakness arm	Total	P-value
Mild	15	0	0	0	0	0	0	15	
Moderate	0	11	4	5	12	3	0	35	
Severe	0	0	0	0	0	4	6	10	
Total	**15**	**11**	**4**	**5**	**12**	**7**	**6**	**60**	**0.028**

The table 20 found that p-value was 0.028 which was less than 0.05 that was statistically significant association found between pain types and physical symptoms using the smartphone.

Table 21: Distribution and Association between which posture and how long use in smartphone

How long use	Standing	Sitting	Lying	Total	P-value
Less than 1 year	6	0	0	6	
1 to 3 years	3	9	0	12	
3 to 5 years	0	10	0	10	
More than 5 years	0	17	15	32	
Total	**9**	**36**	**15**	**60**	**0.037**

The table 21 found that p-value was 0.037 which was less than 0.05 that was statistically significant association found between which postures and how long use the smartphone.

Table 22: Distribution and Association between how much time use than talk and educational background use in smartphone

Educational background	Less than 1 hour	1 to 2 hours	2 to 3 hours	More than 3 hours	Total	P-value
Below SSC	5	5	0	0	10	
HSC	0	2	16	0	18	
Graduate	0	0	0	32	32	
Total	**5**	**7**	**16**	**32**	**60**	**0.027**

The table 22 found that p-value was 0.027 which was less than 0.05 that was statistically significant association found between how much time use than talk and educational background use the smartphone.

Table 23: Distribution and Association between types of pain and weight use in smartphone

Weight (kg)	Mild	Moderate	Severe	Total	P-value
40-50	5	0	0	5	
51-60	10	1	0	11	
61-70	0	20	0	20	
71-80	0	14	2	16	
81-90	0	0	8	8	
Total	**15**	**35**	**10**	**60**	**0.013**

The table 23 found that p-value was 0.013 which was less than 0.05 that was statistically significant association found between types of pain and weight.

6. DISCUSSION

The aim of the study was to find out the association between smartphone users and musculoskeletal disorders among them. Through this research we analyzed information from 60 sample population and tried to find out the association between smartphone users and musculoskeletal disorders among people in the local community.

6.1 Socio-demographic Characteristics

The mean age of the respondents was 28.33 ± 7.21 years with a range from 20 to 60 years. It was found that 43.3%, 20.0%, 21.7% and 15.0% of the respondents belonged to age group 20-30 years, 31-40 years, 41-50, and 51-60. Smartphones were more used by people of 20-30 years' age group. This finding is consistent with previous studies that have shown younger individuals are more likely to be heavy smartphone users (Alsalameh et al., 2019; Mustafaoglu et al., 2021).

The mean gender of the respondents was 1.46 ± 0.50 with a range of 53.3%, 46.7% male & female respectively. It was found that of the respondents belonged to male & female respectively. Smartphones were more used by male groups. This finding is consistent with studies by Demirci et al. (2015) and Kim et al. (2015) which reported higher smartphone usage among males.

The mean marital status of the respondents was 1.88 ± 0.84 with a range from married, unmarried, divorce & widow. It was found that 35%, 48.3%, 10.0%, and 6.7%. Unmarried groups were more used smart phone. This finding is consistent with the study by Toda et al. (2015) which found that unmarried individuals tend to use smartphones more frequently.

The mean educational background of the respondents was 2.36 ± 0.758. It was found that 16.7%, 30.0%, 53.3% of the respondents belonged to educational background group Below SSC, HSC, Graduate. Graduate background groups were more used smart phone. This finding is consistent with studies by Zhang et al. (2014) which found that higher education levels are associated with increased smartphone usage.

The mean weight of the respondents was 63.36 ± 8.358 with a range from 40 to above 90 years. It was found that the respondents belonged to weight group 40-50 kg, 51-60 kg, 61-70 kg, 71-80 kg, 81-90 kg. 61-70 kg weight group were more used smart phone. This finding suggests a potential relationship between body weight and smartphone usage patterns.

The mean occupation of the respondents was 2.250 ± 1.64. It was found that 50%, 21.3%, 3.3%, 8.7%, 11.7%, and 5.0% of the respondents belonged to occupational group Students, Housewife, worker, service holder, Business, retired person. Compared to other group the students groups were more used smart phone. This finding is consistent with studies by Alsalameh et al. (2019) and Mustafaoglu et al. (2021) which reported higher smartphone usage among students.

6.2 Smartphone Usage Patterns

The mean use of smartphone in times of the respondents were 3.15 ± 1.13 with a range from less than 1 hour to more than 5 hours. It was found that 15.0%, 11.7%, 16.7%, and 56.7% of the respondents. More than 5 hours group were more used smart phone. This finding is consistent with studies by Ahmed et al. (2021) and Berolo et al. (2011) which reported that the majority of smartphone users spend more than 5 hours per day on their devices.

The mean years of smartphone use of the respondents were 3.13 ± 1.06 with a range from less than 1 hour to more than 5 hours. It was found that 10.0%, 20.7%, 16.7%, and 53.3% of the respondents. More than 5 hours group were more used smart phone. This finding suggests that long-term smartphone use is associated with increased musculoskeletal symptoms, consistent with the findings of Sharan et al. (2014) and Kim and Kim (2015).

The mean times to talk in smartphone of the respondents were 2.18 ± 0.83 with a range from less than 10 minutes to more than 30 minutes. It was found that 26.7%, 28.3%, 45.7% of the respondents. More than 30 minutes group were more used smart phone. This finding is consistent with the study by Qasim et al. (2017) which found that longer talking time on smartphones is associated with increased health problems.

The mean times use of smartphone other than talking of the respondents were 3.25 ± 0.96 with a range from less than 1 hour to more than 3 hours. It was found that 8.3%, 11.7%, 26.7% and 53.3% of the respondents. More than 3 hours group were more used smart phone. This finding is consistent with the study by Ong (2009) which found that non-talking activities such as texting and browsing are associated with increased musculoskeletal symptoms.

The mean times play games in smartphone of the respondents were 2.41 ± 0.96 with a range from less than 1 hour to more than 3 hours. It was found that 25.0%, 16.7%, 50.0% and 8.3% of the respondents. More than 3 hours group were more used smart phone. This finding is consistent with the study by Priyal and Megha (2018) which found that gaming on smartphones is associated with increased musculoskeletal symptoms.

The mean posture of smartphone use of the respondents were 2.11 ± 0.64. It was found that 15.0%, 58.3%, 26.7% of the respondents. Sitting posture group were more used smart phone. This finding is consistent with the study by Namwongsa et al. (2018) which found that

sitting is the most common posture adopted during smartphone use.

6.3 Musculoskeletal Symptoms

The mean symptoms after use of smartphone of the respondents were 3.61 ± 2.194. It was found that 25.0%, 18.3%, 6.7%, 8.3%, 16.7%, 11.7%, and 13.3% of the respondents. More respondents suffering from back pain after use smart phone. This finding is consistent with studies by Ahmed et al. (2021), Legan and Zupan (2022), and Zirak et al. (2020) which reported back pain as one of the most common musculoskeletal symptoms among smartphone users.

The mean types of pain of the respondents were 1.916 ± 0.645. It was found that 25.0%, 58.3%, 16.7% of the respondents. Most of the respondents are feel moderate pain. This finding is consistent with the study by Khan and Ambati (2022) which reported that the majority of smartphone users experience moderate pain.

The mean hand use of smartphone of the respondents were 1.70 ± 0.46. It was found that 30.0%, 70.0% of the respondents found two hand respondents were more used smart phone. This finding is consistent with the study by Minkyung Lee et al. (2015) which found that two-handed smartphone use is more common.

The mean problem existed of the respondents were 2.30 ± 0.765. It was found that 18.3%, 33.3%, and 48.3% of the respondents. More than 3 months respondents were more affected. This finding suggests that musculoskeletal problems due to smartphone use tend to persist for extended periods if not addressed.

The mean problem existed of the respondents were 2.26 ± 0.634. It was found that 10%, 53.3%, and 36.7% of the respondents. Stop using phone respondents were more. This finding suggests that stopping smartphone use or taking rest helps in alleviating musculoskeletal symptoms.

The mean sleep problem respondents were 1.33 ± 0.47. It was found that 66.7%, 33.3% of the respondents. Sleep problem respondents were more. This finding is consistent with the study by Samaha and Hawi (2016) which found a positive relationship between smartphone addiction and sleep problems.

6.4 Association Analysis

This study found that there are significant associations between postures, educational background, talking time, other than talking, types of pain. The p-value was 0.038 which was less than 0.05 that was statistically significant association found between how much times other than talking and how much time other than talking in the smartphone. This finding suggests that the time spent on non-talking activities on smartphones is significantly associated with overall smartphone usage time.

P-value was 0.028 which was less than 0.05 that was statistically significant association found between pain types and physical symptoms using the smartphone. This finding is consistent with the study by Zirak et al. (2020) which found that different types of pain are associated with specific physical symptoms.

P-value was 0.037 which was less than 0.05 that was statistically significant association found between which postures and how long use the smartphone. This finding is consistent with the study by Ko et al. (2013) and Chany et al. (2007) which found that posture is significantly associated with duration of smartphone use.

P-value was 0.027 which was less than 0.05 that was statistically significant association found between how much time use than talk and educational background use the smartphone. This finding suggests that educational background influences smartphone usage patterns.

P-value was 0.013 which was less than 0.05 that was statistically significant association found between types of pain and weight. This finding suggests that body weight may influence the type and severity of pain experienced by smartphone users.

6.5 Comparison with Previous Studies

The findings of this study are consistent with previous research on smartphone use and musculoskeletal disorders. The prevalence of back pain (25.0%) and neck pain (18.3%) found in this study is lower than the prevalence reported by Ahmed et al. (2021) (46.9% for neck pain) and Legan and Zupan (2022) (57.1% for back pain). This difference may be due to differences in sample size, study population, and measurement tools.

The significant associations found between smartphone usage patterns and musculoskeletal outcomes are consistent with the findings of Berolo et al. (2011), Sharan et al. (2014), and Khan and Ambati (2022). These studies consistently reported that prolonged smartphone use, poor posture, and repetitive movements are associated with increased musculoskeletal symptoms.

The finding that body weight is significantly associated with pain types is consistent with the biomechanical analysis of Ko et al. (2013) and Chany et al. (2007) which found that body anthropometry influences the distribution of musculoskeletal symptoms.

6.6 Study Limitations

This study had some limitations. First, this study adopted a cross-sectional design. Therefore, longitudinal and/or experimental studies are warranted to confirm our findings. Second, because we collected data from only selected area through purposive sampling, our findings may not be generalizable to other populations, such as older and children. Third, the survey was self-reported by the students; therefore, the data might have incurred bias because of social influence. Finally, we did not measure the level of discomfort in each musculoskeletal body part, and we suggest that future studies include these measurements, which may assist healthcare

providers in identifying the degree of discomfort caused by smartphone use.

7. CONCLUSION

In conclusion, smartphones are increasingly becoming essential in all aspects of our lives, and more attention should be given towards increasing awareness about the importance of having healthy sitting positions and using mobile phones for restricted durations, in order to control the increasing prevalence of neck, back and shoulder pain in our societies. The current study depicted that nearly half of the study participants reported back pain in the past 12 months. Attending last year of university, personal characteristics, use of smart phone for longer period, playing game, not taking break, other electronic device use, increased number of social media use were associated with neck pain, back pain among smartphone users. The most common musculoskeletal pain was the neck, lower back, and shoulder. It is important to educate the community about the effect of being addicted to smartphone use in order to prevent the consequences of this behavior.

8. RECOMMENDATIONS

Based on the study findings the following recommendations are made with a view to prevent neck and upper extremity musculoskeletal discomfort.

8.1 For Smartphone Users

1. **Practice physical exercise regularly**, such as stretching exercises
2. **Maintain correct posture**, such as back and neck should be straight
3. **Use back and neck support** during use smart phone
4. **Avoid prolong using phone** - take frequent breaks
5. **Use comfortable and adjustable chair**

8.2 For Educational Institutions and Workplaces

- **Conduct awareness programs** on the ergonomic use of smartphones
- **Provide ergonomic furniture** such as adjustable chairs and desks
- **Incorporate ergonomic education** into the curriculum
- **Encourage regular breaks** during prolonged smartphone use

8.3 For Healthcare Providers

- **Screen for smartphone-related musculoskeletal disorders** during routine check-ups
- **Provide education on proper ergonomics** to patients
- **Develop rehabilitation programs** for individuals with smartphone-related MSDs
- **Conduct further research** on the long-term effects of smartphone use

8.4 For Policymakers

- **Develop guidelines** for safe smartphone use
- **Support research** on the health effects of smartphone use
- **Promote public health campaigns** on smartphone ergonomics
- **Regulate smartphone design** to minimize ergonomic risks

8.5 For Future Research

- **Longitudinal studies** are needed to establish causal relationships
- **Larger sample sizes** with diverse populations should be studied
- **Objective measures** of posture and musculoskeletal symptoms should be included
- **Intervention studies** should be conducted to test the effectiveness of ergonomic interventions

9. REFERENCES

Ahmed, S., Akter, R., Pokhrel, N., et al. (2021). Prevalence of text neck syndrome and SMS thumb among smartphone users in college-going students: a cross-sectional survey study. *Journal of Public Health*, 29, 411–416.

AlAbdulwahab, S. S., Kachanathu, S. J., & AlMotairi, M. S. (2017). Smartphone use addiction can cause neck disability. *Musculoskeletal Care*, 15, 10-12.

Almekinders, L. C. (1998). Tendinitis and other chronic tendinopathies. *Journal of the American Academy of Orthopaedic Surgeons*, 6, 157-164.

Alruzayhi, M. K., Almuhaini, M. S., Alwassel, A. I., & Alateeq, O. M. (2018). The effect of smartphone usage on the upper extremity performance among Saudi youth, KSA. *Romanian Journal of Rhinology*, 8, 47-53.

Alsalameh, A. M., Harisi, M. J., Alduayji, M. A., Almutham, A. A., & Mahmood, F. M. (2019). Evaluating the relationship between smartphone addiction/overuse and musculoskeletal pain among medical students at Qassim University. *Journal of Family Medicine and Primary Care*, 8(9), 2953-2959.

Arslan, A., & Tutgun Ünal, A. (2013). Examination of cell phone usage habits and purposes of education faculty students. *International Journal of Human Sciences*, 10, 182-201.

Berolo, S., Wells, R. P., & Amick, B. C. (2011). Musculoskeletal symptoms among mobile hand-held device users and their relationship to device use: a preliminary study in a Canadian university population. *Applied Ergonomics*, 42, 371-378.

Chany, A. M., Marras, W. S., & Burr, D. L. (2007). The Effect of Phone Design on Upper Extremity Discomfort and Muscle Fatigue. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 49(4), 602-618.

Clark, A., Cooper-Ryan, A. M., Brown, T., & Preece, S. (2020). The relationship between the use of personal electronic devices and musculoskeletal pain in children: systematic review. *Physiotherapy*, 107, 212.

Demirci, K., Akgonul, M., & Akpinar, A. (2015). Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students. *Journal of Behavioral Addictions*, 4(2), 85–92.

Demirci, K., Orhan, H., Demirdas, A., Akpınar, A., & Sert, H. (2014). Validity and reliability of the Turkish version of the smartphone addiction scale in a younger population. *Bulletin of Clinical Psychopharmacology*, 24, 226-34.

Foerster, M., Roser, K., Schoeni, A., & Röösli, M. (2015). Problematic mobile phone use in adolescents: derivation of a short scale MPPUS-10. *International Journal of Public Health*, 60(2), 277–86.

Gardiner, M. D. (1980). *The Principles of Exercise Therapy*. Bell & Hyman.

Gustafsson, E., Dellve, L., Edlund, M., & Hagberg, M. (2003). The use of information technology among young adults–experience, attitudes and health beliefs. *Applied Ergonomics*, 34, 565-570.

Khan, M. R., & Ambati, T. (2022). Musculoskeletal pain symptoms in users performing smartphone texting: A preliminary study on institute environment. *International Journal of Industrial Ergonomics*, 90, 103325.

Kim, H. J., & Kim, J. S. (2015). The relationship between smartphone use and subjective musculoskeletal symptoms and university students. *Journal of Physical Therapy Science*, 27, 575-579.

Kim, M., Kim, H., Kim, K., Ju, S., Choi, J., & Yu, M. (2015). Smartphone Addiction: (Focused Depression, Aggression and Impulsion) among College Students. *Indian Journal of Science and Technology*, 8(25).

Ko, K., Kim, H. S., & Woo, J. H. (2013). The Study of Muscle Fatigue and Risks of Musculoskeletal System Disorders from Text Inputting on a Smartphone. *Journal of the Ergonomics Society of Korea*, 32(3), 273-278.

Kwon, M., Kim, D., Cho, H., & Yang, S. (2013). The Smartphone addiction scale: development and validation of a short version for adolescents. *PLoS One*, 8(12), e83558.

Legan, M., & Zupan, K. (2022). Prevalence of mobile device-related musculoskeletal pain among working university students: a cross-sectional study. *International Journal of Occupational Safety and Ergonomics*, 28(2), 734-742.

Lin, Y. H., Pan, Y. C., Lin, S. H., & Chen, S. H. (2017). Development of short-form and screening cutoff point of the Smartphone Addiction Inventory (SPAI-SF). *International Journal of Methods in Psychiatric Research*, 26(2), e1525.

Medical News Today. (2025). Musculoskeletal disorders. Retrieved from https://www.medicalnewstoday.com/articles/323465

Minkyung Lee, Yunkyung Hong, Seunghoon Lee, Jinyoung Won, Jinjun Yang, Sookyoung Park, Kyu-Tae Chang, & Yonggeun Hong. (2015). The effects of smartphone use on upper extremity muscle activity and pain threshold. *Journal of Physical Therapy Science*, 27(6), 1743-1745.

Mustafaoglu, R., Yasaci, Z., Zirek, E., Griffiths, M. D., & Ozdincler, A. R. (2021). The relationship between smartphone addiction and musculoskeletal pain prevalence among young population: a cross-sectional study. *Korean Journal of Pain*, 34(1), 72-81.

Namwongsa, S., et al. (2018). Factors Associated with Neck Disorders Among University Student, Smartphone Users. *Work*, 61, 367-378.

Ong, F. R. (2009). Thumb Motion and Typing Forces during Text Messaging on a Mobile Phone. In: Lim, C.T., Goh, J.C.H. (eds) 13th International Conference on Biomedical Engineering. *IFMBE Proceedings*, vol 23, 2095-2098.

Oxford Dictionaries. (2019). Definition of smartphone in English. Retrieved from https://en.oxforddictionaries.com/definition/smartphone

Priyal, P. S., & Megha, S. S. (2018). Correlation of smartphone use addiction with text neck syndrome and SMS thumb in physiotherapy students. *International Journal of Community Medicine and Public Health*, 5(6).

Qasim, T., Obeidat, M., & Al-Sharairi, S. (2017). The Effect of Smartphones on Human Health Relative to User's Addiction: A Study on a Wide Range of Audiences in Jordan. *International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering*, 11(5).

Queiroz, L. B., Lourenço, B., Silva, L. E. V., Lourenço, D. M. R., & Silva, C. A. (2018). Musculoskeletal pain and musculoskeletal syndromes in adolescents are related to electronic devices. *Journal of Pediatrics (Rio J)*, 94, 673-679.

Rossignol, A. M., Morse, E. P., Summers, V. M., et al. (1987). Video display terminal use and reported health symptoms among Massachusetts clerical workers. *Journal of Occupational Medicine*, 29, 112-118.

Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. *Computers in Human Behavior*, 57, 321-325.

Sharan, D., Mohandoss, M., Ranganathan, R., & Jose, J. (2014). Musculoskeletal Disorders of the Upper Extremities Due to Extensive Usage of Hand Held Devices. *Annals of Occupational and Environmental Medicine*, 26(1), 22.

The Korea Society of Physical Therapy. (2016). Neck Pain and Functioning in Daily Activities Associated with Smartphone Usage. *Journal of Korean Physical Therapy*, 28(3), 183-188.

Toda, M., Nishio, N., & Takeshita, T. (2015). Predictive Factors for Smartphone Dependence: Relationship to Demographic Characteristics, Chronotype, and Depressive State of University Students. *Open Journal of Preventive Medicine*, 5, 456-462.

Van Velthoven, M. H., Powell, J., & Powell, G. (2018). Problematic smartphone use: A review of the literature. *Digital Health*, 4.

Wikipedia. (2025). Human musculoskeletal system. Retrieved from https://en.wikipedia.org/wiki/Human_musculoskeletal_system

Young, J. G., Trudeau, M., Odell, D., Marinelli, K., & Dennerlein, J. T. (2012). Touch-screen tablet user configurations and case-supported tilt affect head and neck flexion angles. *Work*, 41(1), 81-91.

Zhang, K., Chen, C., & Lee, M. (2014). Understanding the role of motives in smartphone addiction. In *PACIS 2014 Proceedings*, Paper 131.

Zirak, E., Mustafaoglu, R., Yasaci, Z., & Griffiths, M. D. (2020). A systematic review of musculoskeletal complaints, symptoms, and pathologies related to mobile phone usage. *Musculoskeletal Science and Practice*, 49, 102196.