

Musculoskeletal Disorder in Smartphone Users: A Survey Study

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Abstract:-

Background: Smartphone is one of the most popular technological devices among many ages worldwide. In daily life, smartphone users browse the internet, use social media, write documents chat with other users, play games, listen to music, and perform many other activities on their smartphones. During these tasks, individual may be engaged in one position for a long time without moving or making specific movements repeatedly leading to musculoskeletal discomfort.

Purpose: The main purpose of this study was to find the prevalence of musculoskeletal pain among smartphone users and to understand the onset of pain with relation to age and smartphone usage.

Method and material: This study involved participants between the age group 15-60 years. Nordic musculoskeletal questionnaire was administered to the participants to find the pain prevalence and body locations affected, also demographics and characteristics of participants using smartphone was collected.

Results: Among the 80 participants, 95% participants between the age group 15-25 years, 80% participants between the age groups 26-35 and 45-60 years, 90% participants between the age group 36-45 years reported musculoskeletal pain. The most common sites of pain among age group 15-60 years were neck (76.25%), wrist/hands (55%), low back (58.33%).

Conclusion: The study reported that the prevalence of pain among smartphone users is high. Neck, wrist/hands, low back were the common sites of pain. Also characteristics of participants while using smartphone were seen to be related to onset of pain.

Keywords:- Pain, prevalence, smartphone, Nordic musculoskeletal questionnaire, characteristics.

I. INTRODUCTION

Smartphone is one of the most popular technological devices among many ages worldwide.¹ Smartphones offer a range of mobile applications for communication, education, and entertainment and have become an essential part of everyday life.³ In daily life, smartphone users browse the internet, use social media, write documents chat with other users, play games, listen to music, and perform many other activities on their smartphones.^{1,4,5} During these tasks, individual may be engaged in one position for a long time without moving or making specific movements repeatedly leading to musculoskeletal discomfort.²

Different studies have been done in different parts of the world on university students / young population between 19 to 25 years related to association of musculoskeletal factors with smartphone usage. In the current study, the focus will be on determining the association between the usage of the smartphone and the prevalence musculoskeletal pain among the age group i.e. between 15 – 60 years.

- **Need for study:** The study is designed to gather data about musculoskeletal pain among smartphone users, as well as how age and usage factors are associated with the symptoms. It will investigate device usage in terms of usage time, postures adopted during use, purposes of device use in order to explain the symptom occurrences.
- **Aim:** To find the prevalence of musculoskeletal pain in smartphone users.
- **Objectives:** To study the prevalence of musculoskeletal pain in smartphone users between the age groups: 15-25 years, 26-35 years, 36-45 years, 46-60 years. To understand the onset of pain with relation to age and smartphone usage.

II. SUBJECTS AND METHODS

- **Study design** : Observational Survey Design.
- **Sampling method** : Convenience Sampling
- **Sample size** : 80 (20 from each group)

A. Inclusion criteria:

- People using smartphone for a period of minimum a year.
- Population between 15- 60 years of age.

B. Exclusion criteria:

- Any participant with trauma those with congenital deformity, serious neurological condition, limb injuries, limb pain not related to smartphones
- Non – consent to participation
- Incomplete responses
- **Materials:** Consent form, Information sheet, Data collection sheet, Nordic musculoskeletal questionnaire, Pen
- **Outcome measure:** Data collection sheet (Demographics including general characteristics while using smartphone), Nordic musculoskeletal questionnaire

C. Procedure:

- Ethical clearance was taken from the institutional ethics committee
- Purpose and procedure was explained to the participants.
- Participants willing to give consent to participate in the study were included.
- Participants were selected as per the criteria.
- Demographic data and general characteristics of the participants while using smartphone was obtained.
- Nordic Musculoskeletal Questionnaire was administered to the participants.
- Descriptive statistical analysis of collected data was done and results were found

III. RESULTS

A. Demographics and characteristics while using smartphone:

A total of 80 participants were included in the study . There were 4 age groups made and 20 participants from each age group were included . **Error! Reference source not found.** represents the demographics and smartphone usage characteristics of each participant.

B. Pain Profile

- Musculoskeletal pain prevalence between age group 15-60 years:- 4 age group categories i.e 15-25 years , 26-35 years, 36-45 years , 46-60 years were made.

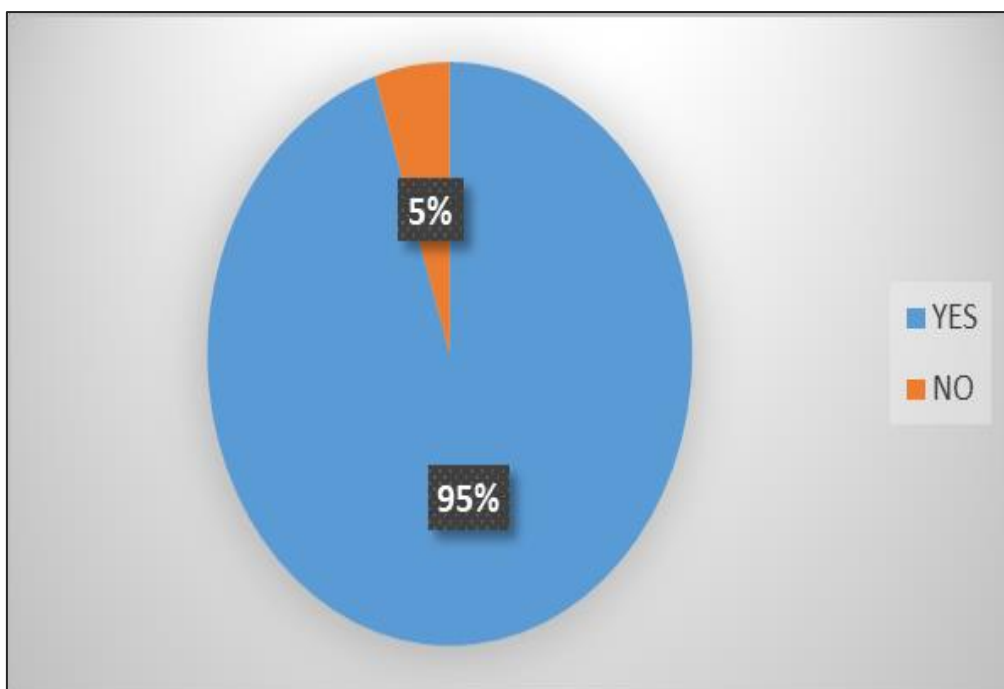


Fig. 1: Musculoskeletal pain prevalence between age group 15-25 years

In Fig. 1, it can be observed that between the age group 15-25 years 95% of participants reported musculoskeletal pain.

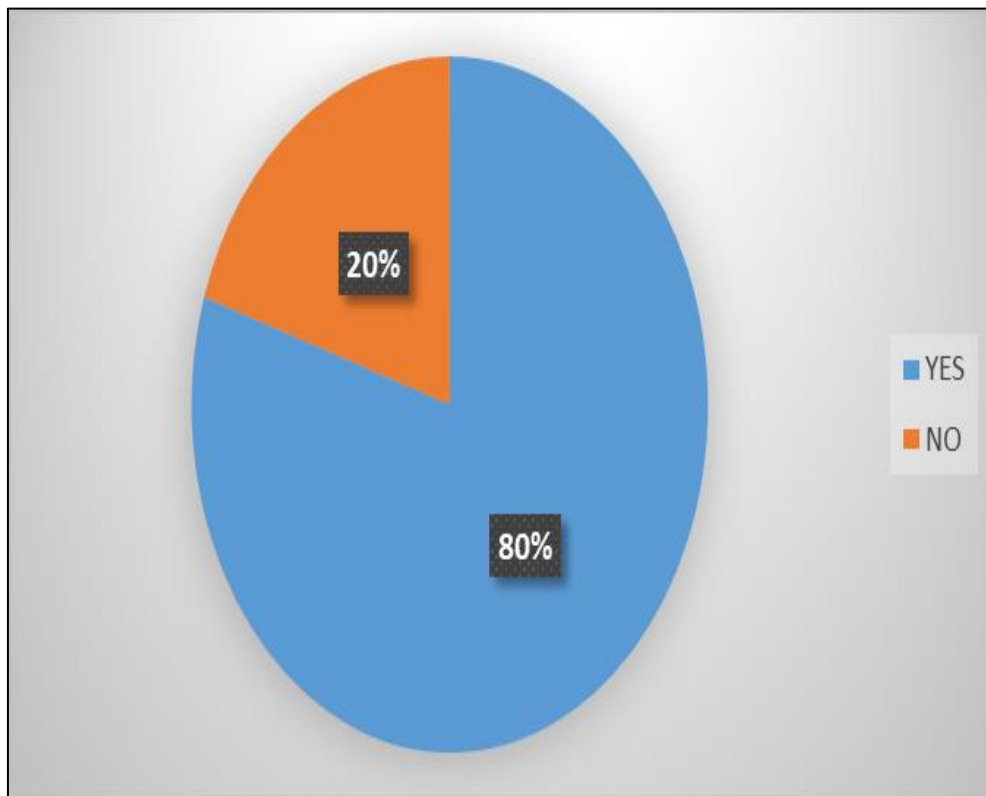


Fig. 2: Musculoskeletal pain prevalence between age group 26-35 years

In Fig. 2, it can be observed that between the age group 26-35 years 80% of participants reported musculoskeletal pain.

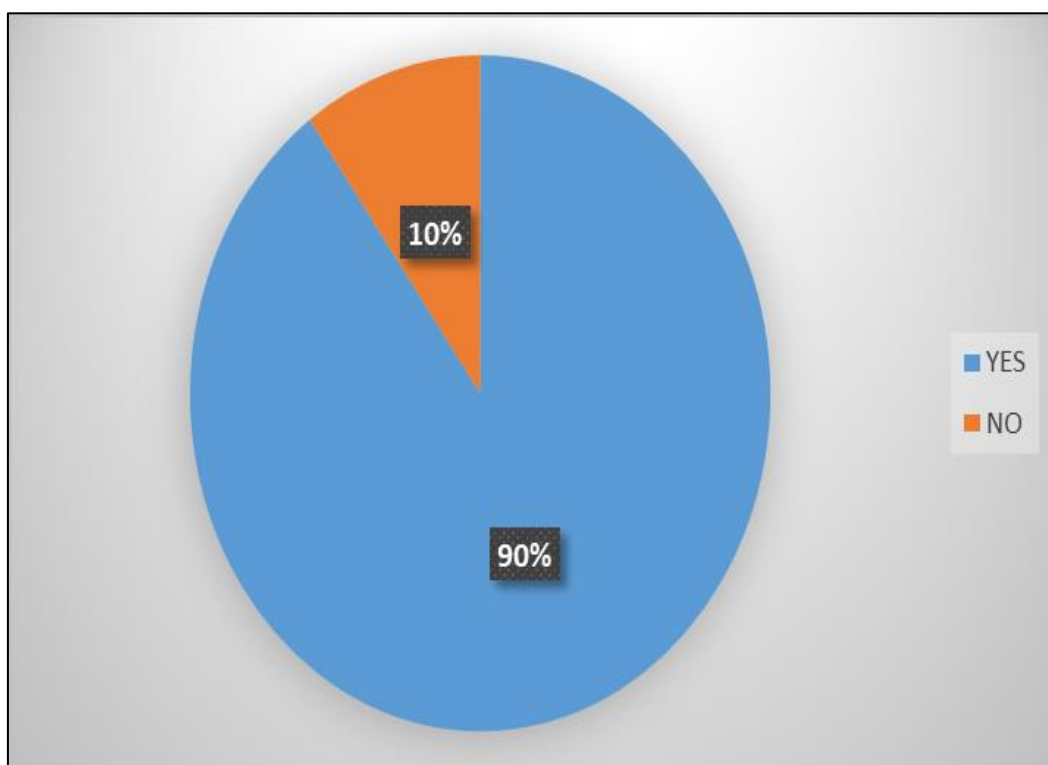


Fig. 3: Musculoskeletal pain prevalence between age group 36-45 years

In Fig. 3, it can be observed that between the age group 36-45 years 90% of participants reported musculoskeletal pain.

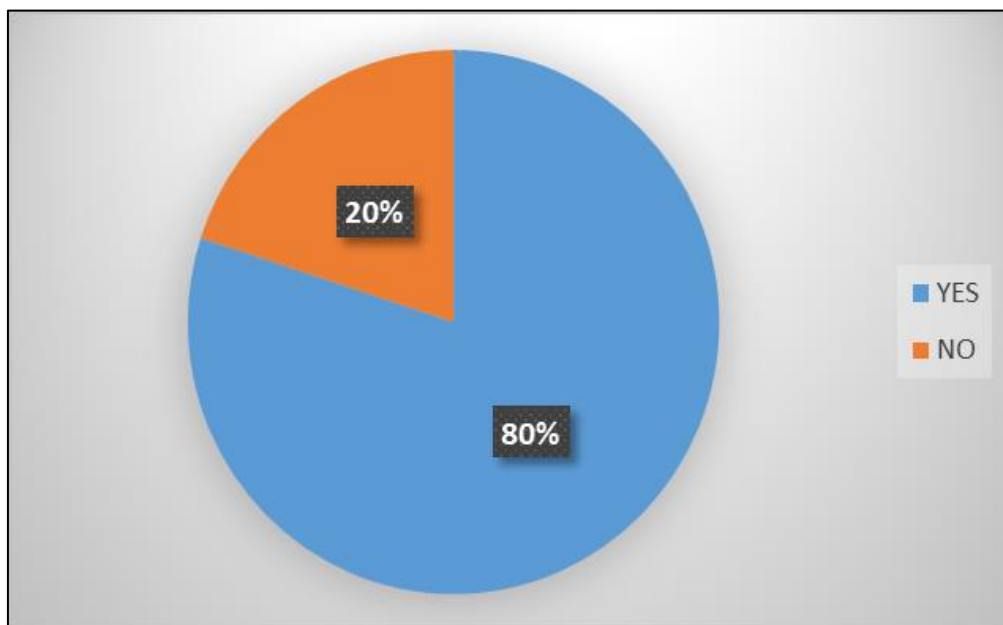


Fig. 4: Musculoskeletal pain prevalence between age group 45-60 years

In Fig. 4, it can be observed that between the age group 45-60 years 80% of participants reported musculoskeletal pain.

group 15-60 years that percentage of people complaining pain or discomfort in past 12 months is more as compared to past 7 weeks which is more as compared to pain preventing the people from doing normal work in past 12 months.

- Classification based on the area of pain between age group 15-60 years:- It was commonly observed across age

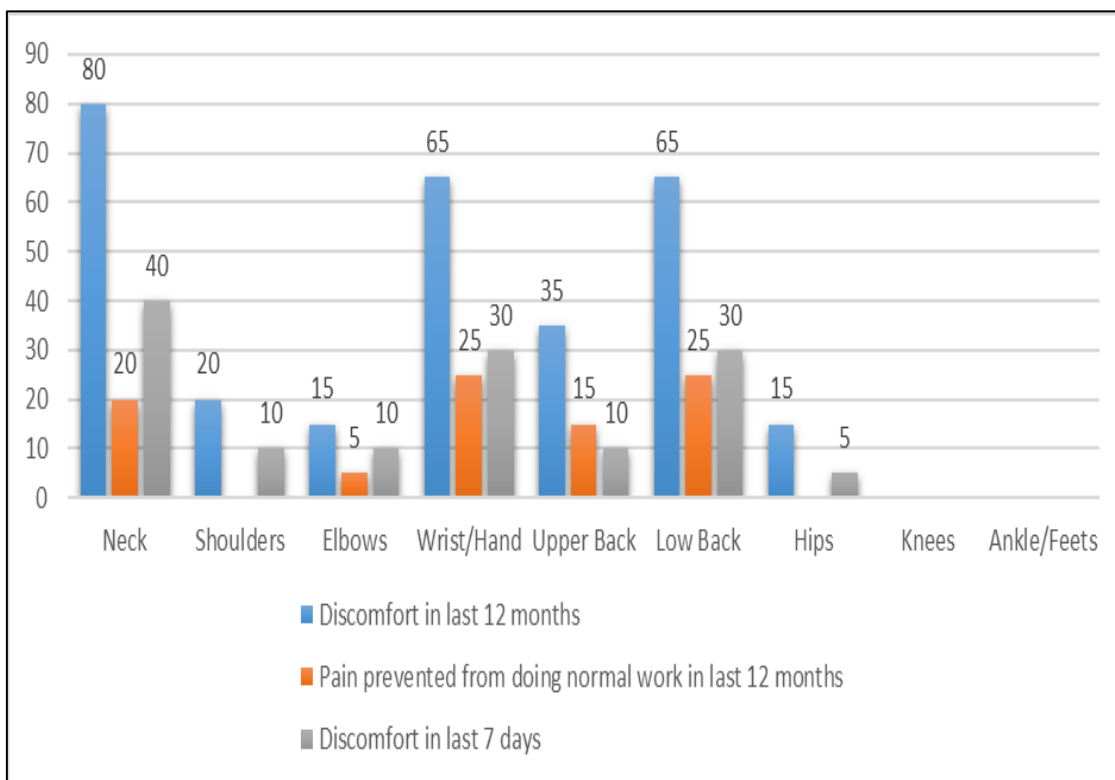


Fig. 5: Classification based on the area of pain between age group 15-25 years

In Fig. 5, it can be observed that between the age group 15-25 years the prevalence of pain is highest in neck

region (80%), followed by wrist/hands and low back region (65%).

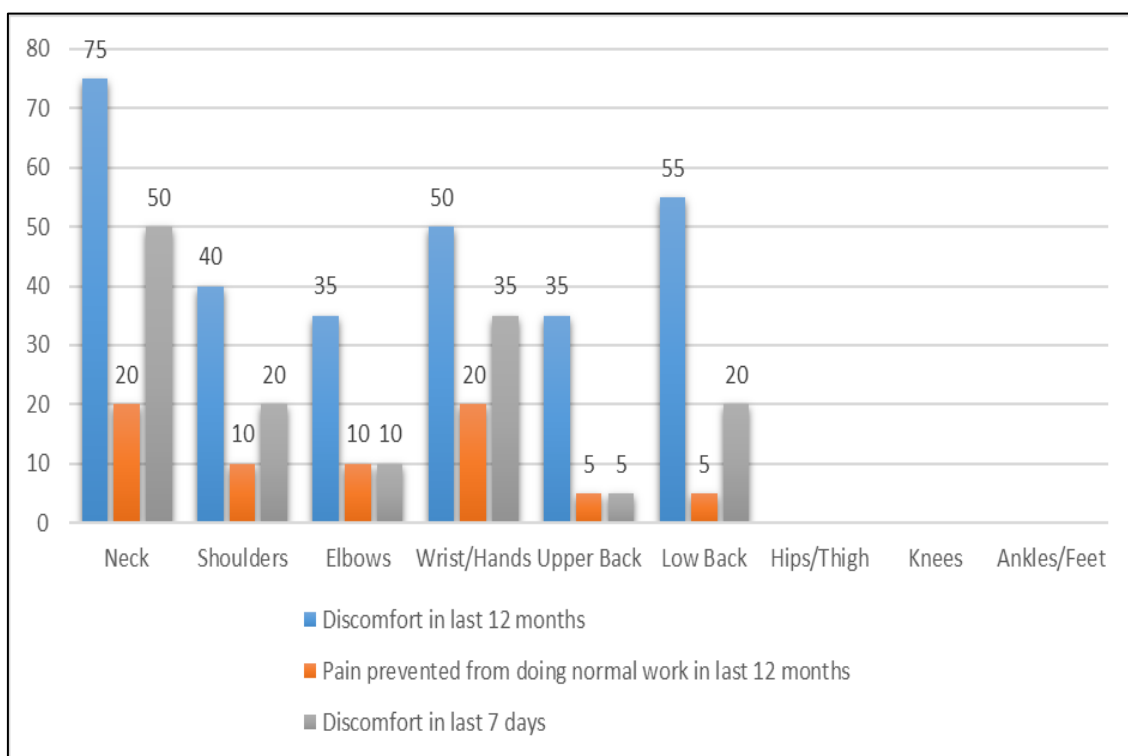


Fig. 6: Classification based on the area of pain between the age group 26-35 years

In Fig. 6, it can be observed that between the age group 26-35 years the prevalence of pain is highest in neck

region (75%), followed by low back region (55%), wrist/hand (50%)

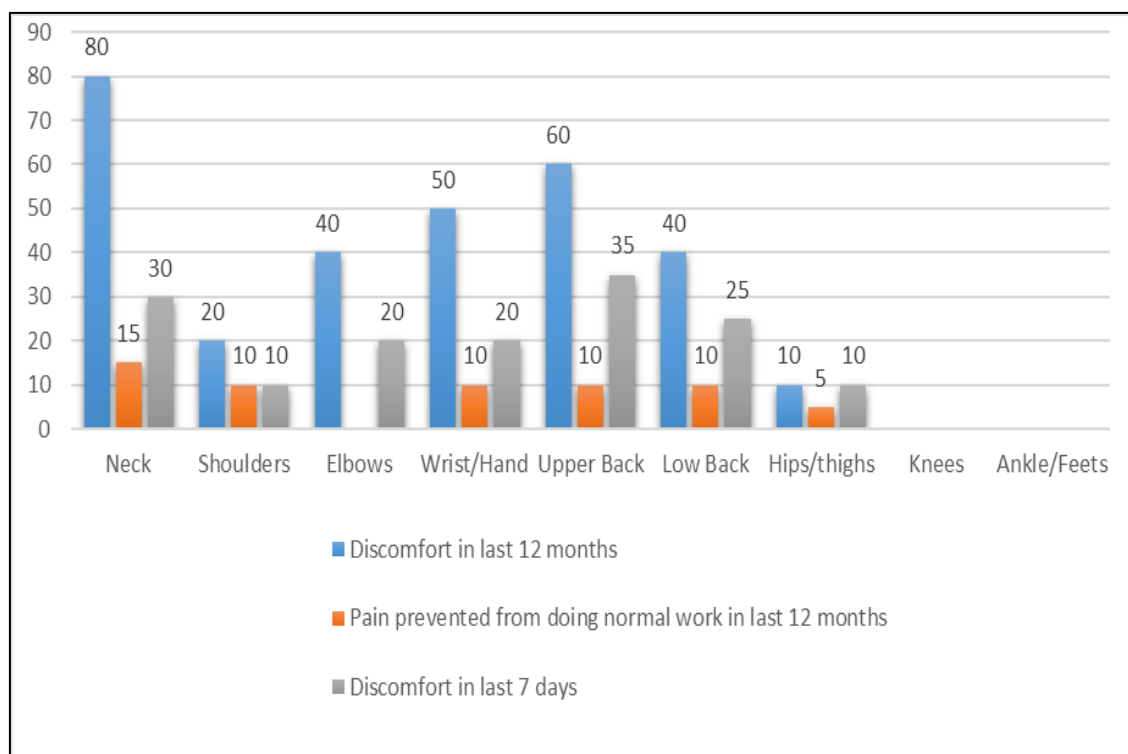


Fig. 7: Classification based on the area of pain between the age group 36-45 years

In Fig. 7, it can be observed that between the age group 36-45 years the prevalence of pain is highest in neck

region (80%), followed by upper back region (60%), wrist/hand (50%).

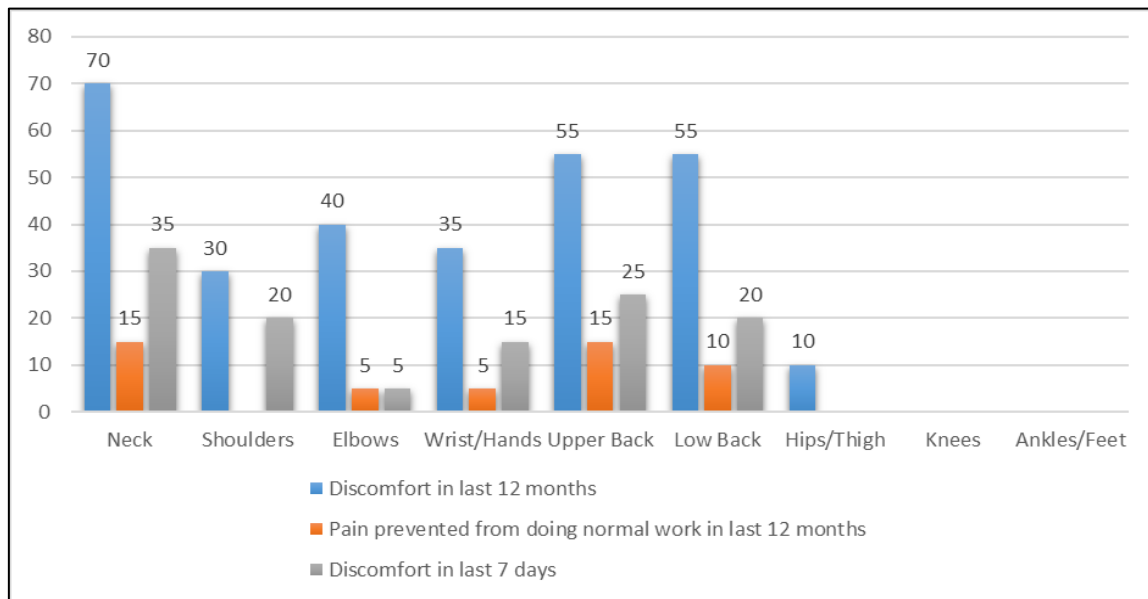


Fig. 8: Classification based on the area of pain between the age group 45-60 years

In Fig. 8, it can be observed that between the age group 45-60 years the prevalence of pain is highest in neck region (70%), followed by upper back and low back region (55%).

C. Association of musculoskeletal pain with characteristics of participants with musculoskeletal pain while using smartphone

In Table 2, it can be seen that maximum participants between age groups 15-60 years with musculoskeletal pain are using their smartphone for more than 5 years. Similarly max participants with msk pain are seen to use smartphone for more than 4 hours on daily basis. It can be seen that max participants with pain use their smartphone for making phone calls, text messaging, watching videos and social networking, also between age group 15-35 percentage of participants with msk pain who use their smartphone for educational/official purpose is high. Sitting and lying on back are the predominant postures used among participants with msk pain between age group 15-60 years, also size of LED screen of max participants with msk pain is more than 5 inches.

IV. DISCUSSION

This study was done to investigate the prevalence of Musculoskeletal pain among smartphone users between age group 15-60 years.

In all the four categories of age groups, it was observed that, the region which was the most affected was neck, followed by wrist/hands, low back, upper back then elbow, shoulder and lastly hip region. However in the age group between 45-60 years, it was seen that along with neck region there was high prevalence of pain in upper back region.

Smartphones are now being used by individuals more frequently than computers every day, so it is not surprising that various negative effects of excessive smartphone use have emerged. Most Smartphone tasks requires engaging in

variety of awkward postures such a sitting in a slouched posture or being in a forward head posture for a prolonged period of time without moving or making specific movements. Maintaining such postures can put excessive stress on the structures or muscles leading to pain.

A study by Rustem Mustafaoglu, Zeynal Yaset et al. on the relationship between smartphone addiction and musculoskeletal pain prevalence among young population conducted on Korean university students revealed that the neck, followed by upper back and wrist hands were common sites of pain.¹ Similarly, findings of various studies based on relationship between smartphone use and musculoskeletal symptoms in university students revealed that upper back, neck, shoulders, wrist-hands were the most affected areas among the participants.

Consistently it is seen that across the age groups from adolescents to adults the most affected region is Neck.

A study revealed that an neck flexion of 33-45 degrees was maintained when using smartphone. Repetitive and prolonged neck flexion posture can be a factor leading to neck pain.⁷ Also people tend to adopt a static flexed spinal posture while using smartphone. This may cause faulty posture such as forward head, slouched posture or protracted shoulders putting strain on the cervical and the lumbar muscles leading to pain in the neck and both upper and lower back region. In a study it was revealed that there is increased muscle activity in upper trapezius, erector spinae and neck extensor muscle during smartphone use. Increase muscle activity is associated with increase in muscle fatigue and decreased pain pressure threshold in neck and shoulder muscles.^{8,9}

According to the results related to smartphone usage, participants between 15-60 years of age who were using smartphone for more than 5 years showed higher prevalence of musculoskeletal pain compared to those using smartphone for less than 5 years. Regarding the daily usage time, it was seen that maximum participants among all age

groups between 15-60 years used their smartphone for more than 4 hours on a daily basis, the usage of smartphone has increased in the past years due to lockdown because of covid crisis. Also the pain prevalence in such participants was higher compared to other participants.

Sitting and lying on back were the most preferred posture while using smartphones among participants of all age group. Poor posture which is maintained for prolonged period of time can lead to musculoskeletal pain among individuals. Also, results showed most of the people used their phones for making calls, text messaging, social networking, for watching videos and also for educational/official purpose. Text messaging and social networking require repetitive thumb movements which can lead to musculoskeletal disorder. Also while watching videos or attending online lectures, if the phone is held in the hand there is sustained flexed posture of the wrist maintained, which can lead to further discomfort.

Maximum people were shown to have a smartphone with screen size of more than 5 inches. A study evaluated the effect of the screen size on upper extremity and trapezius muscle activity and cervical posture during short texting task in college students. It revealed that there is increased muscle activity in the finger flexors, wrist extensors and trapezius along with cervical flexed posture as the screen size increased which can put increased stress on musculoskeletal structures leading to pain and discomfort.¹⁰

The present study ensured that a broad population was surveyed (15-60 years old). Four groups of particular ages were formed so that there is minimum chance of any bias related to age taking place. Important characteristics while using the smartphone such as years of owning and using a smartphone, duration of using smartphone in a particular day, posture while using it along with purpose and size of phone LED screen were taken into consideration.

- **Clinical implications:** Attention should be directed towards safe use of smartphone and public awareness related to the hazards and risk factors associated with improper and excessive usage of smartphone.
- **Future scope:** Further studies can be carried out in different regions, so that the results can be generalized throughout. The findings can be used to support the future study related to factors impacting musculoskeletal problem in smartphone users and further knowledge in knowing about the issues related to usage of smartphone.
- **Limitations:** The study only measured musculoskeletal symptom i.e pain and did not include other impact of device use, including those affecting a person's psychological health. This survey did not include some of the body locations such as the eye, which have been found to be a location of strain and discomfort in previous literature. All the data is collected from participants from urban setup and does include people from rural regions. All the data is self reported, therefore the data could be subjected to method bias. Lastly, it's a survey study so the effect and cause of the pain are not well defined so the results of the study is somewhat limited.

V. CONCLUSION

There is high prevalence of musculoskeletal pain among smartphone users between age group 15-60 years. Neck, wrist/hands, lower back were the common site of pain reported among age groups between 15-60 years. The region which was found to be most affected between 15-60 years of age group is Neck.

REFERENCES

- [1.] Refere Mustafaoglu R, Yasaci Z. The relationship between smartphone addiction and musculoskeletal pain prevalence among young population: a cross-sectional study. *Korean J Pain*. 2021 Jan 1; 34(1): 72–81. Published online 2021 Jan 1.
- [2.] Prachita W, Manasi K, Aniket G, Agasthya D. Musculoskeletal Pain and Risk Factors Associated with Smartphone Use in University Students. *Indian J Occup Environ Med*. 2021 Oct-Dec; 25(4): 220–224. Published online 2021 Dec 31.
- [3.] Alsalameh AM, Mohammad FM, Harisi MJ. Evaluating the relationship between smartphone addiction/overuse and musculoskeletal pain among medical students at Qassim. *J Family Med Prim Care*. 2019 Sep; 8(9): 2953–2959. Published online 2019 Sep 30.
- [4.] Yang G, Cao J, Li Y, Cheng P. Association Between Internet Addiction and the Risk of Musculoskeletal Pain in Chinese College Freshmen – A Cross-Sectional. *Front Psychol*. 2019; 10: 1959. Published online 2019 Sep 3.
- [5.] Alhazmi AA, Alzahrani SH, Baig M. Prevalence and factors associated with smartphone addiction among medical students at King Abdulaziz University, Jeddah. *Pak J Med Sci*. 2018 Jul-Aug; 34(4): 984–988.
- [6.] Haug S, Castro RP. Smartphone use and smartphone addiction among young people in Switzerland. *J Behav Addict*. 2015 Dec; 4(4): 299–307. Published online 2015 Dec 21.
- [7.] Lee SJ, Kang H, Shin G. Head flexion angle while using a smartphone. *Ergonomics*. 2015;58:220–26.
- [8.] Lee M, Hong Y, Lee S, Won J, Yang J, Park S, et al. The effects of smartphone use on upper extremity muscle activity and pain threshold. *J PhysTher Sci*. 2015;27:1743–5.
- [9.] Kim GY, Ahn CS, Jeon HW, Lee CR. Effects of the use of smartphones on pain and muscle fatigue in the upper extremity. *J PhysTher Sci*. 2012;24:1255–8.
- [10.] Kietrys DM, Gerg MJ, Dropkin J, Gold JE. Mobile input device type, texting style and screen size influence upper extremity and trapezius muscle activity, and cervical posture while texting. *Appl Ergon*. 2015;50:98–104.
- [11.] Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, Jørgensen K. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics* 1987;18.3,233-237.

Table 1: Demographics and smartphone usage characteristics of participants

Gender	Age Group 15-25 n(%)	Age Group 26-35 N(%)	Age Group 36-45 N(%)	Age Group 46-60 N(%)
Female	12(60)	11(55)	11(55)	9(45)
Male	8(40)	9(45)	9(45)	11(55)
Dominance				
Right	18(90)	17(85)	15(75)	18(90)
Left	2(10)	3(15)	5(25)	2(10)
Years Of Using Smartphone				
>5 years	13(65)	18(90)	17(85)	16(60)
2-5 years	7(35)	2(10)	3(15)	4(20)
Duration Of Using Smartphone				
Less than 1 hour				
1-2 Hour			3(15)	
2-3 Hours	4(20)	6(30)	6(30)	5(25)
3-4 Hours	6(30)	5(25)	5(25)	4(20)
>4 Hours	10(50)	9(45)	6(30)	11(55)
Purpose Of Smartphone				
Making phone calls	18(90)	20(100)	20(100)	20(100)
Text messaging	18(90)	19(95)	14(70)	13(65)
Educational/Official purpose	16(80)	12(60)	5(25)	7(35)
Gaming	11(55)	4(20)	1(5)	2(10)
Listening to music	14(70)	12(60)	3(15)	13(65)
Watching videos	15(75)	12(60)	11(55)	13(65)
Social networking	18(90)	16(80)	9(45)	11(55)
Posture While Using Smartphones				
Sitting	18(90)	20(100)	20(100)	18(90)
Standing	13(65)	9(45)	8(40)	5(25)
Lying in front	7(35)	3(15)	5(25)	8(40)
Lying on back	9(45)	16(80)	11(55)	10(50)
Lying on side	6(30)	3(15)	1(5)	2(10)
Moving around	11(55)	9(45)	5(25)	3(15)
Size Of Led Screen				
>5 inches	17(85)	9(45)	12(60)	13(65)
5 inches	3(15)	8(40)	5(25)	5(25)
<5 inches	-	3(15)	3(15)	2(10)

Table 2: Association of musculoskeletal pain with characteristics of participants with musculoskeletal pain while using smartphone

Characteristics	Age Group 15-25 N(%)	Age Group 26-35 N(%)	Age Group 36-45 N(%)	Age Group 46-60 N(%)
Years Of Using Smartphone				
>5 years	12 (63.15)	15 (93.75)	15 (83.33)	14 (87.5)
2-5 years	7(36.84)	1(6.25)	3 (16.66)	2 (12.5)
Duration Of Using Smartphone				
Less than 1 hour				
1-2 Hour			3 (16.66)	
2-3 Hours	3 (15.78)	2 (12.5)	4 (22.22)	3 (18..75)
3-4 Hours	6 (31.57)	5 (31.25)	5 (27.77)	3 (18.75)
>4 Hours	10 (52.63)	9 (56.25)	6 (33.33)	10 (62.5)
Purpose Of Smartphone				
Making phone calls	17 (89.47)	16 (100)	18 (100)	16 (100)
Text messaging	17 (89.47)	16 (100)	12 (66.66)	12 (75)
Educational/Official purpose	16 (84.21)	12 (75)	7 (38.88)	5 (31.25)
Gaming	11 (57.89)	4 (25)	1 (5.55)	2 (12.5)
Listening to music	13 (68.42)	11 (68.75)	3 (16.66)	10 (62.5)
Watching videos	15 (78.94)	9 (56.25)	10 (55.55)	10 (62.5)
Social networking	17 (89.47)	15 (93.75)	8 (44.44)	10 (62.5)
Posture While Using Smartphones				
Sitting	17 (89.47)	16 (100)	18 (100)	15 (93.75)
Standing	12 (63.15)	7 (43.75)	7 (38.88)	4 (25)
Lying in front	7 (36.84)	3 (18.75)	5 (27.77)	7 (43.75)
Lying on back	9 (47.36)	11 (68.75)	11 (61.11)	7 (43.75)
Lying on side	6 (31.57)	3 (18.75)	1 (5.55)	1 (6.25)
Moving around	9 (47.36)	8 (50)	3 (16.66)	2 (12.5)
Size Of Led Screen				
>5 inches	16 (84.21)	7 (43.75)	11 (61.11)	11(68.75)
5 inches	3 (14.78)	6 (37.5)	4 (22.22)	4 (25)
<5 inches		3 (18.75)	3 (16.66)	1 (6.25)