Volume 3, Issue 5, 2025

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

PREVALENCE OF MUSCULOSKELETAL PAIN AMONG SMARTPHONE GAMING ENTHUSIASTS: A CROSS-SECTIONAL STUDY

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DOI: https://doi.org/10.5281/zenodo.15805706

Keywords
Musculoskeletal pain, Smartphone gaming, Screen time, Gaming posture, Sedentary behavior

Article History
Received on 29 May 2025
Accepted on 29 June 2025
Published on 04 July 2025

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Abstract

Background: *Musculoskeletal (MSK) pain has become increasingly common among people who spend long hours using screens, especially those who play games on smartphones. This kind of gaming often leads to poor posture, like bending the neck, leaning the head forward, and holding the phone tightly for extended periods. Unlike watching videos or scrolling passively, smartphone gaming involves constant interaction and muscle use, which can build up stress on the body and lead to ongoing pain or discomfort.*

Objective: *This study aimed to assess the prevalence of musculoskeletal pain among individuals who frequently engage in smartphone gaming.*

Methodology: *A cross-sectional study was conducted in 2025 among smartphone gamers aged 17 to 28 years, selected through non-probability convenience sampling. The required sample size of 203 participants was calculated using OpenEpi software. Data were collected using validated assessment tools, including the Standardized Nordic Musculoskeletal Questionnaire (NMQ) and the Visual Analogue Scale (VAS), and were statistically analyzed using SPSS version 26.*

Results: *Among 203 participants, 63% were male and right-handed, with 48.3% aged between 19–23 years. MSK pain was commonly reported, including neck pain (54.7%), shoulder pain (51.7%), and lower back pain (60.1%) in the past year. Over 61% experienced recent (7-day) symptoms, and 41.9% reported moderate pain, often starting within 30 minutes of gaming. Postural issues such as forward head posture (56.7%), rounded shoulders (57.1%), and wrist discomfort (58.1%) were prevalent.*

Conclusion: *Musculoskeletal pain is prevalent among smartphone gamers due to poor posture and prolonged gaming. Preventive strategies, such as ergonomic education, posture correction, and regular breaks, are essential.*

INTRODUCTION

Smartphones are among the most widely used technological devices across all age groups [(1)]. Constant smartphone use forces users to adopt improper postures, significantly increasing the risk of musculoskeletal disorders and pain [(2)]. Musculoskeletal disorder is defined as impairment to the musculoskeletal structures as a result of repetitive movements, forces, and awkward posture adopted during the implementation of certain activities [(3)]. Video gaming is a leisure activity with yearly

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ISSN: (e) 3007-1607 (p) 3007-1593

aggregate popularity. It is usually a sedentary behavior combined with repetitive activities of the upper limbs. [4] Video gaming requires acceptable motor ability to perform the gaming activity. Therefore, it involves frequent movement of the arms, wrists, hands, and fingers to move in the essential environment. [5]

Globally, musculoskeletal disorders are common, with millions of people having pain or injury related to their musculoskeletal system, including muscles, ligaments, tendons, nerves, and joints. The prevalence can vary by region, occupation, and lifestyle factors. In the United States, empirical studies have shown that more than 65% of individuals owning smartphones assign a minimum of one hour daily to their plans. [6].

A research investigation conducted in China revealed a one-week prevalence rate of musculoskeletal complaints among high school students, calculated at 83.9%. In the study, back pain was documented by 23% of students, suggesting a notable concern associated with extended periods of sitting and suboptimal posture during gaming activities. Additionally, 9% of participants experienced upper limb pain, likely due to repetitive strain associated with gaming. Furthermore, diffuse pain was reported by 4% of students, indicating the potential for more extensive musculoskeletal complications Lastly, another 4% indicated pain localized in the trapezius muscle, which could be associated with the positioning of the arms and hands throughout gaming These findings highlight the significant impact of gaming and computer use on the musculoskeletal health of adolescents. [7] In India, a comprehensive survey indicated that 90.9% of students reported experiencing musculoskeletal complaints, encompassing specific symptoms such as pain localized in the thumb (9.8%), elbow (2.7%), and wrist (2.4%) [8]. A similar survey conducted in Canada documented a one-week prevalence rate of 97.9% among students, faculty, and staff utilizing mobile devices. The study on upper-body pain in gamers provides insights into the prevalence of gaming-related pain, particularly focusing on respondents from various countries, including Canada and the United States. Among the 522 respondents, a significant 77.8% reported experiencing gaming-related pain in the upper body. This indicates that a large majority of gamers are affected by pain while gaming [9]. The study focuses on video gamers from the Rawalpindi/Islamabad area, indicating a specific demographic within Pakistan. The sample consisted of 260 video gamers, with participants aged between 11 to 35 years, including adolescents and early adults. Most participants were students, with an equal representation of male and female gamers [10]. In the case of overdoing injuries, initial treatment procedures include rest, the application of ice, compression, elevation, and, subsequently of non-steroidal anti-inflammatory medications or acetaminophen. Additionally, the request of tape or braces may prove advantageous, alongside soft tissue mobilization techniques to facilitate recovery. These comprehensive methodologies underscore the significance of integrating specialized training and therapeutic strategies to bolster the health and performance of sports athletes. [11]

Physiotherapy can be valuable for individuals facing physical strain or injuries related to extended gaming. This may include exercises to improve posture, strengthen muscles, and enhance flexibility, which can help ease the physical effects of prolonged gaming sessions. [12] The study on mobile game habit and its relationship with musculoskeletal pain among students is noteworthy for numerous reasons. Firstly, it sheds light on the disturbing prevalence of musculoskeletal distress, with over half of the members (52.1%) recording pain in many body regions. [13] This finding is decisive for raising alertness among students, educators, and health professionals about the latent health risks linked to unnecessary mobile gaming. Furthermore, the study outlines a decisive connection between the spectacle of mobile game addiction and the exacerbation of musculoskeletal discomfort, mainly in regions such as the cervical spine, shoulders, and upper dorsal area. [14]

MATERIAL AND METHODS

Tools Used: Standardized Nordic Musculoskeletal Questionnaire (NMQ), Visual Analogue Scale (VAS), pen, laptop, assessment forms.

Study Setting: The study was conducted at several academic institutions in Karachi, including Indus

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ISSN: (e) 3007-1607 (p) 3007-1593

University, Karachi University, Bahria University, Iqra University, Dow University of Health Sciences, and Jinnah Postgraduate Medical Centre (JPMC). These settings provided access to a diverse population of university students engaged in smartphone gaming.

Study Design: A cross-sectional study design.

Sampling Technique: A non-probability convenience sampling technique was employed to recruit participants.

Duration of the Study: The study spans six months

Sample size: The sample size for this study was calculated using OpenEpi software, with parameters set at a 5% margin of error, a 95% confidence interval. Based on these criteria, the minimum required sample size was determined to be 203 participants.

Study population: The study population comprised regular smartphone gamers in Karachi, specifically university students aged between 18 and 28 years from institutions such as Indus University, Karachi University, Bahria University, Iqra University, Dow University of Health Sciences, and Jinnah Postgraduate Medical Centre (JPMC).

Sample Selection Criteria

Inclusion criteria:

- Individuals aged between 17 to 28 years
- Regular smartphone gamers
- University students enrolled in institutions in
- Karachi
- Individuals who own and actively use a
- smartphone
- Willing to provide informed consent

Exclusion criteria:

- History of **musculoskeletal surgery**
- Diagnosed with any **disc pathology** or
- **neuromuscular disorders**
- History of **trauma or injury** affecting the
- musculoskeletal system
- Individuals with **chronic illnesses** that may influence musculoskeletal health (e.g., rheumatoid arthritis, fibromyalgia)
- Those currently undergoing **physiotherapy or orthopedic treatment** for MSK conditions

Data collection procedure:

Participants were provided with comprehensive information regarding the study's objectives, methodology, potential risks, and benefits. After explaining the purpose of the study, written informed consent was obtained from each participant before data collection. Participants were recruited through a convenience sampling technique. A total of 203 individuals, aged 17 to 28 years, who regularly use smartphones and engage in smartphone gaming, were included in the study. Standardized outcome measures, including validated questionnaires, were used to collect data. These questionnaires were distributed and completed by participants in a controlled environment to ensure consistency. Throughout the study, participants' privacy and confidentiality were strictly maintained under ethical research guidelines.

Data analysis procedure: The collected data were analyzed using the **Statistical Package for the Social Sciences (SPSS), version 26**. Descriptive statistics, including frequencies and percentages, were used to calculate the **prevalence** of musculoskeletal pain and related postural habits among smartphone gaming participants. The analysis focused on summarizing demographic characteristics, pain distribution, and posture-related responses as reported in the questionnaires.

Ethical Consideration: Ethical approval was obtained prior to data collection, and all participants provided informed consent. Confidentiality and voluntary participation were ensured throughout the study.

RESULT

Figure 1 presents the gender distribution of the study participants. Out of the total 203 respondents, 128 were male, accounting for 63% of the sample, while 75 were female, comprising 37%. This indicates a higher representation of male participants

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in the study, reflecting a possible trend of greater smartphone gaming engagement among males in the sampled population.

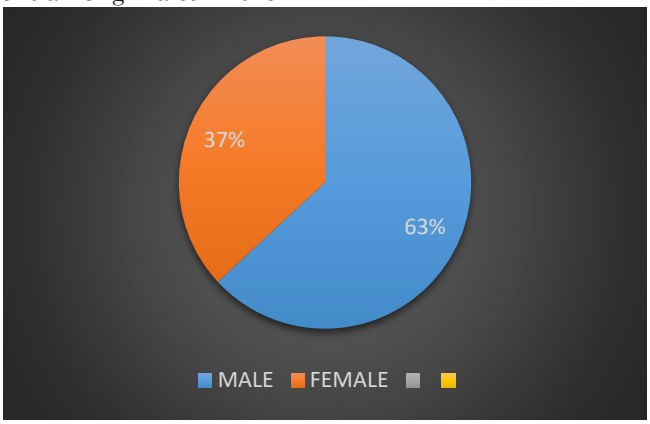

Figure 1: Gender Distribution of Study Participants

Figure 2 shows the age-wise distribution of the study participants. The majority of the respondents (48.3%) belonged to the 19–23 years age group, with 98 participants in this category. This was followed by 62 participants (30.5%) in the 15–18 years age group, and 43 participants (21.2%) in the 24–28 years category. The cumulative percentage reached 100%, indicating that the data was completely recorded for all participants. The findings suggest that smartphone gaming is particularly prevalent among late adolescents and young adults.

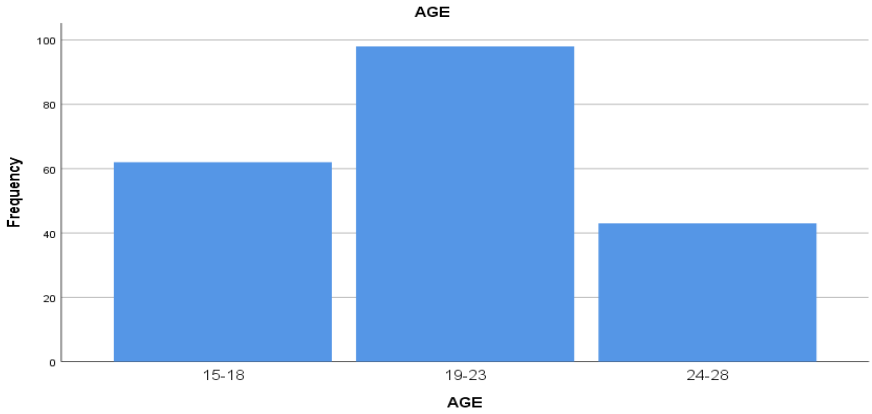

Figure 2: Age-Wise Distribution of Study Participants

Figure 3 illustrates the distribution of participants based on their dominant hand. Among the 203 respondents, 128 individuals (63%) reported being right-handed, while 75 participants (37%) identified as left-handed. This indicates a predominance of right-handed individuals within the study population. The cumulative percentage reached 100%, confirming that data for this variable was fully collected. The distribution reflects typical hand dominance trends observed in the general population.

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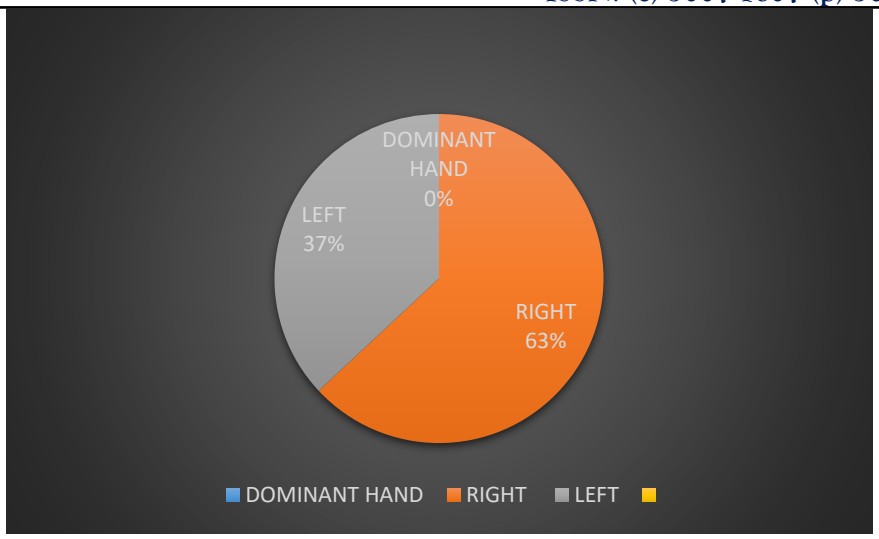

Figure 3: Distribution of Participants by Dominant Hand

Table 2 highlights common posture-related habits among smartphone gamers, with most participants 2reporting forward head tilt (56.7%), hunched shoulders (57.1%), and wrist discomfort (58.1%). While 58.6% rest their arms and 64% use chairs with back support, discomfort often begins within 30 minutes for 41.9%. Break frequency varies, with only 34% pausing every 30 minutes, and 9.9% never taking breaks. Despite these issues, 61.6% are posture-conscious and adjust positions or stretch during long sessions, indicating awareness of posture-related discomfort

Table 2: Postural Habits among Smartphone Gaming Enthusiasts (N=203)

VARIABLE	FREQUENCY	PERCENTAGE
DO YOU TILT YOUR HEAD FORWARD WHILE GAMING		
YES	115	56.7
NO	88	43.3
DO YOUR SHOULDERS FEEL ROUNDED OR HUNCHED DURING GAMING SESSIONS		
YES	116	57.1
NO	87	42.9
DO YOU REST YOUR ARMS ON A SURFACE WHILE GAMING		
YES	119	58.6
NO	84	41.4
DO YOU EXPERIENCE WRIST BENDING OR DISCOMFORT WHILE HOLDING YOUR PHONE		
YES	118	58.1
NO	85	41.9
HOW OFTEN DO YOU TAKE BREAKS DURING GAMING		
EVERY 30 MINUTES	69	34
EVERY HOUR	57	28.1
RARELY	57	28.1
NEVER	20	9.9
DO YOU SIT IN A CHAIR WITH BACK SUPPORT WHILE GAMING		
YES	130	64
NO	73	36

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AFTER HOW LONG OF GAMING DO YOU START FEELING DISCOMFORTABLE		
LESS THAN 30 MINUTES	85	41.9
30-60 MINUTES	69	34
MORE THAN 1 HOUR	49	24.1
ARE YOU CONSCIOUS OF YOUR POSTURE WHILE GAMING		
YES	125	61.6
NO	78	38.4
DO YOU STRETCH OR CHANGE POSITION DURING LONG GAMING SESSIONS		
YES	125	61.6
NO	78	38.4

Figure 4 illustrates the distribution of pain intensity among participants based on the Visual Analogue Scale (VAS). Out of 203 smartphone gaming enthusiasts, 26 individuals (12.8%) reported **no pain** (score 0). Mild pain (scores 1–3) was reported by 68 participants, representing 33.5% of the sample. The largest group, 85 participants (41.9%), experienced **moderate pain** (scores 4–7). A smaller proportion, 24 participants (11.8%), reported **severe pain** (scores 8–10). These findings indicate that the majority of participants experienced mild to moderate musculoskeletal pain, highlighting the impact of smartphone gaming on discomfort levels in this population.

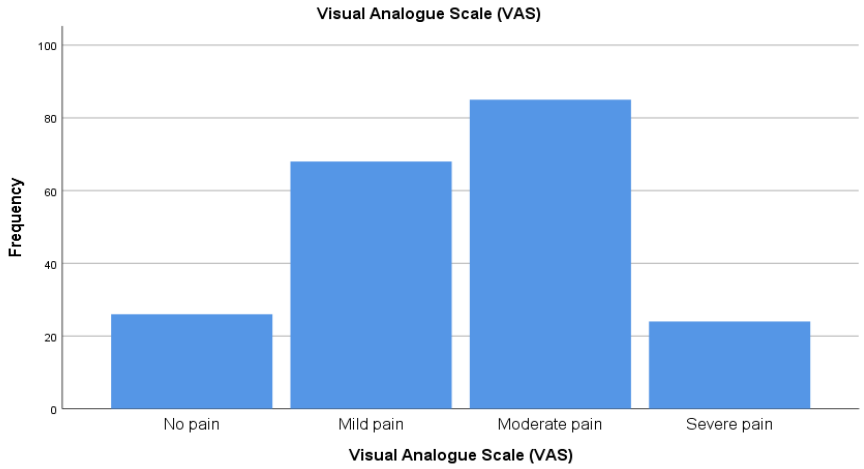

Figure 4: Distribution of Pain Intensity among Participants as Measured by the Visual Analogue Scale (VAS)

Table 1 reveals a high prevalence of musculoskeletal pain among smartphone gamers, especially in the neck (up to 61.6%), shoulders (61.6%), and back (over 56%), with many also reporting related disabilities. Elbow, wrist/hand, and lower limb pain were less common, with symptoms in hips/thighs, knees, and ankles/feet reported by fewer than 25% of participants. These findings underscore the frequent occurrence of upper-body discomfort linked to smartphone gaming.

Table 1: Distribution of the study subjects according to the Standardized Nordic Questionnaire. (N=203)

Body Region	Pain in last 12 Months		Disability Due to Pain		Pain in last 7 Days	
Neck:	N	%	N	%	N	%
Yes	111	54.7	119	58.6	125	61.6

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No	92	45.3	84	41.4	78	38.4
Shoulders:						
No	98	48.3	102	50.2	78	38.4
Yes	105	51.7	101	49.8	125	61.6
Elbows:						
No	144	70.9	142	70	137	67.5
Yes	58	28.6	61	30	66	32.5
Wrists/ Hands:						
No	109	53.7	118	58.1	120	59.1
Yes	92	45.3	85	41.9	83	40.9
Upper Back:						
No	89	43.8	94	46.3	84	41.4
Yes	114	56.2	109	53.7	118	58.1
Lower Back:						
No	81	39.9	83	40.9	77	37.9
Yes	122	60.1	120	59.1	125	61.9
Hips/ Thighs:						
No	176	86.7	173	85.2	173	85.2
Yes	27	13.3	30	14.8	30	14.8
Knees:						
No	154	75.9	151	74.4	156	76.8
Yes	49	24.1	52	25.6	47	23.2
Ankles/ Feet:						
No	166	81.8	170	83.7	156	76.8
Yes	37	18.2	33	16.3	47	23.2

DISCUSSION

This study highlights a high prevalence of musculoskeletal pain among smartphone gamers, particularly in the neck, shoulders, and lower back, with over 50% reporting symptoms in these areas. Poor postural habits such as forward head tilt, hunched shoulders, and wrist discomfort were common and likely contribute to the discomfort. Despite moderate physical activity levels in some participants, prolonged gaming without sufficient breaks led to early onset of pain for many. In this sample of 203 participants, more than half reported experiencing pain in key body regions, specifically 54.7% reported neck pain over the past 12 months, which increased to 61.6% within the past week, indicating persistent or worsening symptoms. Similarly, shoulder pain was reported by 51.7% of participants over the past year and 61.6% in the last 7 days, while lower back pain was the most prevalent complaint, affecting 60.1% of participants in the past year and 61.9% recently. Postural assessment data provide critical insight that over half of the participants (56.7%) admitted to tilting their heads forward during gaming sessions, a well-documented risk factor for increased cervical spine loading and subsequent neck pain. Furthermore, 57.1% reported experiencing rounded or hunched shoulders, which reflects poor upper body posture and contributes to muscular imbalances and shoulder discomfort. Wrist discomfort or bending was reported by 58.1% of users, underscoring the strain placed on the wrists and forearms from holding and manipulating smartphones for extended periods. An alarming observation is that 41.9% of participants began feeling discomfort within less than 30 minutes of gaming, indicating that even relatively short gaming sessions may pose a risk for musculoskeletal pain in this population. Despite this, only about one-third (34%) reported taking breaks every 30 minutes, while nearly 10% never took breaks, which may contribute to cumulative strain and symptom exacerbation. The study emphasizes the need for ergonomic education,

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regular breaks, posture correction, and targeted exercises to mitigate these issues.

LIMITATION:

The study did not account for potential confounding factors such as participants' involvement in other physical activities, academic workload, or pre-existing musculoskeletal conditions, which may have influenced the results. The demographic composition of the sample, including age range and gender distribution, may limit the generalizability of the findings to the wider population. Additionally, the absence of objective postural assessments and ergonomic evaluations may have limited the ability to establish a more precise understanding of posture-related musculoskeletal strain.

STRENGTH:

This study involved a robust sample of 203 university students aged 17 to 28 years, enhancing the reliability and representativeness of the findings within the target population. Validated assessment tools, including the Standardized Nordic Musculoskeletal Questionnaire (NMQ) and the Visual Analogue Scale (VAS), were employed to ensure accurate and consistent evaluation of musculoskeletal pain and discomfort. Additionally, posture-related behavioral data, such as forward head posture (reported by 56.7% of participants) and wrist discomfort (58.1%), provided meaningful insight into common gaming-related risk factors. By capturing both recent (last 7 days) and long-term (last 12 months) symptom prevalence, the study offers a comprehensive view of musculoskeletal health trends among smartphone gamers.

RECOMMENDATION:

Promote ergonomic education to help gamers maintain proper posture while playing. Encourage users to avoid forward head tilt and rounded shoulders during gameplay. Advise users to be mindful of wrist positioning to reduce strain and discomfort. Recommend taking regular breaks during gaming to prevent prolonged static postures. Implement targeted exercise programs focusing on strengthening and stretching the neck, shoulders, and wrists. Encourage stretching and position changes during long gaming sessions. Suggest that game developers incorporate in-app reminders to take breaks and correct posture. Future research should include objective posture and ergonomic assessments. Conduct longitudinal studies better to understand cause-and-effect relationships and the effectiveness of interventions.

CONCLUSION

The prevalence of musculoskeletal pain among smartphone gaming enthusiasts is notably high, with more than half reporting pain in critical regions such as the neck (54.7%–61.6%), shoulders (51.7%–61.6%), and lower back (60.1%–61.9%). Postural issues such as forward head tilt and wrist discomfort affect over 56% of users and are likely key contributors to pain. Although a notable proportion reported engaging in moderate physical activity (44.8%), the intensity and duration of gaming without adequate breaks increase the risk of musculoskeletal pain. Addressing ergonomic behaviors and encouraging regular breaks can help reduce pain and improve the quality of life in this population

ACKNOWLEDGMENT

I would like to express my heartfelt gratitude to all the participants who took part in this study and contributed their valuable time. I am especially indebted to my research supervisor, Dr. Khadija Usman, for her constant guidance, insightful feedback, and unwavering support throughout this research. Lastly, I sincerely appreciate my family and friends for their continuous encouragement and motivation during the course of this study.

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ISSN: (e) 3007-1607 (p) 3007-1593

FUNDING: This study was conducted without external funding. The researcher utilized departmental resources and the collaboration of the supervisor to complete the project. The absence of external funding did not compromise the quality or integrity of this research.

CONFLICT OF INTEREST: There were no financial, commercial, or personal relationships that could have influenced or biased the findings of this study titled "Prevalence of Musculoskeletal Pain among Smartphone Gaming Enthusiasts: A Cross-Sectional Study." The research was conducted independently, and no external funding or sponsorship was involved that could have created a potential conflict of interest.

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