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RELATIONSHIP OF SMARTPHONE ADDICTION WITH MUSCULOSKELETAL DISCOMFORT AMONG UNDERGRADUATE UNIVERSITY STUDENTS

Original Research

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ABSTRACT

Background: With the rapid advancement of digital technology, smartphones have become indispensable handheld devices, integrating communication, education, and entertainment into a single tool. Their widespread use across all age groups, particularly among students, has raised concerns about physical and psychological health consequences. Prolonged smartphone use is associated with poor posture and repetitive strain, contributing to musculoskeletal discomfort. As this behavior becomes habitual, particularly in youth, identifying its health impact has become a growing public health priority.

Objective: To determine the correlation between smartphone addiction and musculoskeletal discomfort among undergraduate university students.

Methods: This cross-sectional correlational study was conducted on 150 undergraduate students from the Foundation University Institute of Rehabilitation Sciences, using a non-probability convenience sampling technique. Participants aged 18–25 years with daily smartphone usage of 4–5 hours were included. Data collection tools included a self-structured demographic form, the Smartphone Addiction Scale-Short Version (SAS-SV), and the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ). Ethical approval and informed consent were obtained prior to data collection. IBM SPSS version 20 was used for statistical analysis. As the data were non-normally distributed ($p < 0.05$), Spearman's rank correlation was applied.

Results: Of the 150 participants, 93.5% (n=143) were female and 5.2% (n=8) male, with a mean age of 21.04 ± 1.89 years. Smartphone addiction was observed in 32.7% (n=50) of the participants. The most frequently reported musculoskeletal discomforts were in the neck (61.4%, n=94), lower back (53.6%, n=82), and upper back (47.1%, n=72). A moderate positive correlation was found between smartphone addiction and musculoskeletal discomfort, particularly in the neck ($r = 0.267$, $p = 0.001$), upper back ($r = 0.352$, $p < 0.001$), and upper limbs ($p < 0.05$).

Conclusion: A significant positive correlation exists between smartphone addiction and musculoskeletal discomfort among undergraduate students, particularly in the neck, upper back, and upper limbs.

Keywords: Musculoskeletal Pain, Neck Pain, Posture, Smartphone Addiction, Students, Technology Use, Upper Limb Disorders.

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INTRODUCTION

The rapid evolution of smartphones has redefined modern living, embedding itself deeply in the fabric of daily routines across the globe. Initially conceived as simple communication tools, smartphones have metamorphosed into powerful handheld computers that consolidate multiple functions—ranging from scheduling and email to high-resolution imaging, video conferencing, streaming media, online shopping, health monitoring, and more—all within a single device (1–3). This unprecedented integration of convenience and connectivity has made smartphones indispensable across generations, catalyzed by continuous advancements in hardware and software. However, the very features that enhance productivity and engagement have also introduced a new spectrum of health concerns. Emerging research highlights a disturbing trend of negative psychosocial and physical consequences stemming from excessive smartphone use, including strained interpersonal relationships, emotional distress, sleep disturbances, and reduced occupational or academic functionality (4–6). These effects are often rooted in poor self-regulation, repetitive checking behaviors, and compulsive usage patterns, now increasingly characterized within the framework of behavioral addiction (7–9). Smartphone addiction, defined as the persistent overuse of smartphones to the extent that it interferes with daily activities, has thus emerged as a pressing public health issue (8,9). This phenomenon is particularly prevalent among university students, who have grown up surrounded by ubiquitous digital technology. Most have never known life without instant connectivity, making them especially vulnerable to the psychosocial and physical implications of excessive smartphone engagement.

Data from the EDUCAUSE Center for Analysis and Research revealed that 99% of students surveyed across 127 universities owned a computer, 90% engaged in daily social networking, and 73% texted regularly—highlighting the digital saturation of this demographic (10–12). Compounding this issue is the rise in musculoskeletal complaints reported by young adults. Prolonged smartphone use promotes static, ergonomically unfavorable postures—such as forward head tilt, rounded shoulders, and repetitive wrist or thumb motions—which elevate mechanical stress and reduce local circulation, ultimately resulting in discomfort and pain in the upper extremities and cervical spine (13,14). Headaches, fatigue, and chronic pain in the fingers, hands, wrists, shoulders, and neck have been widely documented as consequences of this biomechanical strain. While global literature has explored the association between smartphone addiction and musculoskeletal discomfort, there remains a lack of localized research within the Pakistani undergraduate population. Given the increasing prevalence of both smartphone overuse and upper-quarter musculoskeletal complaints in this age group, a critical gap exists in understanding how these variables intersect within the national context. Addressing this knowledge void, the present study aims to determine the correlation between smartphone addiction and musculoskeletal discomfort among undergraduate university students in Pakistan, thereby contributing valuable insight into an emerging public health concern.

METHODS

This study adopted a cross-sectional correlational design to assess the relationship between smartphone addiction and musculoskeletal discomfort among undergraduate students. The research was conducted at the Foundation University Institute of Rehabilitation Sciences from October 2019 to August 2020. A calculated sample size of 384 was initially targeted based on standard statistical parameters to ensure adequate power for correlation analysis. However, due to unforeseen constraints posed by the COVID-19 pandemic—particularly institutional closures, limited access to students, and adherence to social distancing protocols—data collection was restricted. As a result, the final sample comprised 150 participants. Although this reduction may limit the statistical power and generalizability of the findings, the decision was made to proceed with the available sample to contribute preliminary data on a largely unexplored issue in the local context. The limitations arising from this constraint were acknowledged, and the analysis was appropriately adjusted using non-parametric statistics suited for smaller sample sizes and non-normally distributed data. Participants were recruited using a non-probability convenience sampling method. Eligibility criteria included undergraduate student status, age between 18 and 25 years, and a minimum daily smartphone usage of 4–5 hours. Individuals with prolonged work-related device use, recent musculoskeletal injuries or surgeries, diagnosed neurological or orthopedic conditions, or other major systemic illnesses were excluded to control for confounding factors that could independently influence musculoskeletal symptoms.

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Ethical approval was obtained from the Foundation University Ethical Review Committee, and informed written consent was secured from all participants. Confidentiality, anonymity, and the right to voluntary withdrawal were ensured throughout the study. Data collection utilized two validated self-administered tools. The Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) assessed discomfort severity, frequency, and its interference across various body regions. The Smartphone Addiction Scale-Short Version (SAS-SV) was used to measure addiction severity based on gender-specific cut-off scores (15,16). Both instruments have demonstrated high reliability and construct validity in previous studies. Data were analyzed using IBM SPSS version 20. As the dataset did not follow a normal distribution, non-parametric testing was employed. Spearman's rank correlation coefficient was used to examine the association between smartphone addiction and musculoskeletal discomfort, with statistical significance defined at $p < 0.05$.

RESULTS

Data were collected from a total of 150 undergraduate students, of whom 93.5% (n=143) were female and 5.2% (n=8) were male. The mean age of the participants was 21.04 ± 1.89 years. The majority were unmarried (94.1%, n=144), while only 1.3% (n=2) reported being married. The average Body Mass Index (BMI) of the sample was 21.29 ± 3.74 kg/m², indicating a generally normal weight profile among participants. Regarding smartphone addiction, 67.3% (n=103) of the students were classified as non-addicted, while 32.7% (n=50) met the criteria for smartphone addiction based on gender-specific cut-off scores of 31 for males and 33 for females. The median score on the Smartphone Addiction Scale–Short Version (SAS-SV) was 29.00, with an interquartile range of 15.00. Musculoskeletal discomfort was reported across multiple body regions. The most frequently affected areas included the neck (61.4%, n=94), lower back (53.6%, n=82), and upper back (47.1%, n=72). Discomfort was also notable in the right shoulder (39.2%, n=60), left shoulder (37.2%, n=57), right upper arm (32%, n=49), and wrists—right (26.1%, n=40) and left (21.6%, n=33). Other commonly affected areas included the hand fingers, thighs, hips, and knees, with percentages ranging from 20% to 25%. Normality analysis using the Kolmogorov-Smirnov test indicated that data for all study variables, including total musculoskeletal discomfort scores and smartphone addiction scores, were not normally distributed ($p < 0.05$). Linearity analysis further confirmed that the relationship between smartphone addiction and most musculoskeletal variables was linear, with the exception of the left thigh, which showed a non-linear association ($p = 0.016$). Therefore, non-parametric statistical tests were employed.

Spearman's correlation analysis revealed statistically significant positive correlations between smartphone addiction scores and reported musculoskeletal discomfort in several key regions. A moderate correlation was found in the upper back ($r = 0.352$, $p < 0.001$), while weaker but still significant associations were observed in the hand fingers (right: $r = 0.342$, $p < 0.001$; left: $r = 0.263$, $p = 0.001$), wrist (right: $r = 0.314$, $p < 0.001$; left: $r = 0.296$, $p < 0.001$), upper arm (right: $r = 0.289$, $p < 0.001$; left: $r = 0.287$, $p < 0.001$), neck ($r = 0.267$, $p = 0.001$), and lower back ($r = 0.229$, $p = 0.004$). The right shoulder also showed a significant, though lower, correlation ($r = 0.162$, $p = 0.046$). The left shoulder, forearms, knees, and lower legs did not exhibit statistically significant associations. To provide a comprehensive overview of the relationship between smartphone addiction and overall musculoskeletal discomfort, a correlation analysis was conducted using the total score of the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ total). The Spearman's correlation coefficient revealed a statistically significant positive association between smartphone addiction scores and overall musculoskeletal discomfort ($r = 0.379$, $p < 0.001$). This finding reinforces the regional correlation patterns observed earlier, suggesting that higher levels of smartphone addiction are associated not only with localized discomfort (e.g., upper back, wrists, neck) but also with a generalized increase in musculoskeletal symptom burden across multiple body regions. Including the CMDQ total score adds important holistic insight, supporting the primary hypothesis of a meaningful association between excessive smartphone use and physical discomfort among undergraduate students.

Table 1: Demographics of Research Participants

Variable	Result
Age (Mean± SD)	21.04 ± 1.89
Gender	
Male	5.2% (n=8)
Female	93.5% (n=143)
Marital status	
Single	94.1% (n=144)
Married	1.3% (n=2)
BMI (kg/m^2) (Mean± SD)	21.29 ± 3.74

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Table 2: Attributes related to smartphone Addiction

Attributes	Result
Smart phone Addiction (Med ± IQR)	29.00 ± 15.00
No Smartphone Addiction %(n)	67.3 %(n=103)
Smart Phone Addiction %(n)	32.7% (n=50)

Table 3: Frequency of Musculoskeletal Discomfort in different regions of body

Region	Percent (%)
Neck	61.4% (n=94)
Shoulder R.	39.2% (n=60)
Shoulder L.	37.2% (n=57)
Upper back	47.1% (n=72)
Upper arm R.	32% (n=49)
Upper arm L.	27.5% (n=42)
Lower back	53.6% (n=82)
Forearm R.	20.9% (n=32)
Forearm L.	15% (n=23)
Wrist R.	26.1% (n=40)
Wrist L.	21.6% (n=33)
Hand fingers R.	24.8% (n=38)
Hand fingers L.	20.3% (n=31)
Hip	25.5% (n=39)
Thigh R.	24.2% (n=37)
Thigh L.	21.6% (n=33)
Knee R.	20.9% (n=32)
Knee L.	20.9% (n=32)
Lower leg R.	24.8% (n=38)
Lower leg L.	23.5% (n=36)

Table 4: Normality Analysis of Variables Using Kolmogorov-Smirnov Test

Variable	P-Value	Normality
CMDQ Total	< 0.001	Skewed data
Neck	0.001	Skewed data
Shoulder R.	0.001	Skewed data
Shoulder L.	0.001	Skewed data
Upper back	0.001	Skewed data
Upper arm R.	0.001	Skewed data
Upper arm L.	0.001	Skewed data
Lower back	0.001	Skewed data
Forearm R.	0.001	Skewed data
Forearm L.	0.001	Skewed data
Wrist R.	0.001	Skewed data
Wrist L.	0.001	Skewed data
Hand fingers R.	0.001	Skewed data
Hand fingers L.	0.001	Skewed data
Hip	0.001	Skewed data
Thigh R.	0.001	Skewed data

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Variable	P-Value	Normality
Thigh L.	0.001	Skewed data
Knee R.	0.001	Skewed data
Knee L.	0.001	Skewed data
Lower leg R.	0.001	Skewed data
Lower leg L.	0.001	Skewed data
Smartphone addiction	0.028	Skewed data

Table 5: Linearity Analysis Between Smartphone Addiction and Musculoskeletal Discomfort Variables

Variable	P-Value	Linearity Relation
Neck	0.821	Linear
Shoulder (Right)	0.984	Linear
Shoulder (Left)	0.872	Linear
Upper Back	0.106	Linear
Upper Arm (Right)	0.332	Linear
Upper Arm (Left)	0.927	Linear
Lower Back	0.783	Linear
Forearm (Right)	0.713	Linear
Forearm (Left)	0.981	Linear
Wrist (Right)	0.720	Linear
Wrist (Left)	0.672	Linear
Hip/Buttocks	0.573	Linear
Thigh (Right)	0.333	Linear
Thigh (Left)	0.016	Non-linear
Knee (Right)	0.701	Linear
Knee (Left)	0.496	Linear
Lower Leg (Right)	0.628	Linear
Lower Leg (Left)	0.448	Linear
Foot (Right)	0.838	Linear
Foot (Left)	0.799	Linear

Table 6: Correlation of Smartphone Addiction and Musculoskeletal Discomfort

Region	Correlation Coefficient	P-Value
Neck	0.267	0.001*
Shoulder R.	0.162	0.046*
Shoulder L.	0.147	0.069
Upper back	0.352	<0.001**
Upper arm R.	0.289	<0.001**
Upper arm L.	0.287	<0.001**

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Region	Correlation Coefficient	P-Value
Lower back	0.229	0.004*
Forearm R.	0.123	0.129
Forearm L.	0.106	0.194
Wrist R.	0.314	<0.001**
Wrist L.	0.296	<0.001**
Hand fingers R.	0.342	<0.001**
Hand fingers L.	0.263	0.001*
Hip	0.141	0.082
Thigh R.	0.163	0.044*
Thigh L.	0.167	0.039*
Knee R.	0.044	0.586
Knee L.	0.092	0.260
Lower leg R.	0.111	0.171
Lower leg L.	0.104	0.199

Table 7: The Correlation Between Smartphone Addiction and Overall Musculoskeletal Discomfort

Variable Pair	Correlation Coefficient (r)	P-Value
Smartphone Addiction vs. CMDQ Total Discomfort Score	0.379	< 0.001

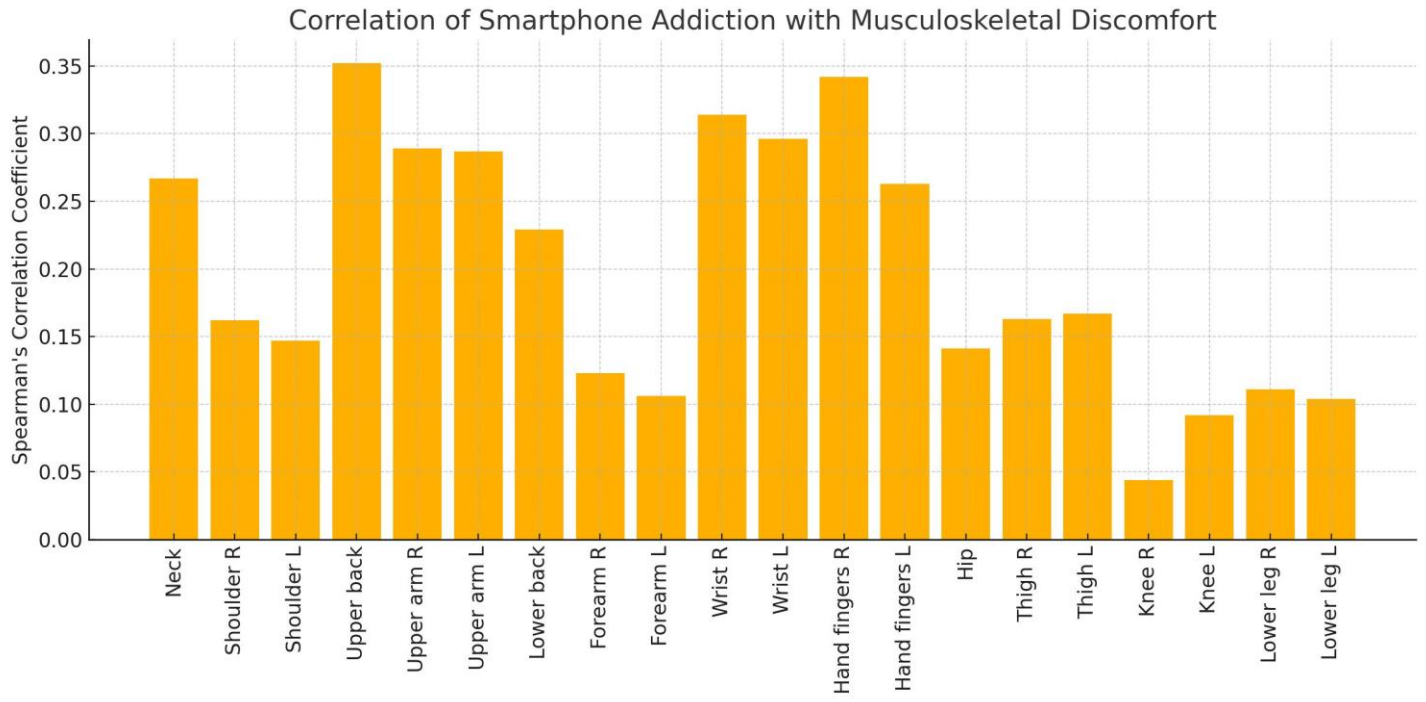

Figure 1 Correlation of Smartphones Addiction with Musculoskeletal Discomfort

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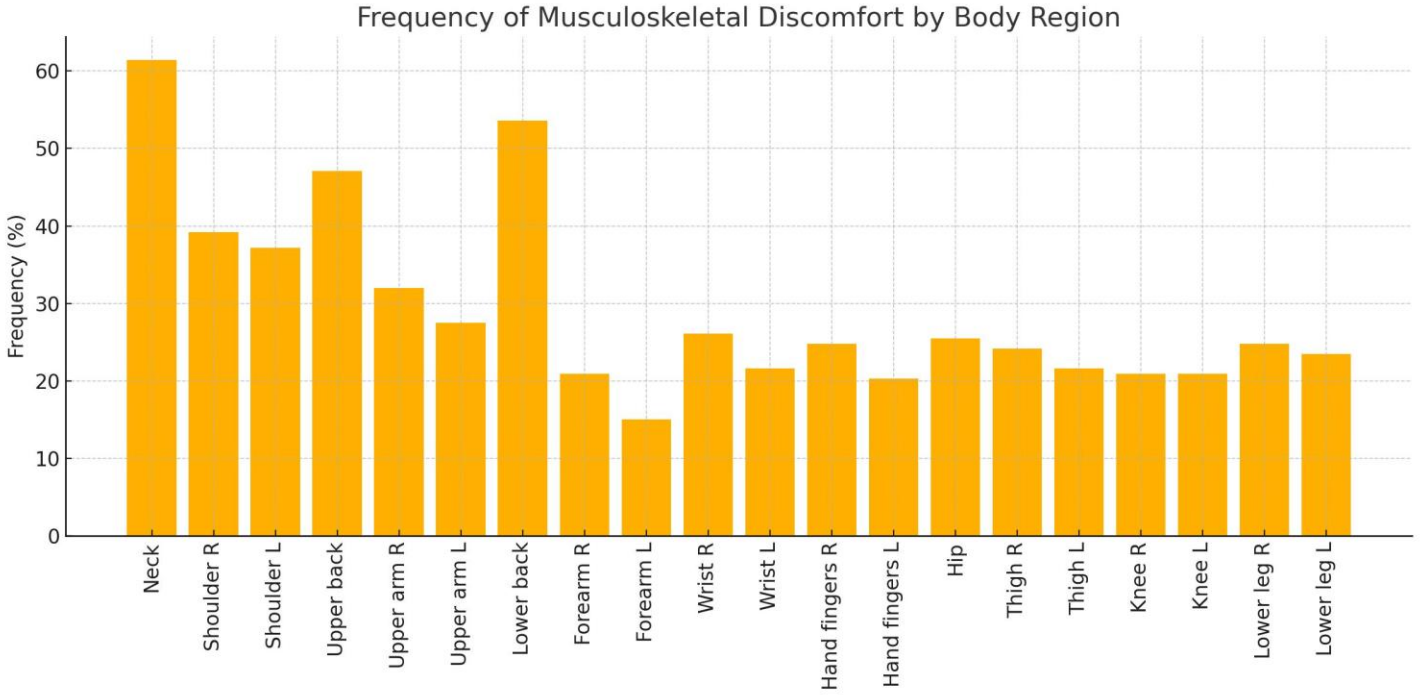

Figure 2 Frequency of Musculoskeletal Discomfort by Body Region

DISCUSSION

The findings of this study provide compelling evidence of a significant association between smartphone addiction and musculoskeletal discomfort among undergraduate students. Using two validated instruments—the Cornell Musculoskeletal Discomfort Questionnaire (CMDQ) and the Smartphone Addiction Scale-Short Version (SAS-SV)—the study successfully quantified both the extent of musculoskeletal complaints and the severity of smartphone addiction. Notably, 32.7% of the participants were identified as smartphone-addicted, and the most frequently reported sites of discomfort included the neck (61.4%), lower back (53.6%), and upper back (47.1%), followed by the shoulders and upper limbs. A positive correlation was observed between smartphone addiction scores and musculoskeletal discomfort in several upper-quarter regions, with the total CMDQ score also significantly correlated with smartphone addiction, reflecting a generalized burden of discomfort associated with higher usage levels (15,16). These results align closely with existing literature that has consistently reported a link between prolonged smartphone use and the development of musculoskeletal symptoms in the cervical and upper thoracic regions. A systematic review of eleven studies reinforced this connection by highlighting neck flexion, static postures, muscle fatigue, and repetitive joint loading as key biomechanical contributors to musculoskeletal discomfort related to smartphone use (17,18). Similarly, a cross-sectional study on university students reported that over 60% of participants experienced smartphone addiction and frequently reported musculoskeletal pain in the neck, shoulders, and lower back—mirroring the distribution of symptoms observed in the present study (19). The consistency of these findings across different populations underscores the global relevance of this issue, particularly among young adults whose academic, social, and recreational lives are increasingly mediated by digital devices.

From a theoretical perspective, the current study contributes to the growing understanding of how behavioral addiction can manifest as physical dysfunction, particularly when combined with biomechanically unfavorable habits. The sustained forward head posture, repetitive use of fingers and wrists, and static muscle activation required during smartphone use impose considerable mechanical strain on the musculoskeletal system (20,21). These mechanical stressors, when compounded by the habitual and prolonged nature of smartphone use, create a pathway for the development of musculoskeletal pain syndromes. This pathophysiological link reinforces the need for interdisciplinary awareness, integrating physical rehabilitation perspectives with behavioral and psychological health considerations (22,23). A notable strength of this study lies in its dual use of validated, widely accepted tools to assess both smartphone addiction and musculoskeletal symptoms. This methodological rigor adds credibility to the observed associations and ensures that findings are grounded in reliable measures. Additionally, by incorporating the CMDQ total score in the correlation analysis, the study

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provides a more holistic view of physical symptomatology, capturing the cumulative burden of discomfort rather than isolated regional symptoms alone. Despite these strengths, certain limitations must be acknowledged. The study relied on self-reported data, which inherently carries the risk of reporting bias. Participants may have underreported or overreported their symptoms and smartphone usage patterns, either unintentionally or due to social desirability bias. Furthermore, the sample was drawn from a single academic institution in Islamabad, and the small sample size of 150 participants limits the generalizability of findings to the broader university student population in Pakistan. The COVID-19 pandemic imposed further constraints, curtailing both data collection and participant outreach, which may have reduced the representativeness of the sample. The cross-sectional nature of the design also limits causal inferences; while correlations were observed, the temporal direction of influence cannot be confirmed.

To address these limitations, future studies should consider using objective monitoring tools, such as smartphone usage tracking apps and ergonomic assessments, to complement self-reported data. Expanding the sample across multiple regions and educational institutions would enhance generalizability, while larger sample sizes would improve statistical power. Moreover, interventional studies aimed at reducing smartphone usage and improving posture awareness could offer practical strategies for mitigating the physical consequences of digital device overuse. Preventive measures, including ergonomics education and behavioral modification strategies, could be integrated into health promotion programs targeted at young adults. In light of the findings, it is evident that the excessive and repetitive use of smartphones has direct physical implications. Awareness campaigns, institutional guidelines promoting posture-friendly digital engagement, and periodic physical assessments can play a vital role in early identification and management of musculoskeletal discomfort in students. The integration of such preventive strategies into academic health services may significantly reduce the long-term burden of technology-induced musculoskeletal issues.

CONCLUSION

This study concludes that there is a significant positive association between smartphone addiction and musculoskeletal discomfort among undergraduate university students. The most commonly affected regions were the neck, lower back, upper back, and right shoulder, reflecting the physical strain linked to frequent and prolonged smartphone use. These findings highlight the growing need to address the musculoskeletal health risks posed by digital device overuse, especially in young adults. Promoting awareness about ergonomic practices and encouraging healthier smartphone usage habits can play a critical role in reducing the burden of discomfort and enhancing overall well-being in this population.

AUTHOR CONTRIBUTION

Author	**Contribution**
Sameen Tariq	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Sana Bashir	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Palwasha Hussain	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Maqsoora Humayun	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Bushra Marium	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Syeda Sumaira Batool	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Huma Khan	Contributed to study concept and Data collection Has given Final Approval of the version to be published
Inayat Ullah*	Writing - Review & Editing, Assistance with Data Curation

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