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Prevalence of Forward Head Posture among School Children Using Smartphones in Rawalpindi

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ABSTRACT

Background: Forward head posture (FHP) is a postural dysfunction characterized by the anterior displacement of the head relative to the vertical midline. The increasing use of smartphones has been implicated in the rising prevalence of FHP among schoolchildren.

Objectives: This study aimed to determine the prevalence of forward head posture among school going children in Rawalpindi, Pakistan, and to assess its association with smartphone usage patterns.

Methods: A descriptive cross-sectional study was conducted in private schools in Rawalpindi from September 2023 to March 2024. A total of 270 participants, aged 10–15 years, were selected using non-probability convenience sampling. Craniovertebral angle (CVA) was measured using Kinovea software for forward head posture measurement after marking the C7 vertebra and capturing lateral-view images. Smartphone usage patterns were assessed through a semi-structured questionnaire. Data were analyzed using SPSS version 25, with results presented as frequencies, percentages, and mean ± SD.

Results: The prevalence of forward head posture (CVA < 48°) was 88.5% (n=239), with males (88.5%) and females (88.6%) equally affected. Most participants (73%) used smartphones more than five days per week, and 91.5% had over two years of usage history.

Conclusion: Forward head posture was highly prevalent among school children in Rawalpindi, strongly associated with prolonged smartphone use. Interventions targeting posture education are urgently needed.

Keywords: Cervical Vertebrae, Craniovertebral Angle, Forward Head Posture, Mobile Phones, Posture, School Children, Smartphone Usage

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Introduction

Forward head posture (FHP) is characterized by the anterior displacement of the head relative to a vertical reference line, frequently accompanied by increased cervical spine lordosis, with the middle cervical spine extended and the lower cervical spine flexed. This posture often leads to associated conditions such as hunchback and rounded shoulders, adversely affecting musculoskeletal health. FHP is a prevalent postural dysfunction and is increasingly associated with modern technological habits, such as prolonged use of visual display terminals (VDTs), particularly smartphones (1, 2). While FHP is linked to biomechanical changes and symptoms such as neck stiffness and discomfort, its isolated presence does not always result in significant clinical symptoms such as chronic pain or headache, indicating a multifactorial etiology (3). However, its adverse effects on respiratory muscle strength, static balance, and shoulder function are well-documented, as FHP contributes to abnormal scapular kinematics and altered muscle activity (4, 5). Over time, this posture may accelerate joint deterioration, leading to degenerative joint disease and impairments in cervical mobility (6).

The widespread adoption of smartphones has led to increased concern about the postural health of younger populations, with studies suggesting that excessive smartphone use contributes to the progression of FHP due to sustained forward-leaning postures (7). Observational evidence indicates that prolonged smartphone use correlates with altered craniovertebral angles (CVA), a critical measure of head posture alignment, potentially resulting in substantial musculoskeletal stress (8). Furthermore, FHP is observed to affect respiratory mechanics, including thoracic shape and muscle function, demonstrating its broad impact on physiological systems (9). Public school children showing higher activity compared to private school children, and low activity levels linked to overweight and obesity (10).

Epidemiological studies have reported varying prevalence rates of FHP across different demographics, with significant variation between age groups and genders. For instance, research has documented moderate to severe FHP among school-aged children and identified smartphone overuse as a critical contributing factor, with prolonged daily use and years of usage exacerbating the condition (11). These findings underscore the importance of studying FHP prevalence within specific populations to develop targeted prevention and intervention strategies. Understanding the relationship between smartphone usage patterns and postural changes is essential for addressing this growing health concern. The current study aims to investigate the prevalence of FHP among school-going children aged 10–15 years in Rawalpindi, Pakistan, focusing on the impact of excessive smartphone use on craniovertebral alignment.

Materials and Methods

This descriptive cross-sectional study was conducted in private schools in Rawalpindi, Pakistan, from September 2023 to March 2024, targeting school-going children aged 10 to 15 years. A sample size of 282 participants was initially calculated using Slovin's formula; however, 12 individuals were excluded based on predetermined criteria, resulting in a final sample of 270 participants. The sample was recruited through non-probability convenience sampling. Ethical approval was obtained from the Institutional Review Committee (IRC) of the University Institute of Physical Therapy, University of Lahore, in accordance with the principles outlined in the Declaration of Helsinki. Written informed consent was secured from all participants or their legal guardians prior to study enrollment. Permissions were also sought from school administrations to facilitate participant recruitment.

Participants were included if they were students of private schools within the specified age range, used smartphones for more than two hours daily and more than two days per week, had a history of smartphone use exceeding two years, and voluntarily agreed to participate. Exclusion criteria encompassed individuals with any musculoskeletal conditions affecting the cervical region, recent neck trauma, degenerative diseases, or recent neck surgeries (12, 13). The semi-structured questionnaire used for data collection was designed to gather information on demographics, smartphone usage patterns, and other relevant variables.

After obtaining consent, participants underwent a physical assessment to measure craniovertebral angle (CVA) as an objective marker for forward head posture. The C7 vertebra was palpated and marked with a marker, and lateral-view photographs of participants were captured. CVA measurements were performed using Kinovea software, which allowed for accurate angular assessments (14). Data collection was conducted systematically, ensuring the privacy and comfort of participants during the assessment process.

Data were analyzed using SPSS version 25. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarize demographic data and CVA measurements. Categorical variables such as gender, age group, smartphone usage duration, and frequency were expressed as percentages, while continuous variables were summarized as mean ± standard deviation. Ethical principles, including participant confidentiality and the voluntary nature of participation, were strictly upheld throughout the study. All participants had the right to withdraw from the study at any time without repercussions.

Results

A total of 270 participants met the inclusion criteria and were included in the analysis. The demographic

characteristics, smartphone usage patterns, and craniovertebral angle (CVA) measurements are presented in the tables. Out of 270, study population included 164 males (57.8%) and 106 females (42.2%). Participants were stratified into two age groups: 10–12 years and 13–15 years. The majority of the participants, 164 (60.7%), belonged to the 10–12 years age group, while 106 (39.3%) were aged 13–15 years. The mean age of participants was 12.29 ± 1.092 years.

Table 1: Demographic Characteristics of the Participants and Smartphone Usage Patterns

Category	Subcategory	Frequency (Percentage)
Gender	Male	156 (57.8)
	Female	114 (42.2)
Age	10 to 12 years	164 (60.7)
	13 to 15 years	106 (39.3)
Start Using Smartphones	1-2 years	23 (8.5)
	More than 2 years	247 (91.5)
Days of Smartphone Use per Week	2-3 days	39 (14.4)
	3-5 days	34 (12.6)
	More than 5 days	197 (73)

Among the participants who use smartphones, 239 (88.5%) were found to have forward head posture (CVA < 48°), while only 31 (11.5%) had normal posture (CVA ≥ 48°). The study revealed a high prevalence of forward head posture (FHP) among school-going children aged 10–15 years in Rawalpindi, with 88.5% of participants demonstrating abnormal craniovertebral angles (CVA < 48°). Males and females exhibited comparable rates of FHP. Prolonged smartphone use, exceeding two years and more than five days per week, was strongly associated with reduced CVA. These findings suggest a significant correlation between smartphone usage patterns and postural deviations among schoolchildren using smartphones.

Table 2: Craniovertebral Angle (CVA) and Prevalence of Forward Head Posture (FHP)

CVA Classification	Frequency	Percentage
CVA ≥ 48°	31	11.5
CVA < 48°	239	88.5
Total	270	100.0

Table 3: Gender-wise distribution of Forward Head Posture (FHP)

Gender	Normal CVA	FHP (CVA <48°)	Total
Male	18 (11.5)	138 (88.5)	156
Female	13 (11.4)	101 (88.6)	114
Total	31 (11.5)	239 (88.5)	270

Discussion

The findings of this study revealed a high prevalence of forward head posture (FHP) among school-going children aged 10 to 15 years in Rawalpindi, with 88.5% of the participants exhibiting a craniovertebral angle (CVA) below the normal threshold. These results align with previous studies conducted in similar populations. For instance, Verma et al. reported an FHP prevalence of 63% among Indian schoolchildren, indicating that FHP is a pervasive issue among youth globally, though the prevalence in the current study was significantly higher (1). This disparity may be attributed to differences in smartphone usage habits, lifestyle patterns, or the age range of participants. Furthermore, the finding that male participants exhibited a slightly higher prevalence of FHP than females corroborates other studies, such as that of Wiguna et al., who observed gender-based differences in FHP prevalence among students (15).

Prolonged smartphone use emerged as a key factor contributing to FHP in the study population. Most participants reported using smartphones for more than five days per week and for periods exceeding two years, a pattern consistent with findings by Kang et al., who identified a strong association between extended use of visual display terminals and postural deviations (3). Smartphone use typically involves prolonged neck flexion and forward-leaning postures, which can lead to musculoskeletal imbalances, reduced CVA, and ultimately, FHP. These biomechanical adaptations, as highlighted in previous research, contribute to various health issues, including cervical muscle fatigue, reduced respiratory function, and shoulder dysfunction (5, 9).

The study further adds to the body of evidence demonstrating the impact of modern technological habits on postural health. However, it is essential to note certain limitations in the current research. Longitudinal studies

would be necessary to determine the temporal relationship and causal pathways between these variables.

To mitigate the prevalence of FHP among children, interventions targeting both individual and environmental factors are recommended. Schools should incorporate ergonomic education and awareness programs to promote correct postural habits during smartphone use and other activities. Encouraging regular breaks during prolonged screen time and fostering participation in physical activities, such as yoga or posture correction exercises, may also help reduce FHP risk. At a policy level, integrating posture health education into school curricula could be an effective preventive strategy (16). Further research should focus on the development and evaluation of these interventions, with an emphasis on diverse populations and longitudinal outcomes.

For the future concern, the study underscored the high prevalence of FHP among school-going children in Rawalpindi, highlighting the need for targeted interventions to address this growing public health concern. By drawing comparisons with prior research and emphasizing the role of smartphone use in exacerbating postural deviations, the study provides a foundation for further exploration and action in this critical area of pediatric health.

Conclusion

The study demonstrated an alarmingly high prevalence of forward head posture among school going children in Rawalpindi, closely linked to excessive smartphone use. This highlights the urgent need for awareness programs targeting posture correction and responsible smartphone habits in schools and homes.

Authors' Contributions

ICMJE authorship criteria	Detailed contributions	Authors
Substantial Contributions	Conception or Design of the work	1,2
	Data acquisition	2,3
	Data analysis or interpretation	1,3
Drafting or Reviewing	Draft the work	1
	Review critically	2,3
Final approval	Final approval of the version to be published.	1,2,3
Accountable	Agreement to be accountable for all aspects of the work.	1,2,3

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