

Prevalence, risk factors of forward head posture and its health consequences on physical outcomes among the adult population in Saudi Arabia

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ABSTRACT

This study investigated the prevalence, risk factors, and health consequences associated with forward head posture (FHP) among Saudi Arabia's adult population. The authors screened 533 adult males using a photographic technique to calculate the craniovertebral angle (CVA), and used direct questions to determine the average screen time per day, the existence of neck pain, and the average number of pain attacks. Body composition was indicated by body mass index (BMI). The numeric pain rating scale (NPRS) assessed the average neck pain intensity. Of the 533 participants, 211 (39%) demonstrated a CVA of 48° or less, indicating FHP. There was a statistically significant negative correlation between screen time exposure and the value of CVA ($r = -.651$; $p < .001$). Similarly, a statistically significant positive correlation existed between BMI and FHP ($r = -.470$; $p < .001$). The existence of pain, its intensity, and the average number of attacks were statistically significantly correlated with the CVA ($R_{pb} = -.692$; $p < .001$). ($r = -.621$; $p < .001$). ($r = -.801$; $p < .001$), respectively. In conclusion, FHP is a common neck problem among adult males in Saudi Arabia. Reducing exposure to smart screens and optimizing body composition could reduce the incidence of FHP and subsequent neck pain.

KEYWORDS

Cervical Spine; Craniovertebral Angle; Risk Factors; Side Effects; Upper Crossed Syndrome

1. INTRODUCTION

The forward head posture (FHP) is a common postural deviation characterized by upper cervical extension and lower cervical flexion. This aberrant postural deviation occurs to keep the eyes horizontal and regain the optimal visual field. The excessive upper cervical extension causes the atlantoaxial and atlantooccipital joints to become less spacious, increasing posterior compressive stresses. The greater occipital nerve or vertebral artery may become irritated or compressed as a result of this posterior compression, which also shortens the suboccipital muscles, compresses the facet joints, and relaxes posterior ligamentous structures (Fiebert et al., 2021).

FHP can cause painful shortening of the muscles at the back of the neck, resulting in muscle imbalances due to aberrant cervical muscle load; additionally, it increases compressive stresses on the articular facets and intervertebral ligaments. Dorsal kyphosis is more common in subjects with FHP, and their cervical spine range of motion (ROM) is frequently significantly reduced. Even though there isn't a direct link between FHP and musculoskeletal diseases, headaches, temporomandibular arthralgia, neck discomfort, and pain are commonly seen in individuals with FHP (Annarumma et al., 2023).

Postural deviations such as FHP can be seen in various populations in modern life. However, its prevalence among the adult population has not been well investigated. According to Saeed et al., more than 67% of the school-age children in India have FHP (Chandoliya et al., 2021). Meanwhile, another Indian study reported a prevalence rate of 63% among children between 12 and 16 years of age (Verma et al., 2018). Four studies assessed the prevalence of FHP among university students. Three of them were conducted in Pakistan and reported prevalence rates between 47.9 and 87.8 (Nawal et al., 2025; Naz et al., 2018; Saeed et al., 2024). Meanwhile, the Indian study reported a prevalence rate of 73% (Singh et al., 2020). Only a single adult-based study in India demonstrated a prevalence rate of 71.42%, where the sample consisted of a small group (n=35) of goldsmith workers (Kulwal & Sakharwade, 2024).

Multiple risk factors, namely, the excessive use of modern technology, demographic characteristics, and other postural deviations, might be linked to the development of FHP. However, the literature discusses only a few of them. For example, Saeed et al. reported a higher prevalence among university students who spend more time in front of smartphone screens (Saeed et al., 2024). Additionally, Naz et al. reported a significant correlation between those demonstrating a rounded-

shoulder attitude and the development of FHP (Naz et al., 2018). On the other hand, Nawal et al. did not observe a correlation between either age or gender and the FHP (Nawal et al., 2025).

The health consequences of FHP have been extensively discussed in previous literature. Several health problems have been reported in subjects with FHP. For example, subjects with FHP demonstrated lower dynamic postural stability than normal subjects (Abbasi et al., 2020). At the same time, other researchers reported abnormalities in the sensory-motor function and the autonomic nervous system (Moustafa et al., 2020). Additionally, arm movement and static balance were linked to the FHP, as reported by Kang et al. (2024). Moreover, several studies reported a significant correlation between FHP and musculoskeletal pain involving the shoulders (Kim & Lee, 2021) or neck regions (Kim et al., 2018).

External postural measures and radiographic examinations are the primary methods for calculating FHP. The external postural measures can be performed using the photographic technique, where a lateral view was taken, and the craniovertebral angle (CVA) was determined using appropriate software. The CVA is an angle formed at the intersection of a line connecting the tragus of the ear and the spinous process of C7 with a horizontal line (imaginary line parallel to the ground) (Youssef et al., 2025).

Another method involves using a plumb line, where the FHP is diagnosed according to the distance of displacement of the tragus of the ear from the plumb line (Chandoliya et al., 2021). The third method of external postural measures involves the use of the traditional goniometer to calculate the CVA, where the fulcrum is placed against the spinous process of the seventh cervical vertebra (C7), one arm is placed horizontally, and the second arm is directed toward the tragus of the ear (Nawal et al., 2025).

The previously published studies have demonstrated various limitations; first, the prevalence studies are limited. Additionally, adults and older adults were not considered. However, most of the existing literature focused on children and college-age students. Also, the existing literature covered a narrow geographical area where most of the studies were conducted either in India (Chandoliya et al., 2021; Kulwal & Sakharwade, 2024; Nawal et al., 2025; Singh et al., 2020) or Pakistan (Nawal et al., 2025; Naz et al., 2018). The small sample size used in most of the previous studies makes it challenging to generalize the study's findings.

This study tries to cover the gap highlighted in the previous literature regarding age groups and geographical factors by investigating the prevalence, risk factors, and health consequences associated with FHP among the adult age group in Saudi Arabia.

2. METHODS

2.1. Study Design and Participants

The time frame for this cross-sectional study was November 2024 through April 2025. The sample was recruited through direct communication, poster announcements, and social media. In this study, 533 Saudi Adult men between the ages of 30 and 50 took part. The Research Ethics Committee approved the study protocol at a local university (H-2024-524). Participants signed a consent form before the start of the study.

2.2. Outcome Measures

The basic demographic data, including age, weight, and height, were recorded. Then the body mass index (BMI) was calculated by dividing the weight in kg by the squared height in meters (Hussein et al., 2023). The value of the CVA indicated the FHP. The CVA was calculated using a side photo of the participant. This photo was captured using a high-resolution (48-megapixel) camera attached to an iPhone 16 Pro Max cell phone.

To take the photo invariably, the cell phone was attached to a tripod, a transportable tool used to raise, steady, and support a camera or other observational or measuring apparatus, where the level of the phone camera should be in line with the center of the participant's shoulder joint. The participant-tripod distance was 1.5 m (Dawood et al., 2023; Mosaad et al., 2020). Before taking the photo, markers were used to highlight the anatomical landmarks (the tragus of the ear and the tip of the 7th cervical spinous process). The participants were instructed to stand relaxed with their right side to the camera. This photographic method of measuring the CVA is valid and has demonstrated high intra-rater and inter-rater reliability as reported previously (Bustam & Herdayanti, 2023).

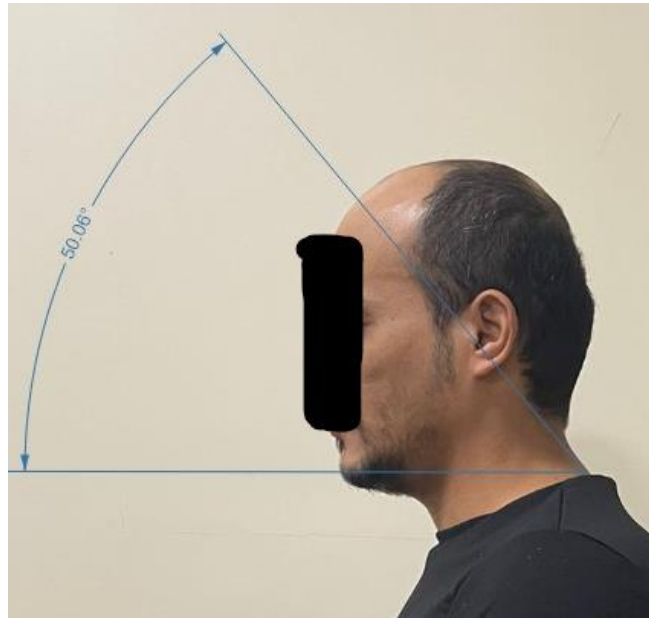


Figure 1. Calculating the CVA using the photographic method

2.3. Statistical Analyses

Data was analyzed using the Statistical Package for Social Science (SPSS Inc., Chicago, IL, USA) version 27. The Shapiro-Wilk test was used to test the normal distribution of data. The results were expressed by means, standard deviations (SDs), and percentages. Pearson's correlation coefficient was calculated between two continuous variables, and the Point-biserial correlation was calculated when one variable was continuous and the other was dichotomous. In case of significant correlation, the risk ratio was calculated between the CVA and these risk factors. The differences were considered significant at $p < 0.05$.

3. RESULTS

This study included 533 adult males from different regions of Saudi Arabia (Figure 2), and 211 (39%) demonstrated a CVA of 48° or less, indicating FHP. The mean age (year), weight (kg), height (meter), and BMI of the participants were 32.27 ± 9.59 , 75.24 ± 18.13 , 1.71 ± 0.07 , 29.80 ± 7.01 , respectively.

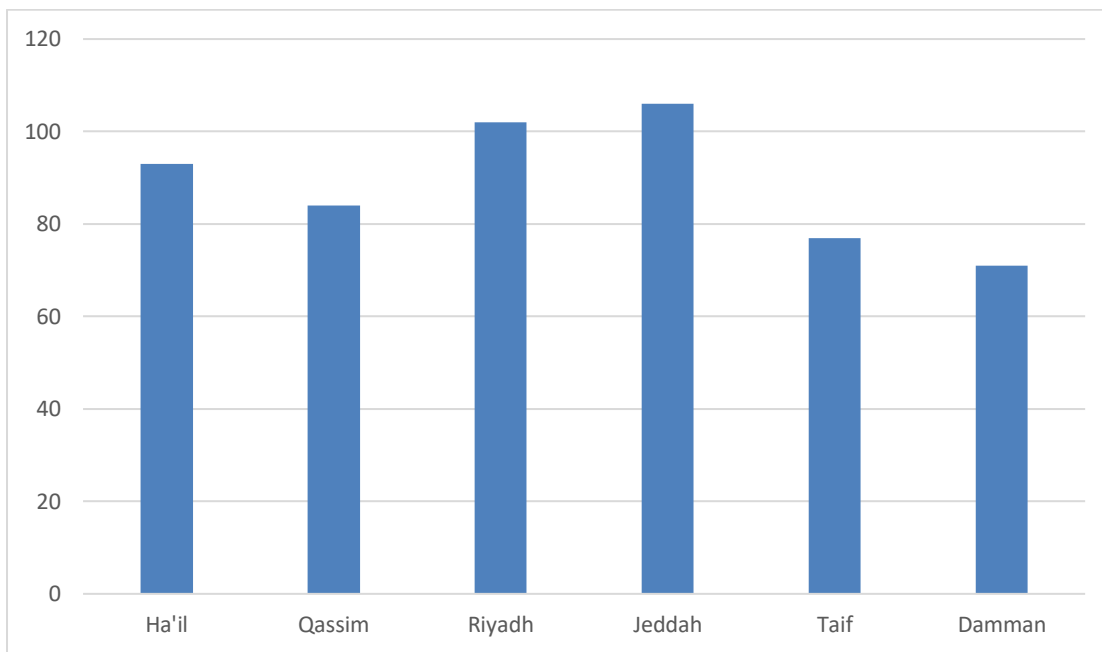


Figure 2. Geographical distribution of the participants

The health condition of the participants varied. For example, 1.8% had hypertension (HTN), and 4.6% (25) were diabetic type 2. Interestingly, 373 (70%) of the participants reported regular and recurrent neck pain attacks within the last six months. Additionally, the BMI values were within the normal level in 18.7% (n=100) of the participants, while the remaining participants (433) were overweight or obese.

Regarding the risk factors of interest, all participants were cell phone users, while different percentages used a tablet 56% (299), a laptop/desktop 29% (156), or a combination of them. 36% of the participants described themselves as smokers, with a daily rate of consumption ranging between 1 and 40 cigarettes.

Table 1 determines whether there is a relationship (correlation) between forward head posture (measured by CVA) and lifestyle factors.

Table 1. Correlation between CVA and screen time, smoking, and BMI

	Risk factors		
	Smoking	Screen time	Body composition
Craniovertebral Angle (CVA)	$Rpb=.065$ $p=.51$	$r =-.651$ $p < .001$ $RR =2.53$ 95%CI (2.20,2.90)	$r =-.470$ $p < .001$ $RR= 1.34$ 95%CI (1.18, 1052)

Note. Rpb , Rpb , point biserial correlation value; r , Pearson's correlation coefficient; RR , risk ratio; CI , confidence interval

Statistical analysis revealed a high negative correlation between the CVA and the average time spent on the smart screens ($r = -.65, p \leq .001$). Additionally, there was a high to moderate negative correlation between the CVA and body composition, indicated as BMI ($r = -.470, p \leq .001$). On the other hand, there was no statistically significant correlation between the CVA and the smoking status of the participants. The risk ratio of demonstrating FHP in subjects spending more than 2 hours daily in front of a smart screen is more than twice that of those spending 2 hours or less. Additionally, obese persons have 1.34 times more risk compared to non-obese persons of developing FHP (Table 1).

In the following, Table 2 shows whether poor posture (CVA) is linked to neck pain frequency, severity, and occurrence.

Table 2. Correlation between the CVA and the occurrence of neck pain, average number of attacks within the last six months, and pain intensity

	Health consequences		
	Existence of neck pain	Number of pain attacks	Pain intensity
Craniovertebral Angle	Rpb= -.692 P< .001	$r = -.801$ $p < .001$	$r = -.621$ $p < .001$

Note. Rpb, point biserial correlation value; r, Pearson's correlation coefficient

Based on the results of Table 2, statistical analysis revealed a high negative correlation between the CVA and the existence of neck pain ($r = -.6920, p \leq .001$), number of pain attacks ($r = -.801, p \leq .001$), and pain intensity ($r = -.621, p \leq .001$) (Table 2).

4. DISCUSSION

This study searched for the prevalence of FHP among the adult male population in Saudi Arabia. Additionally, it investigated some of the proposed risk factors that might contribute to the development of FHP and the possible health consequences. The findings showed a relatively high prevalence rate (39%) among the participants. The participants with FHP demonstrated increased usage of smart screens and increased body composition compared to those with no FHP. Additionally, participants with FHP demonstrated higher exposure to neck pain attacks in terms of intensity and average number of attacks.

Prevalence of FHP

Previously, several studies investigated the prevalence of FHP among diverse populations, such as College-age students (Nawal et al., 2025; Naz et al., 2018; Saeed et al., 2024; Singh et al.,

2020), Goldsmith workers (Kulwal & Sakharwade, 2024), and school-age children or preadolescents (Chandoliya et al., 2021; Verma et al., 2018; Zehra et al., 2024).

Nawal et al. (Nawal et al., 2025) screened 180 medical college students of both genders using a universal goniometer. The angle was measured in a seated position, and the findings were subdivided into normal, mild, moderate, and severe FHP. The overall prevalence of FHP reported was 87.8%, much higher than the current study findings. This difference can be attributed to the variations in the method of measuring the FHP and the characteristics of the study population, as the current study included a wider age group compared to the Nawal study, where only 18-to 20-year-old people were investigated. Similarly, Naz et al. assessed 197 participants recruited from four local universities for the prevalence of FHP. They reported a prevalence rate of 63.96% among the studied population. However, this rate was less than that reported by Nawal et al., but it is still much higher than the current study findings. Naz et al. used the plumb line method to determine the FHP (Naz et al., 2018).

In contrast to previous studies, Saeed et al. reported a prevalence rate of 47.9% among a large sample of 340 university students. In this study, a traditional goniometer and a ruler were used to assess the FHP (Saeed et al., 2024). In another study, the FHP was evaluated, using a photographic method, among a sample of 35 goldsmith workers in India. 71.42% of these workers demonstrated FHP.

Among the school-age population, the prevalence of FHP ranged between 63% (Chandoliya et al., 2021; Verma et al., 2018) and 88.5% (Zehra et al., 2024). The methods of assessing FHP were variable. Some researchers used plumb lines (Chandoliya et al., 2021), and others used photographic methods (Verma et al., 2018; Zehra et al., 2024). Also, the sample size was different among these studies, ranging between 100 and 300 school students of both genders.

Risk Factors

Previous work investigated several proposed factors that might have contributed to the development of FHP. As we did in the current study, Saeed et al. reported a significant correlation between the usage of smartphones and the development of FHP (Saeed et al., 2024). However, the study was conducted on a relatively large sample (340); the age of this sample was younger than that of those included in the current study. Also, Saeed et al. assessed the use of smartphones only, while in the current study, we asked for the usage of any smart screens usually utilized by the age group we targeted. Even among the younger school-age children, Zehra et al. found a significant correlation

between the FHP and the prolonged use of smartphones among school-age children. Zehra et al. assessed the use of smartphones through a semi-structured questionnaire. Interestingly, they reported that most children use their smartphones more than 5 days per week, for a period that extended over the last two years (Zehra et al., 2024). Our current findings support what was reported in those previous studies regarding the association between prolonged use of smart screens and FHP.

On the other hand, a previous study reported no significant correlation between one of the demographic characteristics (age) and FHP among a group of medical college students (Nawal et al., 2025). This finding could be attributed to the narrow age group (18-25 y) included in the study. However, in the current study, we investigated another demographic factor (body composition), and we reported an increased risk of developing FHP with increased BMI.

Health Consequences

The current study reported a significant correlation between FHP and the intensity of neck pain and the number of attacks. These findings are partially supported by Kim and Lee (H.-J. Kim & Lee, 2021), who reported a positive correlation between FHP and shoulder pain among a group of adult populations compared to healthy controls. Similarly, another study found that FHP and neck pain are linked (D. H. Kim et al., 2018). These findings agreed with those reported among a group of office workers with FHP in Iran (Nejati et al., 2015).

Additionally, Naz et al. reported a significant correlation between FHP and rounded shoulder posture (Naz et al., 2018). However, an earlier study didn't support this finding (E. K. Kim & Kim, 2016). Additionally, it was reported that FHP can negatively influence arm movements and static balance. In other studies, subjects with FHP demonstrated deviations in sensorimotor control and autonomic nervous system function (Moustafa et al., 2020). On the other hand, the survey conducted by Saeed et al. reported no significant correlation between FHP and the level of Daily activities among university students (Saeed et al., 2024).

The current study's findings could be attributed to a few reasons. In modern life, more people adopt a relaxed lifestyle and consume unhealthy food, which has led to a rapid rise in obesity (Hussien et al., 2021; Liu et al., 2021). Obese persons tend to use a more relaxed posture, especially during the sitting position, which increases stress and abnormal cervical posture and might develop FHP. Additionally, the easy accessibility to modern technology and the addiction to social media (Cheng et al., 2021) and other applications could contribute to the increased prevalence rate of postural abnormalities, such as FHP (Abu Halimah et al., 2024).

Using smartphones and similar devices could lead to unusual neck-shoulder alignment, especially when the person assumes a fixed neck position without shoulder support. Consequently, the imbalance between the length of the anterior and posterior neck muscles can develop FHP. Such health consequences could, in the long term, lead to major health problems like decreased work capacity, depression, or reduced quality of life (Tasmeer et al., 2022).

All these health consequences raise the importance of correcting this postural malalignment (Kang, 2024) as well as increasing awareness regarding good posture (Zehra et al., 2024), especially among highly vulnerable subjects such as those having elevated fat composition or those using smart screens longer than two hours per day. Responsible authorities should pay more attention to this health problem and increase awareness about its risk factors and health consequences among vulnerable populations. Educational classes, scientific flyers, and regular postural examinations could be beneficial in workplaces to educate people about preventive measures and possible treatments.

The current study's limitations include gender restrictions; we could not include females due to some cultural background. So, the current findings could not apply to adult females with FHP. We did not consider the occupation as a confounding factor in this study. We recommend that future studies investigate the possible correlation between different occupations and the development of FHP.

5. CONCLUSIONS

The study concludes that nearly 40% of the studied population demonstrated FHP. FHP was higher among subjects exposed to smart screens and those with high BMI. The FHP population demonstrated high neck pain intensity and average pain attacks compared to healthy subjects.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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