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The prevalence of certain upper body abnormalities and their association with mental health among female students at Payame Noor University

Fatemeh Alzahra Pourmavaddat[1], Khatoon Pourmaveddat[2]*

1. Physical Education Department, Payame Noor University (PNU), Tehran, Iran.
2. Department of Psychology, Payame Noor University (PNU), Tehran, Iran. (*Corresponding author: ✉Pourmaveddat@pnu.ac.ir, https://orcid.org/0000-0002-1292-4935)

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Abstract

Background: The modern increase in mechanical and sedentary lifestyles has led to a rise in musculoskeletal abnormalities within society. These physical irregularities may influence individual mental health.

Aim: This study explores the correlation between upper body musculoskeletal abnormalities and mental health among female students at Payame Noor University, Bushehr.

Material and Methods: A total of 173 female students were selected via convenience sampling for this cross-sectional study. The presence of scoliosis, forward head posture, kyphosis, and increased lordosis was assessed using a flexible ruler, the New York Test, a chessboard, and a scoliometer. Body mass index (BMI) and waist-to-hip ratio (WHR) were also measured. Participants completed the General Health Questionnaire (GHQ-28). Statistical analysis was conducted using one-sample t-tests and Pearson's correlation coefficient, with a significance threshold set at $P< 0.05$.

Results: The findings indicated that lordosis was significantly more prevalent among students aged 15 to 24 ($t=31.5$, $P= 0.001$) and those aged 25 and above ($t=57.3$, $P= 0.003$), compared to societal norms. Other assessed abnormalities were within normal ranges. Mental health vulnerabilities were noted in specific domains; however, no significant correlation was found between mental health status and the physical abnormalities studied.

Conclusion: While lordosis was notably more common among the study's participants than in the general population, the incidence of other musculoskeletal abnormalities aligned with societal averages. No substantial impact of these physical conditions on mental health was observed. It is advisable to integrate educational initiatives and corrective exercise programs into the curriculum for educators, coaches, and students to promote overall well-being.

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1. Introduction

In the contemporary era, marked by technological advancements and the ubiquity of social media, a trend toward physical inactivity has emerged. This sedentary lifestyle is a precursor to various musculoskeletal disorders (MSDs) [1]. Given this reality, the importance of maintaining proper posture cannot be overstated. Posture, defined as the consistent, correct alignment of body parts and joints, is crucial for the integrity of bodily functions. Deviations from optimal posture result in organ impairments and systemic dysfunctions [2]. Prominent postural issues affecting the upper body include kyphosis, characterized by an exaggerated forward curvature of the thoracic spine [3]; lordosis, an abnormal inward curvature of the lumbar spine [4]; scoliosis, a lateral curvature or twisting of the spine [5]; forward head posture, also known as 'nerd neck' [6]; and asymmetrical shoulders [7].

Detrimental movements or extended periods of inactivity can disrupt bodily systems, particularly the skeletal system, leading to discomfort, compromised bodily integrity, and dysfunction [8]. Studies indicate a high incidence of skeletal issues among male students, attributed to physical inactivity and weakened upper body musculature, especially around the spinal area [9]. Research presents mixed findings regarding the association between these musculoskeletal impairments and demographic factors. For instance, one study highlighted a significant correlation between the prevalence of lordosis and hyperkyphosis with students' gender and academic level [10].

Conversely, another investigation found no significant link between the rates of kyphosis and lordosis with variables such as weight, height, Body Mass Index (BMI), family size, weekly working hours, and job sector. While the incidence of kyphosis did not vary across different genders and ages, the rate of lordosis was more pronounced in females and increased with age [9].

Sedentary habits also seem to influence psychological well-being. In this context, researchers have explored the relationship between hyperkyphosis, forward head posture, and body image in non-athletic females, concluding that body image concerns were more acute in visible impairments like kyphosis. The lack of awareness regarding forward head posture may diminish the affected individuals' self-perception [2], potentially impacting their bio-psychological health [1].

Additionally, an investigation into the prevalence of MSDs and their correlation with mental health among nurses found significant associations with depression, anxiety, and stress [11]. However, another study reported no substantial links between kyphosis and psychological conditions such as anxiety and depression [12]. Corrective exercises, a specialized field within physical education and sports science, are instrumental in identifying and addressing MSDs, thereby contributing to both physical and mental health [2].

Poor habits, a sedentary lifestyle, muscular weaknesses, and improper posture are known to precipitate MSDs, which may, in turn, be intertwined with mental health challenges. The reciprocal nature of this relationship suggests that mental disorders can lead to physical ailments and vice versa [13]. Evidence suggests that MSDs can adversely affect life quality and lead to emotional fatigue [14]. As students represent a pivotal demographic influencing societal health, understanding the interplay between MSDs and mental health within this group is of paramount importance. Amidst conflicting reports, this study aims to examine the correlation between MSDs (such as kyphosis, uneven

shoulders, scoliosis, hyperlordosis, and hyperkyphosis) and the waist-hip ratio (WHR)- an indicator of fat distribution [15]- among female students at the Payame Noor University, Bushehr Branch, Iran.

2. Materials and Methods

2. 1. Participants

This cross-sectional study involved 173 female students from Payame Noor University, Bushehr Branch, Iran. The participants had a mean age of 21.43±3.1 years, a mean height of 160.43±5.73 cm, and a mean weight of 60.96±12.23 kg. The inclusion criterion was female students irrespective of their academic discipline. The study spanned four months during the second semester of the 2022–2023 academic year, encompassing sampling, MSD analysis, data collection, and analysis phases. Convenience sampling was employed to select participants, with the sample size of 173 being informed by the average participant number in prior related studies [1, 2, 6].

2. 2. Procedure

Upon a comprehensive briefing about the study, participants provided informed consent by reading and signing consent forms. Mental health assessments were conducted using Goldberg's 28-Item General Health Questionnaire (GHQ-28) from 1979 [16].

For MSD evaluation, a one-sample t-test was utilized. The mean scores for kyphosis, lordosis, and waist-to-hip ratio (WHR) were compared against normative scores. For participants aged 15–24, the normative range for lordosis was 34.91–58.93, and for those over 24, it was 36.30–64.38. Scores outside these ranges indicated lordosis, with average norm scores set at 60 and 65 for the respective age groups [17].

WHR assessments followed the cut-off point of 0.80 as proposed by Molarius et al. (1999) [18] with WHRs below this threshold considered normal. Consequently, a WHR of 0.81 was used for comparative analysis.

Scoliosis evaluations were based on the cut-off point of 5° suggested by Gheitasi et al. (2018) [19], with angles below this considered normal. Therefore, scoliosis measurements were benchmarked against a 5° angle.

Pearson's correlation coefficient was applied to determine the relationship between mental health and MSDs.

2. 3. Measurement

2. 3. 1. The New York Test

The New York Test was administered to evaluate 13 distinct body postures, with a focus on 11 postures pertinent to spinal assessment. The evaluation process utilized a checkerboard for recording [20]. In this study, the forward head position and shoulder asymmetry were assessed using the New York Test. For each posture, a set of three images was provided: the leftmost image represented the normal posture with a score of five, the central image depicted a mild disorder with a score of three, and the rightmost image indicated severe abnormality with a score of one. Examiners selected the image most closely matching the participant's posture. The concurrent application of the checkerboard and the New York Test enhanced measurement precision and facilitated disorder identification. Participants with scores of one and three were identified as having forward head posture and shoulder asymmetry, respectively (Figure 1).

2. 3. 2. Anthropometric measurements

Participant height was measured using a Seca brand wall-mounted stadiometer. Individuals were instructed to stand erect, heels together, with their back and bare feet against the wall, ensuring proper alignment

with the height gauge. Body weight was ascertained with a BodyCare digital scale, Iran. Participants were advised to remove footwear and wear minimal clothing to ensure accurate measurement.

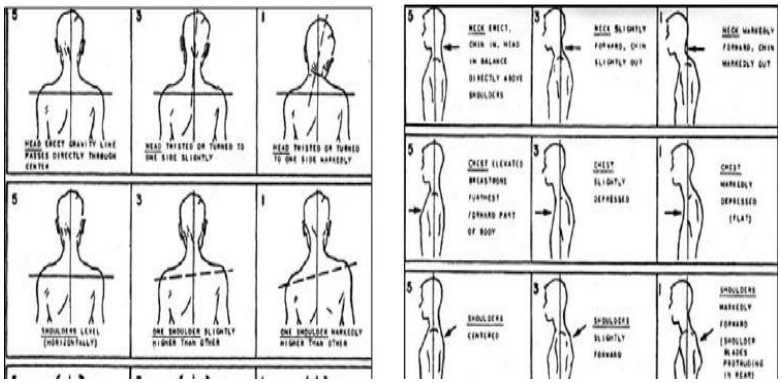

Figure 1. Depictions from the New York Test for postural assessment

2. 3. 3. Flexible ruler assessment

For the assessment of kyphosis and shoulder asymmetry, participants were positioned against a wall on a checkerboard sheet, barefoot and in minimal attire, ensuring equal weight distribution across both feet. The examiner visually inspected for shoulder asymmetry and documented the findings.

To evaluate forward head posture, participants stood laterally while the examiner recorded the most pronounced posture. For lordosis assessment, the examiner identified the C7 vertebra, the most prominent spinal protrusion, and traced downward to mark the T2 vertebra. Concurrently, the examiner palpated the lateral edges of the rib cage, following the rib line to the point of disappearance, marking the T12 vertebra at the convergence of the fingers. The sacral process was then marked as L1.

To locate the S2 spinal process, the anterior superior iliac spines were palpated bilaterally, and a line connecting these points was drawn, marking the S2 process. A flexible ruler was then contoured to the spine from C7 to S2, ensuring no gaps between the ruler and the skin. The spinal curvature was transcribed onto paper, maintaining the original angles.

The curvature's linear span (line L) and the perpendicular distance from the curvature peak to line L (line h) were measured in mm. The curvature angle (Θ) was calculated using the formula [21]:

$$\Theta = 4 \arctan\frac{2h}{l}.$$

2. 3. 4. Scoliometer assessment

The scoliometer, a non-invasive tool for assessing scoliosis, was utilized to detect abnormal spinal curvatures. Participants, minimally clothed, assumed a forward bend position to align their upper bodies with their shoulders and pelvis. From this position, the scoliometer was placed perpendicular to the spine along the intervertebral discs. The instrument's zero mark was aligned with the apex of the spinous process, and the degree of lateral curvature was recorded [22].

For WHR measurements, the narrowest waist circumference was obtained at the end of a normal exhalation using a tape measure. The maximum hip circumference was similarly measured. The WHR was calculated by dividing the waist measurement by the hip measurement [23].

2. 3. 5. GHQ-28 evaluation

The General Health Questionnaire (GHQ-

28), developed by Goldberg in 1972 and its expanded form introduced in 1987, was employed to assess mental health. An Iranian validation study confirmed its reliability with test-retest reliability at 0.70, split-half reliability at 0.93, and Cronbach's alpha at 0.90. Its concurrent validity with the Middlesex Hospital Questionnaire (MHQ) yielded a coefficient of 0.55. Inter-correlations among the GHQ-28 sub-scales ranged from 0.72 to 0.87, indicating a robust overall construct. Factor analysis using varimax rotation, guided by the scree plot, identified four factors- depression, anxiety, social dysfunction, and somatic symptoms- accounting for over 50% of the variance [16].

3. Results

Figure 2 presents a histogram with descriptive statistics for mental health analysis. The mental health scores were normally distributed, with a mean of 26.12 and a standard deviation of 10.5. A total of 37% of participants scored between 0–21, indicating an absence of significant mental health concerns. Scores ranging from 22 to 43 were observed in 56.1% of participants, suggesting the presence of mental health issues. Notably, 6.9% of participants scored between 43–63, indicative of severe mental health conditions.

In terms of BMI, 5.8% of participants were categorized as underweight, 59% as having a healthy weight, 27.7% as overweight, and 7.5% as obese. Postural analysis revealed that 19.1% of participants exhibited forward head posture. Specifically, 29 individuals (16.8%) were identified with forward head disorder, while 144 participants (83.2%) did not exhibit this condition.

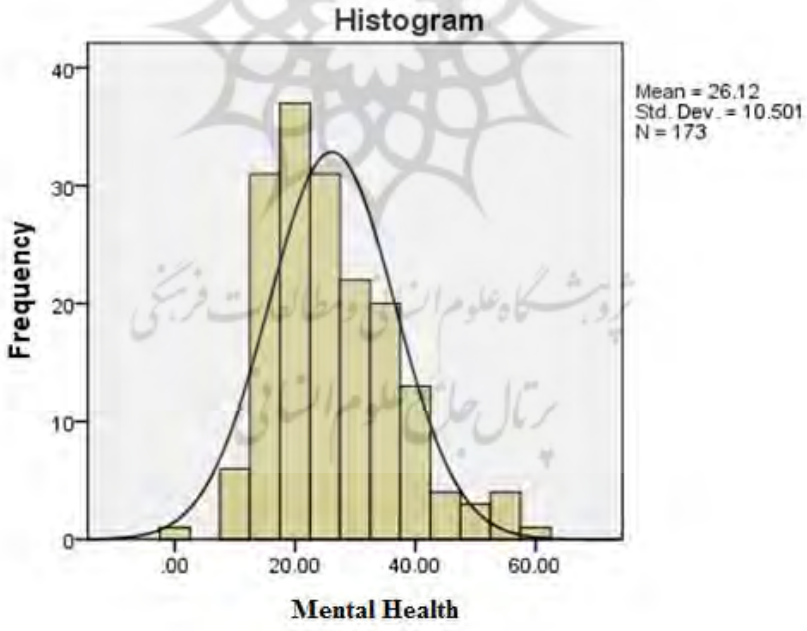

Figure 2. Mental health histogram

The application of the one-sample t-test indicated that the lordosis scores among female participants aged 15–24 were significantly above the normative mean (M= 66.23, t= 5.31, *P*< 0.0001). Additionally, for participants aged over 24, the lordosis scores were also significantly greater than the normative mean (M= 78.96, t= 3.57, *P*= 0.003). These findings suggest a prevalence of lordosis in these age groups when compared to the total sample population (Table 1).

Table 1. One-sample t-test results for the lordosis of female students

Age	Norm	*M*	*SD*	*t*(n)	*P*	Cohen's *d*	95% CI	
							UL	LL
15–24	34.91-58.93 (>60 is deviation)	66.23	14.77	5.31(159)	0.0001	.494	3.91	8.54
>24	36.30-64.38 (>64.38 is deviation)	78.96	15.26	3.57(14)	0.003	.955	5.76	23.39

The independent-sample t-test analysis revealed that the kyphosis scores for female participants aged 15–24 fell within the range of 28–49, significantly below the established norm (M= 31.07, t= -20.38, *P*< 0.0001). Additionally, female participants over the age of 24 exhibited kyphosis scores (M= 34.92) were significantly lower than the norm (t= -7.39, *P*< 0.0001). Consequently, it was determined that the kyphosis scores of the female students were beneath the population norm cut-off point (Tables 2).

Table 2. One-sample t-test results for the kyphosis of female students

Age	Norm	*M*	*SD*	*t*(n)	*P*	Cohen's *d*	95% CI	
							UL	LL
15–24	28-49 (>49 is deviation)	31.07	11.70	-20.38(159)	0.001	1.53	-20.76	-17.09
>24	30.37-53.05 (>53 is deviation)	34.92	9.20	-7.39(14)	0.0001	1.96	-23.49	-12.86

*P<0.01

The one-sample t-test analysis indicated that WHR of the participants was significantly lower than the normative value (M=0.72, t= -7.04, *P*<0.0001). Consequently, the WHR measurements for the female student cohort fell within the normal range (Table 3).

Table 3. One-sample t-test results for the WHR of female students

Norm	*M*	*SD*	*t*(n)	*P*	Cohen's *d*	95% CI	
						UL	LL
(>0.8 is deviation)	0.729	0.13	-7.04(173)	0.0001	.546	-0.09	-0.05

*P<0.01

The one-sample t-test indicated that the scoliosis measurements for the participants were significantly below the normative threshold (M= 2.44, t= -13.45, *P*< 0.0001), suggesting that the cohort fell within the normal range for scoliosis (Table 4). Analysis using Pearson's correlation coefficient revealed no significant associations between mental health and the variables of kyphosis, lordosis, forward head posture, WHR, and BMI.

Table 4. One-sample t-test results for the scoliosis of female students

Norm	*M*	*SD*	*t*(n)	*P*	Cohen's *d*	95% CI	
						UL	LL
5-20° for structural scoliosis	2.44	2.49	-13.45(173)	0.0001	1.028	-2.92	-2.17

*P<0.01

4. Discussion

The findings of this investigation revealed that the lordosis scores among participants exceeded the normative values, as reported by Rajabi and Latifi (2010) [17]. This suggests that factors such as physical inactivity, prolonged sitting, improper lying and standing postures, and a lack of education on posture correction may contribute to the exacerbation of lordosis in females. This aligns with previous research identifying lordosis as a prevalent musculoskeletal impairment [24]. Participants conformed to normative standards for kyphosis and WHR, corroborating the results of Farahani et al. (2012) [25]. Contrary to the findings of Shaghayegh-Fard et al. (2015) [26], participants exhibited normal BMI and forward head posture, potentially attributable to differences in measurement methodologies.

The GHQ-28 questionnaire outcomes indicated potential vulnerabilities in certain aspects of the participants' mental health, echoing the findings of Mehri and Sedighi (2012), who reported that a significant proportion of students face mental health challenges [27]. These results are also consistent with those of Dessauvagie et al. (2022) [28] and Shahabinejad, Sadeghi and Salem (2016) [29].

Notably, no significant correlation was found between mental health and MSDs. This contrasts with several studies that have reported such associations [30]. The discrepancy may be explained by the youthful demographic of this study's participants, suggesting that age may play a role in the manifestation of musculoskeletal impairments and mental health concerns. Supporting this notion, some studies have found no significant link between BMI and mental health in younger populations [31, 32]. Consistent with the current study's results, previous research has not found significant correlations between mental health and various postural conditions in working adults [33, 34, 35]. Earlier studies suggested that anxiety, depression, and kyphosis had no significant correlations [12]. Additionally, while mental health and quality of life may be interconnected with physical conditions and age in males, this association does not appear to hold for females, particularly in younger age groups [36].

5. Conclusion

The study concluded that the prevalence of hyperkyphosis, forward head posture, WHR, and scoliosis among the participants mirrored that of the broader population. However, an elevated incidence of lordosis was noted. No significant correlation was established between MSDs and mental health. Nonetheless, the implementation of corrective exercise and educational programs is recommended for physical educators, athletes, and students to mitigate the risk of hyperkyphosis and to foster mental well-being.

Conflict of interest

The authors declared no conflicts of interest.

Authors' contributions

All authors contributed to the original idea, study design.

Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc. This article has an ethical code in terms of ethics in Payam Noor University research [Ethics Code: (IR.PNU.REC.1402.277).

Data availability

The dataset generated and analyzed during

the current study is available from the corresponding author on reasonable request.

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This research was conducted under ethical standards, and the participants signed written consent forms. This paper was extracted from an approved thesis at Bushehr Payame Noor University.

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