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Research Article

Association of Upper Quarter Posture with Depression, Anxiety, and Level of Physical Activity in Sixth Grade Elementary School Students of Karaj City, Iran

Shakiba Asadi-Melerdi[1], MSc; Elnaz Rajabi-Shamli[2], MSc; Rahman Sheikhhoseini[2*], PhD; Hashem Piri[2], PhD

[1]Faculty of Physical Education and Sport Sciences, University of Tehran, Tehran, Iran
[2]Department of Corrective Exercise & Sport injury, Faculty of Physical Education and Sport Sciences, Allameh Tabataba'i University, Tehran, Iran

Corresponding author:* Rahman Sheikhhoseini, PhD; Faculty of Sport Sciences, Allameh Tabataba'i University, Western Azadi Sport Complex Boulevard, Hakim Highway, Tehran, Iran. **Tel: +98 21 48394134; **Email:** Rahman.pt2@gmail.com

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Abstract

Background: Postural abnormalities are prevalent among elementary school students. The aim of this study was to investigate the association of the upper quarter posture with depression, anxiety and level of physical activity in elementary school students of Karaj.
Methods: In this cross-sectional study, 346 sixth grade students were randomly selected from 10 elementary schools. Levels of physical activity, anxiety, and depression were measured and the data were collected employing International Physical Activity Questionnaire-Short form (IPAQ-SF), Revised Children's Manifest Anxiety Scale (RCMAS), and Children's Depression Inventory (CDI), respectively. Photogrammetric method and a flexible ruler were used to assess the students' posture. Pearson correlation test and linear regression model at the confidence level of 95% ($P<0.05$) was utilized to analyze the data.
Results: There was a significant relation between depression and the craniovertebral angle ($P=0.003$); physical activity levels were also correlated with the sagittal head angle ($P=0.012$), and kyphosis ($P=0.012$).
Conclusions: Certain postural abnormalities were associated with physical activity and psychological problems. Therefore, preventive actions are of great necessity to decrease postural and psychological problems.

Keywords: Posture, Students, Physical activity, Depression, Anxiety, Photogrammetry

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1. Introduction

Posture could be defined as a combination of arranging all segments of the body at a specified point of time (1). An upright posture is considered to be an important marker of movement system condition (2). Due to the advent of technology in modern lifestyle, human motor behavior has changed, and poor posture is becoming more and more prevalent among children (3, 4). Postural deviations are considered as health-related problems and risk factors for further injuries; hence several studies have dealt with these deviations (1, 3-27). Low levels of physical activity, obesity, electronic entertainment, poor nutrition, carrying heavy bags, and incorrect sitting position are believed to be the risk factors of poor posture in children and adolescents (4). Moreover, a review study conducted among children and adolescents reported that sitting time, stress, depression, and psychosomatic symptoms are the risk factors contributing to the upper quadrant musculoskeletal pain syndromes (20).

Postural changes in children might be attributed to probable consequences including musculoskeletal pains and these disorders may increase with age (6), resulting in chronic musculoskeletal pain syndromes in adulthood, whose treatment would impose an economic burden on people (5, 20). Thus, an investigation of different dimensions and related factors of posture has captured a lot of scientific attention. Physical factors affecting posture have been studied by several researchers (10, 14, 17, 27). Also, it is believed that mental and emotional states affect the movement and posture of human (21), and a person's posture reveals his or her emotional state in non-verbal communication (1).

Several studies investigated the relation between psychological dimensions and posture (1, 8, 9, 16, 18, 19, 21-24, 26). It was shown that slumped sitting was related to mental and spiritual states and individuals with poor posture experience rather negative emotions (16, 19, 26).

Mental and physical aspects of human are interrelated and all of the human posture deviations cannot be explained physically and mechanically (28). For instance, forward head posture and rounded shoulders in some adults could be a sign of shyness or lack of confidence (18). Thus, it is vital to pay attention to psychological dimensions when it comes to designing postural correction protocols. It has been shown that there is a significant relationship between upper quadrant posture and depression, and sadness of female gender (23). In another study conducted on elementary school students, faulty posture was significantly associated with psychological distress (8). What is more, a significant relation was observed between the recurrence of depressive episodes and postural deviation in adults (1).

Meanwhile, few studies have been conducted on posture, depression and anxiety, and physical activity levels in children and adolescents in comparison to that in adults (23, 29). The relation between standing posture and effective factors is less studied and the association between pain and sitting posture in adolescents was investigated previously in other studies (5, 20, 30). It is noteworthy to mention that poor posture in elementary school students is more prevalent among boys than girls (12). To our knowledge, no study, so far, has investigated the relation among mental and spiritual states, physical activity and posture in elementary school students. Accordingly, in this study we aimed to answer the question of whether there is a relation between upper quadrant posture and depression, anxiety and physical activity levels in sixth grade students of Karaj.

2. Methods

This was a cross-sectional study that was performed in the first semester of the academic year of 2018-2019. The participants included 346 sixth grade students selected from 10 elementary schools in Karaj, a city of Alborz province, Iran. The study was approved by the Vice-Chancellery for Research and Technology of Allameh Tabataba'i University.

Both the research process and objectives were first explained to the participants' parents, and then the informed consent and personal information forms were filled out by the student's parents. The subjects and their parents were assured that the initiation and continuation of participating in this study were voluntary and any information they give to researchers would be kept confidential. Forward head, round shoulders, sagittal head, kyphosis, and lordosis angles were measured by two corrective exercise specialists at the postural assessment center of the education department of Karaj. Anxiety and depression questionnaires were filled out by the subjects and physical activity questionnaires were filled out by interviewing them. The study inclusion criteria were as follows: (1) male gender, (2) age range of 11-12 years, and (3) those living in Karaj. The subjects with a history of pain and injury in upper extremities resulted in activity modification and avoidance, shoulder dislocation and fracture history, peripheral and central nervous system disease history, cardiovascular disease history, genetic and congenital abnormalities, untreated visual impairments, and inner ear infection were excluded from the study.

In order to measure the sagittal head tilt, craniovertebral, and sagittal shoulder-C7 angles, the photogrammetric method from the lateral side was employed. Photogrammetry is the most frequently used method of indirect measurement of posture, which eliminates the risks of exposure to x-ray in comparison with radiological methods, with no need to print the pictures (31). It has been represented that craniovertebral (as a measure of forward head posture), sagittal head (as a measure of sagittal head tilt), and sagittal shoulder-C7 angles (as a measure of forward shoulder posture) contain moderate to high interrater and intrarater reliability (31). Three anatomical landmarks including ear tragus, right side acromion process and C7 spinous process were first identified with markers. Afterwards, the participants stood beside the wall at a predetermined location and photos were taken using a digital camera placed on a tripod 80 centimeter away from them. The camera height was adjusted to the height of the C7 vertebra of each participant. Participants were asked to hold their arms above their head three times, while standing naturally and comfortably, focusing on an imaginary point on the wall (eyes in horizontal level). After a 5-second pause, three photos were taken by a tester from the lateral side. Ultimately, mentioned photos were transferred to a computer and using AutoCAD software, craniovertebral (an angle between a line connecting tragus to C7 and a horizontal line), sagittal head (an angle between a line from the canthus of the eye and the tragus of the ear and the horizontal line) and sagittal shoulder-C7 angles (an angle between a line connecting C7 to acromion process and a given line in sagittal plane that crosses C7) were measured. The average of three measurements was recorded as the forward head (craniovertebral angle and sagittal head angle) and shoulder (sagittal shoulder-C7 angle) angles.

A flexible ruler was employed to measure thoracic and lumbar curves. The validity and reproducibility of the flexible ruler were proved in a previous study (31). In order to measure thoracic kyphosis and lumbar lordosis angles, T2 and T12 spinous processes, and T12 and S2 spinous processes were identified by markers, respectively. The participants were asked to be relaxed and comfortable, stand against the spine stabilizer instrument, look ahead and distribute their weight on two feet equally. Two dowels of spine stabilizer instrument were placed on the subjects' xiphoid process of the sternum and pubic symphysis, and the flexible ruler was placed on their spinal column, then points of interest were marked on the flexible ruler with a board marker. The flexible ruler was picked up from the participants' body and the concave curve of the flexible ruler was drawn on paper, and T1, T12, and S2 points were identified. Two direct lines were drawn between T1 and T12, and T12 and S2, these lines were considered as curve length (L), and maximal vertical distance from the deepest point of curve (H) to L line was considered as curve height, and the formula below was used to calculate kyphosis and lordosis angles (25).

$\theta = 4 \arctan(2H/L)$

The Persian Version of Children's Depression Inventory (CDI) was utilized to evaluate the depression severity in children. This inventory consisting of 27 items is designed for people aged 7 - 17 and each item has three options including zero, one and two. The higher the scores are, the higher the severity would be. This CID has an appropriate validity (alpha Cronbach=0.83) and reproducibility (0.87) (32-34). The Persian Version of Revised Children's Manifest Anxiety Scale (RCMAS) was utilized to measure the anxiety. This questionnaire containing 37 items is designed for people aged 8 or more possessing 28 items that measure the anxiety and 9 items for lie evaluating, with yes or no questions. The RCMAS has an appropriate validity (alpha Cronbach=0.74) and reproducibility, too (35-37).

In order to estimate the levels of physical activity, the International Physical Activity Questionnaire-Short Form (IPAQ-SF) was employed. This questionnaire measured the physical activity in a week before. Based on the obtained score, the level of activity (light, moderate and vigorous) was determined (38). The validity (0.85) and reproducibility (0.70) of the Persian version of this questionnaire were confirmed (39).

Pearson test was employed to investigate the correlation between the variables. The linear regression model was used to identify the possible relation among the study variables. All the statistical analyses were performed using SPSS software version 19. P value ≤ 0.05 was considered to be statistically significant.

3. Results

The participants were sixth grade students selected from 10 elementary schools in Karaj, Alborz province, Iran. Figure 1 shows photogrammetric method from lateral side, which was used to calculate forward head posture, sagittal head tilt, and forward shoulder posture.

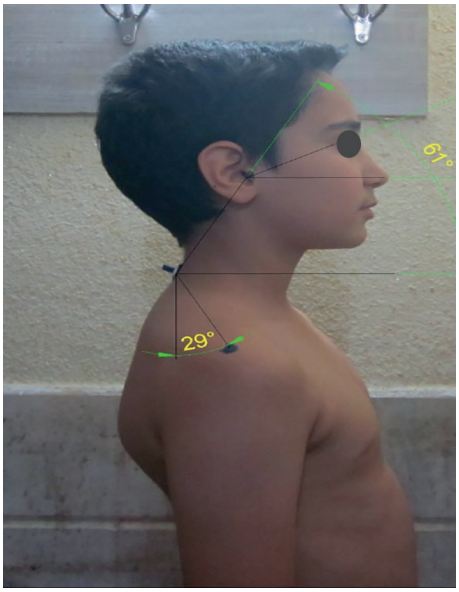

Figure 1: This figure shows the photogrammetric method from lateral side.

The craniovertebral, sagittal head, sagittal shoulder-C7, demographic data, depression, anxiety, physical activity, thoracic kyphosis, and lumbar lordosis angles in boy students are summarized in Table 1.

Table 2 represents the findings of investigating the correlation among the variables using the Pearson correlation test. Based on our results, there was a significant relation between physical activity and kyphosis angle (P=0.012, r=0.137), and a correlation was observed between physical activity and sagittal head angle (P=0.012, r=-0.137), and depression and craniovertebral angle (P=0.003, r=0.161).

Based on our results, the participants' physical activity levels were observed in light (12.8%), moderate (60.5%), and vigorous (26.7%) intensity. Revised Children's Manifest Anxiety Scale revealed that 4.4% of participants had anxiety and 95.6% of them were normal. The results of the depression questionnaire

Table 1: Demographic characteristics of the participants (N=346)

Variable	Mean±SD	Minimum	Maximum
Age (year)	11.51±0.5	11	12
Weight (kg)	44.7±12.38	24	82
Height (cm)	148.93±8.18	122	173
Body mass index	19.92±4.28	12.33	31.56
Craniovertebral angle	51.55±6.107	33.00	66.00
Sagittal shoulder-C7 angle	27.32±11.63	1.5	59.00
Sagittal head angle	22.12±7.31	1.00	51.33
Thoracic kyphosis	34.84±8.23	13.84	57.43
Lumbar lordosis	39.33±10.16	17.37	77.15
Physical activity	2424.56±56.47	120.00	16512.00
Depression	11.02±5.98	0	32
Anxiety	9.53±5.66	0	27

Table 2: Correlation coefficient and significant level (N=346, P>0.05)

First Variable	Second variable	P value	Correlation Coefficient
Physical activity	Craniovertebral angle	0.539	-0.034
	Sagittal shoulder-C7 angle	0.538	-0.034
	Sagittal head angle	0.012*	-0.137
	Lumbar lordosis	0.260	-0.062
	Thoracic kyphosis	0.012*	0.137
	Depression	0. 997	0.001
	Anxiety	0.779	-0.021
Depression	Craniovertebral angle	0.003*	-0.161
	Sagittal shoulder-C7 angle	0.546	-0.033
	Sagittal head angle	0.944	-0.004
	Lumbar lordosis	0.423	0.043
	Thoracic kyphosis	0.275	0.059
Anxiety	Craniovertebral angle	0.607	-0.038
	Sagittal shoulder-C7 angle	0.614	0.038
	Sagittal head angle	0.944	-0.004
	Lumbar lordosis	0.681	-0.031
	Thoracic kyphosis	0.380	0.066

Significant relations between variables (P<0.05)

Table 3: Linear regression results

	Model	Unstandardized Coefficient		Standardized Coefficient	t	Sig.
		B	Std. Error	Beta		
Thoracic Kyphosis	Constant	32.350	1.399		23.12	<0.001*
	Physical activity	0.001	0.001	0.173	2.317	0.022*
Craniovertebral angle	Constant	53.61	0.775		69.16	<0.001*
	Depression	-0.168	0.055	-0.164	-3.04	0.003*
Sagittal head angle	Constant	23.218	0.580		40.014	<0.001*
	Physical activity	0.001	0.001	-0.137	-2.534	0.012*

*Significant Coefficients

showed that the percentages of normal, verge of depression, and depressed students were 36.4%, 54.2%, and 9.3%, respectively.

Linear regression was employed to investigate the relation between the variables. The results are presented in Table 3. Stepwise regression was used to develop the equations. The relation between lumbar lordosis and the other variables were not statistically significant.

4. Discussion

In this study, we aimed to investigate the relation between upper quadrant posture and anxiety, as well as depression and physical activity levels. The results demonstrated that physical activity levels were significantly correlated with thoracic kyphosis and sagittal head tilt, and also there was a significant correlation between craniovertebral angle and depression. Meanwhile, no statistically significant correlation was observed between anxiety and other variables. Manifest anxiety problem was seen only in 4% of the students.

In this study, 54% of participants were on the verge of depression. Our results showed a negative relation between the craniovertebral angle and depression. With regard to the fact that smaller craniovertebral angle shows a more severe deformity, a negative relation that was discovered in the present study approved higher depression score with an increase in craniovertebral angle. A positive relation between forward head posture and depression has been reported in adults inflicted with severe depression. Moreover, a high prevalence of depression was confirmed in people suffering from chronic neck pain (1, 40). In another study, a negative relation between forward head posture and depression was reported (16). A possible reason for the relation between depression and alignment could be the interaction between emotional conditions and muscle's contraction, so muscle contraction can result in posture change (1). On top of that, forward head posture is an element of depressive posture in depressive disorders (7). The tendency to flex the lower cervical vertebrae could be considered as a reason for an increase in the craniovertebral angle in depressed students (7). The results of this study suggest that depression may involve changes in the head posture.

On the other hand, a negative relation was observed between physical activity levels and the sagittal head angle, meaning that with a higher level of physical activity, the value of the sagittal head angle would be smaller. Our results are in line with a previous study showing that in adolescents head is inclined toward anterior relative to trunk in the sagittal plane (22).

The results of this study showed that there was a positive relation between thoracic kyphosis angle and physical activity levels. This result is inconsistent with previous studies suggesting that children with higher levels of physical activity have less postural deviations. It is possible that performing physical activities in an improper way results in postural deformity. Any activity that strengthens the pectoral muscles without paying attention to the thoracic extensor muscles may result in muscle imbalance and hyperkyphosis. It seems that many factors such as improper habits, carrying backpacks, improper sitting and sleeping other than physical activity could be influential on the posture (41, 42). Children at school and home spent most of their time doing assignments in sitting position, and this prolonged sitting position would affect their posture; since posture is a multifactorial issue, physical activity alone cannot prevent postural abnormalities. Other factors such as prolonged sitting, digital entertainment (e.g., mobile, laptop) could cause kyphosis, which was not investigated in the present study. It is noteworthy to mention that, among the abnormalities that are formed during childhood, kyphosis is often overlooked (43). Considering a chain reaction in spinal column and the relation between forward head posture and hyperkyphosis (13), in the case of paying little attention to problems such as depression, more postural deformity in this region is unavoidable.

In the present paper, no significant relation was observed between other variables, depression and anxiety levels while a positive relation was reported in psychological studies between anxiety and thoracic kyphosis angle in over 18-year-olds and high school males (1, 7, 18, 24, 44). Besides, a positive relation was observed between depression and round shoulder among female participants (9, 23). Based on an epidemiological study, depression increases with the initiation of puberty, hormonal changes, cognitive, social and mental development (45). It seems that the interaction between depression and age are fairly different at 11-12-year-old people compared with older ones.

Further research is required to achieve a deep understanding of the relation between posture and psychological problems and physical activity in children and adolescents. Physical activity with a posture enhancement approach, for example: doing physical activity in order to increase muscular endurance in back muscles (22), has been proposed as a therapeutic method for postural correction in adults with severe depression (1). Corrective exercise is another option, which could be used for improving the psychological wellness of clients along with clinical treatments.

It is recommended that future research compare different people at each age with larger sample sizes,

in longitudinal forms from adolescence to adulthood to investigate the possible impacts of psychological problems on posture before and after puberty. Future studies could also investigate the relation between anxiety and posture in adolescences. It should be kept in mind that in this study, the participants were 11 to 12-year-old male students, thus our results cannot be generalized to other age groups.

5. Conclusions

The findings of this study showed that only forward head posture was correlated with depression. On top of that, Kyphosis and head angles were correlated with physical activity levels in elementary school students. Preventive measures seem to be necessary in order to decrease postural and psychological issues in sixth grade students.

Highlights

Only forward head posture was correlated with depression.

Thoracic kyphosis and head angles were correlated with physical activity levels in elementary school students.

Preventive measures seem to be of great necessity in order to decrease postural and psychological problems in sixth grade students.

Conflict of interest

The authors declared no conflict of interest.

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Ethical Approval

The study was approved by the Vice-Chancellery for Research and Technology of Allameh Tabataba'i University. Written informed consent was obtained from the student's parents.

Authors' contributions

All the authors provided the original idea, writing the manuscript, protocol development, data analysis, abstracted data, and prepared the manuscript.

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