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The investigation of relationship between allergic rhinitis with forward head posture and anxiety in children

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Abstract

Introduction Forward head posture is a common postural issue across all age groups, often linked to the overuse of electronic devices such as computers, smartphones, and tablets, leading to poor posture in children. Allergic rhinitis is also prevalent in children, but its effects on musculoskeletal and psychological health are not well understood.

Objective This study aimed to explore the relationship between allergic rhinitis, forward head posture, and anxiety levels in Iranian children aged 7–12 years.

Materials and methods Fifty children aged 7–12 were recruited from the Allergy-Infection Clinic at Bandar Abbas Children's Hospital. The participants were divided into two groups: 25 healthy children and 25 children diagnosed with allergic rhinitis. Anxiety levels were assessed using the Spence Anxiety Scale, while forward head posture was measured by analyzing photographs of the children's body profiles using AutoCAD software.

Results Of the total participants, 24 children (46%) exhibited a forward head posture, defined as a craniovertebral angle of less than 48 degrees. Among these, 14 (56%) were in the allergic rhinitis group and 10 (40%) were in the healthy group. However, there was no statistically significant association between allergic rhinitis, forward head posture, and anxiety based on age, gender, or duration of nasal allergy.

Conclusion The study found no significant relationship between allergic rhinitis, forward head posture, and anxiety. The findings highlight the need for increased awareness of proper posture, particularly in relation to the use of electronic devices, and the importance of evaluating postural disorders in children.

Keywords Allergic Rhinitis, Forward Head posture, Anxiety, Children

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Introduction

Forward head posture (FHP) represents a common postural imbalance characterized by the positioning of the head in a forward orientation relative to the body's vertical axis [1]. This condition is typically marked by a pronounced protrusion of the head and neck beyond the shoulders [2]. The prevalence of FHP has increased notably, particularly as a consequence of prolonged engagement with computers, smartphones, and other activities that encourage slouched posturing [3]. FHP may lead to a range of musculoskeletal complications, including but not limited to neck pain, headaches, and shoulder tension, owing to the additional strain it places on muscles, ligaments, and joints [4]. FHP exhibits a specific kinematic characteristic with hyperextension in the craniocervical joint and flexion in the subaxial cervical spine [5, 6]. In the literature, it is acknowledged that the FHP is associated with the weakening and elongation of the upper cervical flexors and lower cervical extensor muscles, as well as the shortening of the upper cervical extensor and lower cervical flexor muscles [7]. It has been reported that due to the FHP, the shortening and weakening of accessory muscles, along with the imbalanced muscle forces during the forced inspiration of the thoracic cage, could potentially lead to the release of dynamic pulmonary volume [8, 9].

Allergic rhinitis (AR) is among the most prevalent chronic conditions affecting children, with a significant proportion of the pediatric population worldwide being impacted [10]. This condition is characterized by inflammation of the nasal mucosa in response to various allergens, including pollen, dust mites, animal dander, and molds. Common symptoms of AR include sneezing, nasal congestion, rhinorrhea, and pruritus in the nasal passages, eyes, and throat [11].

The connection between allergic rhinitis and FHP may be attributed to physiological changes caused by chronic inflammation in the nasal passages. Children experiencing breathing difficulties due to congestion may adapt their posture to facilitate respiration, leading to the development of FHP [12].

Allergic rhinitis can contribute to forward head posture by influencing breathing mechanics and musculoskeletal alignment. Chronic nasal obstruction, which is prevalent in AR, frequently leads to mouth breathing. This alteration in breathing patterns modifies head and neck alignment, as individuals often adopt a forward head posture to facilitate airflow through the mouth. This compensatory mechanism is thought to increase strain on the cervical spine and surrounding musculature, consequently leading to the development of FHP [13]. Prolonged FHP has been shown to contribute to musculoskeletal imbalances, characterized by increased tension in the upper trapezius and pectoral muscles, as well as diminished strength in the deep neck flexors [14]. A body of research suggests a significant correlation between allergic rhinitis (AR) and anxiety [15, 16]. Although AR is not life-threatening, it can seriously affect people's quality of life and impair their daily lives. There is the correlation between anxiety and recurrence of AR [17]. Poorly controlled AR can also lead to impairment in sleep and a decrease in school/work performance, thereby affecting the quality of life. In addition, AR can produce serious mental and psychological disorders such as depression and anxiety [18]. Moreover, anxiety may exacerbate the symptoms of AR by elevating sympathetic nervous system activity, which is thought to enhance the inflammatory response to allergens, thus intensifying AR symptoms [15, 19].

There is a growing body of evidence indicating a correlation between AR, FHP, and anxiety, particularly within pediatric and adolescent populations. These conditions may exacerbate one another, resulting in a complex interplay of physical and psychological effects. Additionally, The necessity of conducting this research stems from its focus on the specific environmental and demographic factors unique to Bandar Abbas, which were not thoroughly addressed in previous studies. While earlier research established a correlation among allergic rhinitis (AR), forward head posture (FHP), and anxiety, this study delves into the interplay of these conditions within a specific geographic and climatic context. The hot, humid climate of Bandar Abbas may exacerbate AR through the proliferation of indoor allergens such as dust mites and mold, as well as seasonal outdoor triggers like pollen and dust. These environmental factors, coupled with the high prevalence of pediatric and adolescent AR in the region, highlight the need for localized research to better understand how these variables interact and how management strategies can be tailored for the population. By addressing these specific factors, this study contributes novel insights that build upon prior findings and adapt them to a regional context.

Hypotheses

Children with AR are more likely to develop FHP than those without the condition. This is often due to compensatory changes in breathing mechanics, such as mouth breathing, resulting from nasal obstruction. Additionally, children with both AR and FHP tend to experience higher levels of anxiety compared to those with either condition alone or those without either condition.

Materials and methods

Study design

This is a randomized case-control that involved 50 children aged between 7 and 12 were enrolled in the Allergy-Infection Clinic at Bandar Abbas Children's Hospital, and the study took place between may to July 2024. The

Table 1 Frequency of variables

Variable	Options	Allergic Rhinitis (25 persons)	Without Allergic Rhinitis (25 persons)	Total(50 persons)
		(%) No:	(%) No:	(%) No:
Age	**7 to 8 years old**	(52) No:13	(44) No:11	(48) No:24
	9 to 12 years old	(48) No:12	(56) No:14	(52) No:26
Sex	**Male**	(48) No:12	(48) No:12	(48) No:24
	Female	(52) No:13	(52) No:13	(52) No:26
Time of Allergic Rhinitis	**Healthy**	(0) No:0	(100) No:25	(50) No:25
	1 to 5 years	(48) No:12	(0) No:0	(24) No:12
	6 years and more	(52) No:13	(0) No:0	(26) No:13
Anxiety	**mild**	(76) No:19	(72) No:18	(74) No:37
	moderate	(24) No:6	(28) No:7	(26) No:13

Table 2 Standard deviation(SD) and average of variables

Variable	Allergic Rhinitis (25 persons)	Without Allergic Rhinitis (25 persons)	Total (50 persons)
	SD ± Average	SD ± Average	SD ± Average
Age (year)	49/1 ± 68/8	64/1 ± 12/9	56/1 ± 90/8
Time of Allergic Rhinitis	67/2 ± 16/5	0	20/3 ± 58/2
Forward Head Posture (angle)	66/4 ± 52/47	64/4 ± 00/49	66/4 ± 26/48
Anxiety	75/2 ± 88/4	15/3 ± 76/4	93/2 ± 82/4

participants were divided into two groups: 25 were healthy children, while the remaining 25 were diagnosed with Allergic Rhinitis. The inclusion criteria required the children to be between 7 and 12 years old, with and without Allergic Rhinitis, body mass index below 95% and without asthma, cardiac diseases, neuromuscular diseases, tonsillectomy, congenital anomalies, and using smart devices less than 3 h. Initially, the children's anxiety levels were assessed using the Spence anxiety test [20]. Subsequently, the forward head angle was measured using photographic method. The severity of forward head posture is often assessed using the craniovertebral angle (CVA), which is measured by drawing a horizontal line passing through the spinous process of the seventh cervical vertebra (C7) and connecting the midpoint of the tragus to the C7 prominence [21, 22].

Data Collection and Statistical Analysis

The mentioned photos were transferred to the computer and we measured the angle of the connecting line of the tragus and 7C with the vertical line (angle of the head forward) using AutoCAD software. After collecting the data, we entered them into the checklist. Finally, the collected data was analyzed using SPSS version 23 statistical software. Shapiro-Wilk test was used for data distribution, t test was used to compare the mean of research variables, and Spearman and ETA test were used for correlation between research variables.

Ethical considerations

This study was conducted in adherence to the tenets of the Declaration of Helsinki and was ethically approved by the Ethics Committee of Tehran University (Approval ID: IR.UT.SPORT.REC.1403.023). Informed consent was obtained from the children and their parents.

Results

From 50 patients, 24(48%) were male and 26(52%) were female, aged 7 to12 years.Table 1. The average age of the children was 56/1 ± 90/8years old. The average time of Allergic Rhinitis was 2/58 ± 3/20 years. Out of the subjects studied, a total of 24 individuals (46%) showed a craniovertebral angle of less than 48 degrees while standing, indicating a forward head position. Among these individuals, 14 (56%) were in the Allergic Rhinitis group, while the remaining ten (40%) were in the healthy group. Table 2. However, expand on potential confounding variables that might explain the lack of significance, such as the small sample size, varying degrees of allergic rhinitis severity, or environmental factors.

Discussion

In this study, the relationship between forward head posture (FHP) and anxiety in children aged 7 to 12 years with allergic rhinitis was investigated. The findings showed that around 46% of the children had FHP, but there was no significant correlation between FHP and allergic rhinitis. Additionally, no statistically significant difference was found in anxiety levels between children with and without allergic rhinitis.

These findings are somewhat consistent with previous studies, though there are variations in the reported outcomes. For example, some research has highlighted a connection between poor posture, including FHP, and

increased anxiety levels in children. A study found that children with breathing difficulties, such as those who breathe through their mouths due to conditions like allergic rhinitis, were more likely to develop FHP [13]. This posture, in turn, could contribute to elevated anxiety levels due to discomfort and chronic pain associated with poor posture. However, the current study did not find such a direct link, suggesting that other factors might mediate the relationship between allergic rhinitis and FHP.

On the other hand, studies such as those have shown that FHP is often associated with the use of electronic devices and poor postural habits, rather than specific medical conditions like allergic rhinitis. These studies suggest that lifestyle factors, such as prolonged screen time and improper ergonomics, play a more significant role in the development of FHP [23, 24]. The current study supports this notion by indicating that allergic rhinitis alone is not a strong predictor of FHP.

Moreover, the lack of a significant difference in anxiety levels between children with and without allergic rhinitis aligns with research suggesting that anxiety in children is multifactorial. While conditions like allergic rhinitis can contribute to discomfort and possibly anxiety, the overall impact on mental health may be moderated by other factors such as family environment, overall physical health, and psychological resilience.

In comparison to other studies that have found more robust associations between posture and psychological outcomes, this study highlights the need for further research with larger and more diverse samples. It also suggests the importance of considering a broader range of variables, including environmental and behavioral factors, when examining the relationship between physical health conditions and psychological outcomes in children.

Finally, this study emphasizes the importance of education and intervention programs aimed at improving posture and reducing screen time among children. These measures could help mitigate the development of FHP and its potential psychological consequences, regardless of whether the child has allergic rhinitis.

Conclusion

This study explored the relationship between allergic rhinitis, forward head posture (FHP), and anxiety in children aged 7 to 12 years. The findings revealed no significant association between allergic rhinitis and FHP or between allergic rhinitis and anxiety levels. While nearly half of the participants exhibited FHP, it was not significantly more prevalent in children with allergic rhinitis compared to healthy children. These results suggest that allergic rhinitis alone is not a strong predictor of FHP or anxiety, pointing instead to other factors, such as lifestyle habits, as potential contributors.

Limitations

Several limitations should be considered when interpreting the results of this study:

Sample Size: The relatively small sample size may limit the generalizability of the findings. Larger studies are needed to confirm these results.

Cross-Sectional Design: This study's cross-sectional nature prevents establishing a causal relationship between allergic rhinitis, FHP, and anxiety. Longitudinal studies would be more suitable for exploring causality.

Limited Control of Confounding Variables: Although efforts were made to control for some confounding factors (e.g., age, body mass index, and screen time), other factors like socioeconomic status, sleep quality, or previous physical activity levels were not accounted for and could have influenced the results.

Reliance on Photographic Analysis: While photographic methods are widely used to assess FHP, the measurements may be subject to observer bias or errors in landmark identification.

Recommendations

Based on the findings and limitations of this study, the following recommendations are suggested:

Further Research: Conduct larger, longitudinal studies to better understand the causal relationships between allergic rhinitis, FHP, and anxiety in children. Future research should also consider a broader range of potential confounding factors.

Comprehensive Postural Assessments: Incorporate multiple methods for assessing posture to increase accuracy, such as 3D motion analysis or clinical assessments by physical therapists, rather than relying solely on photographic methods.

Intervention Programs: Develop and implement intervention programs focused on posture education, ergonomic adjustments, and reducing screen time in children. These programs should be tailored to include all children, regardless of whether they have allergic rhinitis, to help prevent FHP and promote healthy musculoskeletal development.

Holistic Approach to Anxiety Management: Given the multifactorial nature of anxiety, consider integrating physical health assessments, family environment evaluations, and psychological support when addressing anxiety in children.

Information on other potential influencing factors, such as participants' level of physical activity, socioeconomic conditions, and the number of siblings, is valuable for future research. However, most participants were only

children in their families, which limits the applicability of these factors in this study.

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Author contributions
Study concept and design: M. B., R., and T.M.; acquisition of data: M. B.R., and T. M.; analysis and interpretation of data: M. B.R., T. M., and M.H. A; statistical analysis: M.B.R. and H. D.; study supervision: M. B.R., H. D., and M.H. A.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Ethically approved by the Ethics Committee of Tehran University(Approval ID: IR.UT.SPORT.REC.1403.023). Written informed consent was obtained from a legally authorized representative(s) for the anonymized patient.

Consent for publication
The authors declare that they have no conflict of interest.

Competing interests
The authors declare no competing interests.

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