Respiratory symptoms of portuguese pediatric athletes

Original Article

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Article received on April 2, 2024.
Accepted for publication on July 26, 2024.

Abstract

Introduction - Respiratory diseases and allergic sensitization have a known impact on the daily lives of athletes. These pathologies are often neglected and are not routinely evaluated in sports medicine.
Objectives - The objective of this study is to determine the incidence of nasal/respiratory and allergic symptoms in both pediatric athletes and the non-active population, showing the importance of combining the Allergy Questionnaire for Athletes (AQUA) and Nasal Obstruction Symptom questionnaires. Evaluation (NOSE) in screening these patients.
Material and Methods - A cross-sectional study was carried out using an online self-completed questionnaire by young people between 12 and 18 years old. Participants were recruited during the months of November and December 2023. Both athletes and non-active controls completed a survey consisting of the AQUA and NOSE questionnaires. Of the 436 responses received, 407 were considered complete and included in this study (290 athletes and 117 non-active controls).
Results - The athlete cohort consisted predominantly of male individuals (63.1%, n = 183) with a mean age of 15.2 ± 1.7 years. Both groups coincide in terms of distribution by age and sex. The majority of athletes were rugby players (37.9%, n = 110), followed by football players (12.8%, n = 37) and ballet dancers (10.3%, n = 30). Recurrent upper respiratory tract infections (URTIs) were reported in 71 athletes (24.5%), compared to 14 non-active controls (12.0%), representing a significant increase in the incidence of URTIs in athletes (p = 0.0049). More than 45% of athletes missed training at least once a year due to URTI and 14.5% missed training more than 3 times last year for this reason. With regard to symptoms, there was no significant difference (p = 0.1589) in the number of athletes who reported nasal symptoms (32.8%, n = 95) compared to non-athletes (25.7%, n = 30); however, athletes have significantly higher scores on the NOSE questionnaire (p = 0.0001). Ninety-five athletes (32.8%) report having at least one medically diagnosed allergic disease, as opposed to 35 non-active controls (29.9%), with no significant differences between the groups

(p = 0.5776), even with regard to prevalence of asthma (p = 0.4446) or rhinitis (p = 0.4390).
Conclusions - The application of the AQUA and NOSE questionnaires to young athletes could be of great importance in clinical practice as these pathologies have an impact on both training attendance and quality of life.
Keywords: Athletes; exercise; allergy; quality of life; AQUA questionnaire.

Introduction

For athletes, maintaining an optimal state of health is essential for achieving peak physical performance. The primary functions of the upper respiratory tract include humidifying and heating inhaled air, and acting as the first barrier against environmental particles, such as allergens, pathogens, and irritants.[1] During intense physical activity, when metabolic demands are higher, the minute ventilation significantly increases in athletes, which highlights the important role of the upper respiratory tract during excercise.[2] The acute effects of exercise on the upper respiratory tract are well established, including vasoconstriction of the capacitance vessels, which leads to increased volume of the nasal cavity and enhanced absolute nasal ventilation.[3] However, the long-term effects of exercise on the respiratory tract remain inadequately understood. The literature reports a varying prevalence of rhinitis in athletes, ranging between 15–47%.[4] This variation may be attributed to different definitions of rhinitis, study methods, and athlete populations. For example, some studies included athletes who engaged in water sports or trained in cold air environments. As both cold air and chlorine irritate the nasal mucosa, athletes exercising in these environments are more susceptible to non-allergic rhinitis phenotypes.[5,6] The association between intense physical exercise and asthma has been a subject of debate for a long time, but recent interest has been directed toward the upper respiratory tract of athletes.[7] This population seems to be more prone to experiencing nasal symptoms than the nonactive population.[8] Additionally, some studies have suggested that factors associated with excessive ventilation or environmental exposure may contribute to dysfunction of the upper respiratory tract.[9]

The Allergy Questionnaire for Athletes (AQUA), derived from the European Community Respiratory Health Survey Questionnaire, is the first questionnaire that has been validated for allergy screening in athletes.[10] It also collects information about the sport practiced, training intensity, and relevant habits. The questionnaire is a straightforward instrument comprising 25 questions, designed for self-administration, and can identify athletes who require further investigation for allergies, with a high positive predictive value (0.94).

The Nasal Obstruction Symptom Evaluation (NOSE) is a tool developed by Stewart et al. that assesses the quality of life of patients with nasal obstruction.[11] The NOSE has been validated for the pediatric population[12] and for European Portuguese speakers.[13] It uses a 5-point (0–4) Likert scale and includes five questions The final score is the sum of the responses to these questions, and ranges from 0–20, which is multiplied by five for a total score of 0–100. Higher scores indicate a greater severity of nasal obstruction symptoms.

The investigation of nasal and allergic symptoms is not yet a standard practice in sports medicine, and the actual impact of these diseases on the quality of life and physical performance of athletes remains unknown. Most studies evaluated only adults, but younger individuals have been participating in competitive sports at increasingly earlier ages. Thus, it is essential to expand the investigation of allergic symptoms to include pediatric athletes. This study aims to determine the prevalence of nasal, respiratory, and allergic symptoms in both pediatric athletes and nonactive individuals, to highlight the importance of combining the AQUA and NOSE questionnaires for screening these populations.

Materials and methods

This cross-sectional study used an online self-administered questionnaire for young people

between 12–18 years of age. The participants were recruited in November and December 2023. Both athletes and sedentary controls responded to the survey consisting of the AQUA and NOSE questionnaires. Athletes were defined as individuals engaging in at least four hours of exercise per week, excluding mandatory school sports. The term "sedentary" was defined as individuals engaging in less than four hours of activity per week. The exclusion criteria were individuals under the age of 12 or over the age of 18 years, or presence of significant cardiorespiratory comorbidities, such as uncontrolled hypertension, previous acute myocardial infarction, or known and uncontrolled pulmonary disease. Athletes were recruited from sports clubs and invited to participate, while sedentary controls were identified in Portuguese schools with students in the target age group. All participants provided informed consent for the anonymous use of their data in this study. Among the 436 responses received, 407 were considered complete and included in this study (290 athletes and 117 sedentary controls).

Participants were asked to provide demographic data (age, sex, and smoking status), weekly training regimen (hours spent exercising), and training environment (indoor, outdoor, or mixed). They were also asked to describe their nasal symptoms, including whether they experienced nasal obstruction, rhinorrhea, nasal itching, or sneezing on a daily basis throughout the year. Additionally, participants were asked about the use of topical and systemic drugs, history of nasal injuries or surgeries, and symptoms of upper respiratory tract infections (URTI). Symptomatic athletes and controls were referred for allergy and immunology and otorhinolaryngology appointments. These appointments were used for taking a comprehensive clinical history, objective examinations with nasal endoscopy, and ancillary diagnostic tests, including acoustic rhinometry, skin tests, and respiratory function tests.

Statistical analysis

The Fisher's exact test was used for categorical variables and the Student's t-test or Mann-Whitney U-test for non-categorical variables. A p-value < 0.05 was considered statistically significant. Data analysis was performed using the SPSS software version 25 (SPSS Inc., Chicago, IL, USA).

Results

A total of 407 participants completed the study (290 athletes and 117 sedentary controls). The mean age of the athletes was 15.2 ± 1.7 years (range: 12–18 years), while that of the sedentary controls was 14.4 ± 2.0 years (range: 12–18 years). The athlete cohort predominantly consisted of boys (63.1%, n = 183), as did the control group (59.8%, n = 70). There was no significant difference between the two groups in terms of the age and sex distribution (Table 1). The majority of the athletes were engaged in rugby (37.9%, n = 110), followed by soccer (12.8%, n = 37) and ballet (10.3%, n = 30). Most of them trained outdoors (n = 170, 58.6%) and more than three times a week (n = 153, 52.8%).

The incidence of recurrent URTI was significantly higher in athletes (71, 24.5%) than in sedentary controls (14, 12.0%) (p = 0.0049). More than 45% of athletes reported that they missed training at least once a year due to URTI, and 14.5% had missed training more than thrice in the previous year because of URT. Most athletes (76.1%) with recurrent URTIs revealed that infections were frequent during overtraining periods. There was no significant difference between the number of athletes (32.8%, n = 95) and controls (25.7%, n = 30) who reported nasal symptoms in the AQUA (p = 0.1589). In the NOSE (Table 2), 208 athletes (71.7%) reported nasal symptoms, compared to 42 controls (35.9%). The majority of symptomatic athletes had mild nasal symptoms (62.5%, n= 130) and nine (4.3%) had severe or extreme symptoms (NOSE score above 55). Among the sedentary controls, only 42 (35.9%) had nasal symptoms, mostly mild (85.7%, n = 36), with no cases of severe or extreme symptoms. Athletes exhibited

Table 1
Comparison of characteristics between athletes and sedentary controls

	Athletes (n = 290)	Controls (n = 117)	*p*
Sex, male	183, 63.1%	70, 59.8%	0.5376
Age	15.2 ± 1.7	14.4 ± 2.0	0.2101
Recurrent URTI	71, 24.5%	14, 12.0%	0.0049
Medical diagnosis of allergic disease	95, 32.8%	35, 29.9%	0.5776
Medical diagnosis of asthma	18, 6.2%	5, 4.3%	0.4446
Medical diagnosis of allergic rhinitis	34, 11.7%	17, 14.5%	0.4390
Allergic disease suspected by the individual	83, 28.3 %	35, 29.9%	0.7946
Nasal symptoms reported in AQUA	95, 32.8%	30, 25.7%	0.1589
Dyspnea reported in AQUA	52, 17.9%	11, 9.4%	0.0313

URTI, Upper Respiratory Tract Infection; AQUA, Allergy Questionnaire for Athletes

Table 2
Comparação da pontuação nas perguntas do questionário NOSE entre a população de atletas (n = 290) e a população não ativa (n = 117).

	Athletes	Controls	*p*
1. Nasal congestion or fullness	0.9 ± 0.9	0.4 ± 0.6	< 0.0001
2. Nasal obstruction or blockage	0.7 ± 0.9	0.3 ± 0.6	< 0.0001
3. Difficulty breathing through the nose	0.7 ± 0.9	0.3 ± 0.6	< 0.0001
4. Difficulty in sleeping	0.6 ± 0.9	0.2 ± 0.4	< 0.0001
5. Inability to breathe through the nose during physical exercise	0.7 ± 0.9	0.3 ± 0.5	< 0.0001
Total*	17.8 ± 17.8	7.1 ± 11.6	< 0.0001

* The total score is the sum of the scores of the five questions, multiplied by five (final score between 0–100).
NOSE, Nasal Obstruction Symptom Evaluation

significantly higher NOSE scores (p < 0.0001). The two groups demonstrated statistically significant differences (p < 0.0001) in all five questions of the NOSE.

A total of 95 (32.8%) athletes reported having at least one medically diagnosed allergic disease, compared to 35 (29.9%) controls, with no significant difference between the two groups (p = 0.5776), including the prevalence of asthma (p = 0.4446) and rhinitis (p = 0.4390). Allergic disease was suspected by 83 (28.3%) athletes, regardless of their medical diagnosis, but it was not statistically significant compared to the controls (n = 35, 29.9%) (p = 0.7946). In the AQUA, 17.9% (n = 52) of athletes reported dyspnea during exercise, compared to 9.4% of controls (n = 11), with a statistically significant difference (p = 0.0313).

Discussion

This study is the first to compare the prevalence of nasal and allergic symptoms between young athletes and sedentary controls in Portugal. The prevalence of URTI was significantly higher in athletes than in the control group; in particular, the number of athletes with recurrent URTI was more than twice as high. This finding was first described in a 2018 study of the English population with an average age of 26 years.[4] URTI is the most prevalent disease in athletes,[14] and is the most common reason for missing training and seeking medical care during both the winter and summer Olympic Games.[15,16] Nevertheless, an infectious agent is identified in only one-third of the reported cases of URTI in athletes, even when actively investigated.[17] The lack of consistent evidence of an infectious agent

has led some investigators to challenge the conventional wisdom that symptoms typically associated with URTI, such as nasal obstruction, rhinorrhea, low-grade fever, and cough, are caused by exercise-induced upper airway inflammation.[18]

Studies have demonstrated that athletes have a higher prevalence of nasal symptoms and allergic diseases, including rhinitis and asthma.[4] However, our study found no significant differences in the prevalence of nasal symptoms and asthma or rhinitis between athletes and controls. These discordant findings have two possible explanations. Firstly, there may have been a selection bias in our study. Secondly, this study exclusively evaluated the pediatric population, in contrast to other studies, which primarily investigated adult athletes. The prevalence of nasal symptoms in our cohort was similar between athletes and sedentary controls. This result aligned with those of previous studies, particularly those based on a pre-existing diagnosis made by a physician, such as a study of Italian Olympic athletes, which reported a prevalence of 26.2% for nasal symptoms, and a Polish study of Olympic athletes, which found a prevalence of 27%.[20]

The NOSE enables the identification of a higher number of young athletes with nasal symptoms compared to the AQUA (71.7% *versus* 32.8%), but most study participants only exhibited mild symptoms. Furthermore, this questionnaire does not permit the analysis of other symptoms, such as dyspnea, incidence of URTI or allergic diseases, or the impact of nasal symptoms on athletic performance. In fact, if participants indicated that they experienced "very mild symptoms" in response to just one of the five questions in the NOSE, they surpassed the cutoff point and were classified as symptomatic, which may account for the difference between the number of individuals considered symptomatic in the NOSE and AQUA. The results of our study demonstrate that athletes with nasal symptoms experience a negative impact on their quality of life. If untreated, upper respiratory diseases pose a significant burden for this population and can potentially limit their physical performance. An observational study evaluating the impact of daily use of intranasal budesonide in athletes with rhinitis demonstrated a significant improvement in the self-rated performance after just eight weeks of treatment.[21] Although it is unclear whether this subjective notion of improvement represents objective competitive gains, these findings highlight the benefits of diagnosing and treating nasal pathology in this population.

The primary advantage of a study based on self-administered questionnaires is the ability to obtain a representative sample and draw conclusions based on robust statistical analysis. However, such studies cannot determine the etiology of rhinitis or distinguish whether the nasal symptoms in athletes are allergic or due to irritants. Further clinical research is necessary to establish the etiology of these upper respiratory tract symptoms and provide a deeper insight into the emerging field of athlete well-being. In this study, participants were offered allergy and immunology and otorhinolaryngology appointments, including a full physical examination and necessary diagnostic procedures. The data collected are expected to provide a better understanding of the etiology of nasal symptoms and improve the management of these patients.

Conclusions

This study is the first to compare the prevalence of nasal and allergic symptoms between young Portuguese athletes and sedentary controls.

The AQUA and NOSE questionnaires can be effective tools for screening allergic and respiratory diseases in young athletes. Implementing such screening is crucial in clinical practice, as these conditions have a well-documented impact on the training attendance and quality of life of the athletes.

Conflict of Interests

The authors declare that they have no conflict of interest regarding this article.

Data Confidentiality

The authors declare that they followed the protocols of their work in publishing patient data.

Human and animal protection

The authors declare that the procedures followed are in accordance with the regulations established by the directors of the Commission for Clinical Research and Ethics and in accordance with the Declaration of Helsinki of the World Medical Association.

Privacy policy, informed consent and Ethics committee authorization

All the processed data were based in published reports that fulfilled privacy policy and ethical considerations.

Financial support

This work did not receive any grant contribution, funding or scholarship.

Scientific data availability

There are no publicly available datasets related to this work.

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