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Original article

Impact of high body mass index on allergic rhinitis patients

Influence de l'élévation de l'indice de masse corporelle sur la rhinite allergique

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Abstract

Background. – Allergic rhinitis is one of the most prevalent diseases in the world and many studies have been done to find its risk factors. Several studies have shown that there is an association between suffering from allergic rhinitis and increased body mass index (BMI), but no consensus has been yet achieved.

Materials and methods. – There is a case–control study conducted in Imam Ali Clinic in Shahrekord during 2014–2015. Fifty-four participants with allergic rhinitis and 54 healthy persons were selected and their body mass index values were measured. Also, demographic data were collected by a questionnaire and analyzed by SPSS.

Results. – The mean body mass index in the case and control groups were 25.03 ± 3.5 kg/m² and 23.32 ± 2.80 kg/m² respectively, with a significant difference between the two groups ($P=0.006$). In the case group, 53.7% of participants have high body mass indexes but in the control group, 33.3% of participants have high body mass indexes, with a statistically difference between two groups according to χ^2 test ($P=0.04$).

Conclusion. – These results indicate a significant association between high body mass index value and allergic rhinitis. We underline that this relationship is more prominent in women.

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Keywords: Allergic rhinitis; Body mass index; Obesity; Adiposity

Résumé

Contexte. – La rhinite allergique est l'une des maladies les plus répandues dans le monde et de nombreuses études ont été effectuées pour préciser ses facteurs de risque. Plusieurs études ont montré qu'il existe une association entre le fait d'avoir une rhinite allergique et une augmentation de l'indice de masse corporelle (IMC), mais aucun consensus n'a encore été atteint.

Matériel et méthodes. – Une étude cas–témoins a été effectuée à la clinique Imam-Ali à Shahrekord au cours de la période 2014–2015. Cinquante-quatre participants atteints de rhinite allergique et 54 personnes en bonne santé ont été sélectionnés et leur IMC a été mesuré. Les données démographiques ont été recueillies par un questionnaire et analysées par SPSS.

Résultats. – L'IMC dans le groupe des cas et celui des témoins était respectivement de $25,03 \pm 3,5$ kg/m² et $23,32 \pm 2,80$ kg/m², soit une différence significative entre les deux groupes ($p=0,006$). Dans le groupe des cas, 53,7 % des participants ont des IMC élevés, alors que dans le groupe témoin, 33,3 % des participants ont des IMC élevés, soit une différence statistique entre deux groupes selon le test du χ^2 ($p=0,04$).

Conclusion. – Ces résultats indiquent une association significative entre la valeur élevée de l'indice de masse corporelle et la rhinite allergique. Cette relation est plus importante chez les femmes.

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Mots clés : Rhinite allergique ; Indice de masse corporelle ; Obésité ; Adiposité

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1. Introduction

Obesity and allergic rhinitis are both major health problems in the world, and their prevalence have increased markedly in the last decades [1,2]. Allergic rhinitis (AR) is an immune-mediated inflammation in mucus membrane, which could extend to paranasal sinuses [3,4]. It is one of the most prevalent diseases worldwide, and its prevalence is related with sex, age and life style. Allergic rhinitis prevalence is about 20% in adults in the United States and it is between 10–30% in Iran [5,6]. Studies reveal the developing prevalence of this disease. Specially, a large number of studies on quality of life show that this disease impairs the quality of patients' life. It decreases the patients' level of performance. Annually, 1.5 billion dollars is paid in the USA for treatments and drugs of the patients suffering from allergy [7]. The symptoms are presented in any age with the same outbreak among men and women [8,9]. Because of its effect on quality of life, several studies have been done on allergic rhinitis. Allergic rhinitis is the most prevalent type of rhinitis in 15% of adults and 40% of children in different regions. Male suffer from this disease more than female in childhood. Conversely, male and female adults may equally suffer from it [8]. Allergic rhinitis makes significant social and economic effects. Obesity has several effects on the immune system that could play a major role in increasing allergic disease [10]. Adipose tissue may be related to immune response and inflammation through production of adipokines and activation of macrophage [11]. Body mass index (BMI) is used widely as a definition for overweight and obesity in the large number of epidemic studies. Although obesity has been associated with high risk of asthma, studies about the relationship between obesity and allergic rhinitis have conflicting results [12–19]. Gender is important in examining the relationship between allergic rhinitis and obesity. Some studies have shown that obesity increase the risk of allergic rhinitis only in female [20–24]. These contradictory results led us to examine the effect of high BMI on allergic rhinitis disease.

2. Materials and methods

2.1. Study design and populations

This study was conducted in Imam Ali's Clinic of ENT in Shahrekord, Iran between March 2014 and January 2015. The study population consisted of patients referred to ENT sector of the clinic. The inclusion criteria were the participant's consent to take part in the study, the present of symptom of allergic rhinitis in the past 12-month and definite diagnosis of allergic rhinitis in the patients and no diagnosis of allergic rhinitis in the control group. Participants who suffer from asthma were excluded from the study, because it is linked with both allergic rhinitis and body mass index. The other exclusive criteria are having acute or chronic respiratory infections, having the history of immunotherapy and use of nasal or oral steroids, suffering from congenital or occurred developmental abnormalities, genetic syndromes, psychiatric and neurological disorders that may affect the BMI level. By sample size calculation equation and

with respect to confidence interval 95% ($Z_{1-\alpha/2} = 1.96$), test power 80% ($Z_{1-\beta} = 0.84$), estimated prevalence of rhinitis in the community in other studies, i.e. 2% [8], and the minimum significant difference between two groups (approximately 0.2), 45 participants were needed in each group.

$$N = \frac{2(Z_{1-\alpha/2} + Z_{1-\beta})^2 P(1-P)}{d^2} \\ = \frac{2(1.96 + 0.84)^2 0.2(1 - 0.2)}{(0.2)^2} = 45$$

The two groups were well adjusted for age, sex, job, region of residence, educational level and alcohol and tobacco use. For consistency of age, all participants were selected from age range of 15–55 years old. The initial diagnosis of allergic rhinitis in the case group was made by the history of allergy based on the standardized questionnaire derived from the well-documented questionnaires used by the International Study of Asthma and Allergies in Children (ISAAC), and the Questionnaire of Allergic Rhinitis and Its Impact on Asthma (ARIA), which was used to diagnose allergic rhinitis and included items concerning symptoms, disease duration, smoking, medication, alcohol, genetic disorders, etc. The final diagnosis was made by the ENT specialist microscopic nasal examination [24,25]. These two questionnaires measure the severity of allergic rhinitis. The case group was selected from the participants who had moderate to severe allergic rhinitis. The control group was made by participants who referred to ENT sector of clinic because of other reasons and the diagnosis of allergic rhinitis based on the ARIA and ISAAC questionnaires and microscopic nasal examination by the ENT specialist was negative.

2.2. Measurements

Participants' heights were measured with individuals standing upright without shoes by trained health technicians. BMI was calculated by dividing weight in kilograms by the square of height in meters (kg/m^2).

Body mass index was classified in to four groups according to WHO BMI cut offs as follow [26].

Underweight: $\text{BMI} < 18.5 \text{ kg/m}^2$
Normal weight: $\text{BMI} = 18.5\text{--}24.9 \text{ kg/m}^2$
Overweight: $\text{BMI} = 25\text{--}29.9 \text{ kg/m}^2$
Obese: $\text{BMI} \geq 30 \text{ kg/m}^2$

2.3. Statistical analysis

Collected data were analyzed by SPSS (version 22) using χ^2 test and t test.

3. Results

This study involved 54 patients with allergic rhinitis and 54 normal individuals. Mean age of case group and control group were respectively 31.92 ± 12.9 and 34.94 ± 13.21 years old. t

Table 1
Body mass index classification in case group and control group.

Group	Patient		Control		Total	
	Number	Percent	Number	Percent	Number	Percent
BMI class						
Under weight	1	1.8	3	5.55	4	3.7
Normal weight	24	44.4	33	61.1	57	52.77
Over weight	24	44.4	18	33.3	42	38.88
Obese	5	9.25	0	0	5	4.63
Total	54	100	54	100	108	100

test outcomes showed no significant difference in mean age between the two groups ($P=0.23$). For gender, there was no significant difference between the two groups ($P>0.05$). Additionally, there were 9 (16.7%) and 7 (13%) students in case group and control group, respectively. Thirteen patients in case group (24.1%) and 16 participants in control group (29.6%) were housewives. Eleven patients in case group (20.4%) and 8 individuals in control group (14.8%) were employees. Fischer's exact test showed no significant difference in distribution of jobs.

Mean BMIs in the case group and control group were respectively $25.03 \pm 3.53 \text{ kg/m}^2$ with the range of 18–36 kg/m^2 and $23.32 \pm 2.8 \text{ kg/m}^2$ with the range of 17–29 kg/m^2 , with a significant difference between the two groups ($P=0.006$).

In the case group, 29(53.7%) participants of allergic rhinitis patients have high BMIs, including 24(44.4%) who were overweight and 5(9.25%) who were obese, In control group, 18(33.3%) of participants are overweight but no member in control group is obese according to WHO BMI cut-offs. χ^2 test showed significant difference in this regard ($P=0.04$) (Table 1).

Calculated mean BMI value in total men was $23.4 \pm 3.72 \text{ kg/m}^2$ with the range of 18–36 kg/m^2 and it was $24.5 \pm 3.1 \text{ kg/m}^2$ in total women with the range of 17–33 kg/m^2 , that did not emphasize any difference between them ($P>0.05$). Similarly, no significant difference was observed in mean of BMI value between men and women in control group ($P>0.05$). Conversely, mean BMI of women in case group significantly higher than mean BMI of men in case group ($P=0.0001$). There was no significant difference between mean BMI value of men in the two groups ($P>0.05$), But mean BMI value of women in case group is significantly higher than that of women in control group ($P=0.0001$) (Table 2). In the case group, 21 participants had severe allergic rhinitis and 33 participants had moderate allergic rhinitis. There was no significant difference in mean BMI value between the two groups ($P>0.05$).

Table 2
Mean and standard deviation of mean BMI value in men and women of case group and control group.

SexGroup	Female	Male	P
Patient	26.3 ± 2.6	23 ± 3.9	0.0001
Control	23.1 ± 2.6	24.2 ± 3.4	>0.05
P	0.0001	>0.05	

4. Discussion

It is evident that the prevalence of allergic disease is increasing worldwide [27]. Several environmental factors are responsible for development of allergic disorders. So, some lifestyle factors such as physical inactivity, dietary factors, alcohol consumption and obesity have gotten distinctive regard recently [27]. Decreased physical activities and increased consumption of fast food promote the prevalence of overweight and obesity. Furthermore, there are some evidences that high BMI is positively associated with allergic disorders, probably due to the immunological effects of adipose tissue on the progress of allergic disease [28,29]. But the link between adiposity and allergic disease is still unclear. BMI is the most used proxy for classification of obesity [27]. Some studies reported a positive association between high BMI value and allergic rhinitis disease [27,30].

For example, in a study conducted by Ciprandi et al. (2013), a global association was found between high BMI levels and allergic rhinitis and asthma. They said this relationship might be due to release of leptin and estrogen hormone from fat tissue [31]. There are some experimental and clinical data that are linking allergic disease and obesity. Adipose tissue has high concentration of aromatase and it could increase circulation of estrogen in obese women. Estrogen has been used to modulate IL4 and IL13 production by monocytes and enhance eosinophil's function [32,33]. In this study, our findings demonstrate that the mean BMI value is significantly higher in allergic rhinitis patients than normal population. In other words, we found that more participants in allergic rhinitis patients group are overweight and obese than normal population with a significant statistical difference that may be due to the effect of leptin and estrogen hormone from adipose tissue on immunological pathway. There is a hypothesis that says, increasing BMI in allergic rhinitis patients is because of their inadequate physical activities in order to allergic rhinitis symptoms. But this hypothesis could not be approved until we collect data on participant's physical activities [34]. Conversely to our study, some studies found no meaningful association between obesity and allergic rhinitis [34,35,19,36]. This discrepancy may be due to different prevalence of allergic rhinitis, life style and age groups. Some studies show a gender dependent association between obesity and allergic rhinitis. Several studies demonstrate that obesity in women increase the risk of allergic rhinitis but this association has not been seen in men. Our results confirm their findings. We found that BMI value is significantly higher in women than in men with allergic rhinitis. That might

be due to hormonal effects on immune system [37,38]. Unlike to our study, Ciprandi et al. (2009), said that allergic rhinitis was associated with high BMI only in males [27]. This disparity may be due to different gender distribution between two groups.

In conclusion, we found a significant relationship between allergic rhinitis disease and the high BMI value that is more prominent in females. This study highlights the role of obesity in allergic disease, but further studies are needed to confirm this association.

Disclosure of interest

The authors declare that they have no competing interest.

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