The effects of allergic rhinitis on growth, development and body mass indexes in school children

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Abstract

Objective The purpose of this study is to determine the frequency of allergic rhinitis (AR) in children and investigate if allergenic rhinitis demonstrated any effects on developmental growth levels and body mass indexes (BMI) in children.

Materials and methods 651 students, between 3–15 years of age who were randomly selected from four elementary schools located at Kartal, Istanbul were assessed according to symptoms and the presence of AR by nasal examination with the aid of a 0 degree 2.7 mm hand rigid endoscope. Height and weight percentile values of students regarding growth according to age and their BMI were calculated and statically assessed. Results obtained are presented.

Results Findings obtained from a questionnaire and clinical examination does not allow us to perform a definite differentiation regarding in school children at age 3–5. The prevalence of AR in girls is higher. However, there are no any significant differences regarding BMIs in children with or without AR ($p < 0,142$). But there are statistically significant differences regarding height and weight percentiles in children with and without AR. Accordingly, there was a tendency in children diagnosed with AR to display low values related with height and weight percentiles. In Pearson chi-square testing, p values

of percentile values related with weight ($p < 0,032$) and p values of percentiles related with height ($p < 0,001$) were determined.

Conclusion AR prevalence was higher in girls independently from BMI values. We determined a strong relationship between BMI values and AR dependant to age and gender.

Keywords Allergic rhinitis · Body mass index · Growth parameters

Introduction

Allergic rhinitis (AR) is one of the most frequent systemic inflammatory disease observed in children. Its prevalence is closely related with age, gender and lifestyle [1, 2]. The worldwide incidence of allergic symptoms and atopic reactions have gradually increased [3].

The actual effect of AR on development and growth in children is not yet clear enough. In many studies, the relationship between allergies of the respiratory tract, asthma and their morbidities and body mass indexes (BMIs) of such cases were thoroughly investigated and results are still controversial [4].

Even though there are several studies that indicate a linear relationship between high BMI values and asthma in men, this relationship was not affiliated with allergic conjunctivitis (AC) and atopic dermatitis (AD) whereas there were a linear relationship between high BMI values and allergic rhinoconjunctivitis in women whereas particularly, this issue was not adequately investigated in studies that include various age groups of children [5].

We are aware that AR frequently may lead to upper respiratory tract obstructions and cause snoring and a sleep

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apnea syndrome [6]. Deterioration of the sleep awakening cycle is closely related with physiological release of the growth hormone (GH) [7]. As AR may cause severe sleeping disorders, and have an impact on GH release, we assume that it may cause variations in growth percentile values in children by degenerating growth parameters. In AR cases, growth can be decreased due to various conditions such as chronic respiratory track obstructions, e.g. adenotonsillary diseases which may lead to an increase in respiratory effort during a sleeping mode, abnormal night time GH release, nocturnal hypoxemia, nocturnal respiratory acidosis and increased caloric consumption [8, 9].

The scope and purpose of our study is to investigate the effects of AR on BMI values and growth patterns such as growth and development percentile values, especially in different children age groups where developmental growth is naturally rapid.

Materials and methods

An approval was obtained for this study from the Ethical Board of the Kartal Education and Research Hospital. One thousand and forty-one students, who were between 3 and 15 years old and who were randomly selected from schools located at Kartal (Istanbul) were investigated in this study. Height and weight values of the entire school children were measured. Clinical examinations were carried out by the aid of a 0 degree 2.7 mm hand rigid endoscope device (Storz). Parents of children were requested to fill a modified International study of asthma and allergies in childhood (ISAAC) core questionnaire. A written informative consent was also obtained from parents. Endoscope examination of children, where symptoms such as sneezing, rhinitis and itchy hydrous ophthalmologic events were present, indicated that children with a hydrous, edema pale mucosa or hyperemic nasal mucosa were accepted as AR cases. Cases that do not contain these findings were admitted as cases without AR.

Children who suffered from congenital and subsequently developed craniofacial abnormalities and genetic syndromes and neurological and psychiatric disorders and children who failed to comply with the examination and who did not complete the questionnaire form in an orderly manner were excluded from the study. Eighty-three girls and 76 boys out of 159 children with AR and 229 girls and 263 boys out of 492 children without AR were determined and 651 children were enrolled into the study.

Height and weight percentiles of growth curves and the BMIs of children with and without AR are determined. All children were divided into 5 groups based to their BMI values and were classified as 2.5 group interval from 12.5 to 25 and as 8 groups as 3% and 97% according to their height percentiles. Percentile values of growth curves and BMIs

were calculated and the data obtained from this study was statistically assessed.

Statistical analyzes

The data obtained from the study was statistically assessed by the aid of a social sciences evaluation intentional Windows 11.5 version computer program. Children with BMI values that varied between 12.5 and 25 were included in the 2.5 group and divided into 5 groups, while children with height and weight percentile values between 3 and 97 were divided into 8 groups and then assessed by a Pearson Chi-square test for statistical significance. p values <0.05 were admitted as significant.

Findings

AR prevalence was found 22.5% in boys and 26.5% in girls and 24.4% in the total number of children. When BMI values of school children are considered, we found that there as no any statistically significant difference in children with or without AR ($p < 0.142$) (Table 1) and showed graphically (Fig. 1). However, it was statistically

Table 1 The distributions of the BMI's of school children with or without AR

BMI	AR(+)			AR(-)		
	girls	boys	total	girls	boys	total
12,4–14,9	16	10	26	51	45	96
15,0–17,4	27	28	55	90	105	195
17,5–19,9	24	22	46	60	65	125
20,0–22,4	11	12	23	19	29	48
22,5–25,0	5	4	9	9	19	28

Fig. 1 Diagram showing the distributions of the BMIs of school children with or without AR

determined that AR caused a meaningful difference in weight and height percentile values of these children. The presence of AR may increase the tendency of low percentile values in children regarding height and weight (Table 2) and showed graphically (Figs. 2a and 2b). When we calculated the BMI mean values of children according to age and gender we determined that, BMI values of boys with AR and between 6 and 8 years of age was higher when compared to other groups, and that BMI values were lower than other groups at age 9 and 10. (Fig. 3) However, a completely reverse intention was determined in girls at the same age. But this difference state is totally removed after girls are over 11 years of age (Table 3) and showed graphically (Fig. 3).

We assume that this change is dependent to limited physical activity due to AR and hormonal changes that originate from puberty. A significant difference equal to 10 to 0% and 7.9–14.5% was determined in groups without

Table 2 Distribution of the weight and height percentiles of the school children with or without AR

Percentiles (weight)	AR(–)	AR(+)	Percentiles (height)	AR(–)	AR(+)
3–	27	9	3–	51	0
3–10	44	15	3–10	39	23
10–25	88	45	10–25	78	24
25–50	136	42	25–50	117	43
50–75	103	22	50–75	109	34
75–90	56	14	75–90	48	20
90–97	23	3	90–97	37	11
97–	16	9	97–	13	4

Fig. 2a Diagram showing the distributions of the weight percentiles of the school children with or without AR

Fig. 2b Diagram showing the distributions of the height percentiles of the school children with or without AR

Table 3 Distributions of the children's mean BMIs and their relations with or without AR and their ages

Age	boy AR(+) mean BMI	boy AR(–) mean BMI	girl AR(+) mean BMI	girl AR(–) mean BMI
6	18,25	15,74	15,3	15,81
7	18,16	15,73	14,6	15,6
8	17,47	16,19	16	15,7
9	14,55	16,64	18,3	16
10	13,3	16,24	19,06	16,65
11	16,7	17,73	15,66	16,87
12	17,82	18,21	17,33	16,26
13	18,97	19,29	18,35	18,45
14	19,69	19,84	19,3	19,11
15	18,2	19,5	21,48	19,92

Fig. 3 Diagram showing the distributions of the children's mean BMIs and their relations with or without AR and their ages

an AR condition where height percentile values are between 3 and under and 3–10, while a significant difference equal to 17.9–28.3% and 20.0 to 13.8% was determined in groups without an AR condition where weight percentile values are between 10 and 25, and 50 and 75. *p* values for height percentiles was found $p < 0.001$ and $p < 0.032$ for weight percentile. (Figs. 2a, 2b)

Discussion

Results that were obtained from studies, performed in school children related with the effect of AR on BMI values and growth parameters are controversial with one another. In the present study, our objective was to obtain definite results and determine the effect of AR on growth and development and BMI. Overweight conditions may lead to unwanted variations in immunological balance and accordingly, to miscellaneous allergenic disorders and therefore childhood allergies may have an effect on development and growth in children [10]. However, no any definite results are obtained from studies performed on these issues [1]. It was determined that high BMI values were risk factors for asthma and allergenic rhinitis in children and adults. As suggested, leptin release and estrogen hormone can be responsible from this condition [11–13].

It was reported that, increase in BMI values and in the incidence of AC and AD risk in women showed a linear elevations while such elevation was not observed in men [3]. A relationship is described between increased BMI values or with adult asthma in childhood obesity [4, 14].

In another study, it was determined that there was no any relationship between BMI values during the first 10 years and birth weight and asthma in adults, but that BMI values and prevalence of asthma showed a tendency to increase during adulthood, while this relationship did not exist between AR and eczema [4]. Similar relationships were determined among AD [15]. High BMI values in children lead to increase in prevalence and AD weight, but there are some studies that report a lower AR and AC prevalence among boys [10].

During the prepubertal term, prevalence of asthma was higher in girls, while this condition converts conversely after puberty [13]. It was reported that, early menstrual period in girls showed a linear relationship related with asthma, AR and AC and BMI increase [5, 11, 16]. In this study, we determined that, when mean BMI values were considered, a difference was observed regarding the presence or absence of AR in children and gender, regarding age groups of 6–8 and 9–10.

Mean BMI values among the 6–8 years of age groups showed a high course in boys diagnosed with AR, but was low in girls diagnosed with AR. Nevertheless, this relationship

converts into a converse direction at 9–10 years of age and we determined that, mean BMI values among girls with AR were high and low in boys when compared to other groups. However, starting from puberty, this difference is totally vanished and a similar mean BMI value can be observed in entire groups (Table 3). It was also reported that, girls with high BMI values possessed a high prevalence regarding bronchial excessive sensitivity (BHR), atopy and presence of AR symptoms, but that this relationship was absent in boys. The atopy prevalence in this study was found 42% and 27%, respectively in boys and girls [17]. This finding is partly controversial to the findings in this study. Prevalence ratios of girls are very near to the data obtained from this study, but were found higher when compared with the values obtained from boys. Further more, we found no any statistically significant relationship between AR and BMI variances (Table 1). As age is not considered in school children, no any significant difference was found due to the presence or absence of AR in girls and boys regarding BMI distribution (Table 1). There are three studies in the literature which investigates the effect of high BMI values on AR. The first two studies are only questionnaires. But studies carried out by Ciprandi et al. [18] and by us are based on clinical data and specialist diagnoses and posses a stronger base.

In a study conducted by Braback et al. [15] no any relationship was found between BMI values and AR. In another study carried out by Kilpeläinen et al. [1] it was reported that high BMI values in women was the reason of increase in AR risk and did not effect males at all. In a study carried out by Ciprandi et al. [18] a global relationship was determined between BMI values and AR and asthma.

In our study, globally no any meaningful relationship was found between BMI and AR, but we determined that both genders were effected at different degrees regarding AR and BMI among certain age groups. We found that, weight and height percentile values showed a tendency to decrease in children with AR and that this finding was statistically significant.

Conclusions

It may be very difficult to differentiate a child with or without AR by the means of a specialist examination based on symptoms and an endoscope study. In our study, we monitored that AR prevalence was higher in girls independently from BMI values. We determined a strong relationship between BMI values and AR dependant to age and gender.

Based on these findings, we hope that the relationship between AR, BMI and growth percentile values shall become clearer by the help of new studies that shall be conducted in the future.

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