The incidence of Iron Deficiency Anemia in Allergic Rhinitis patients in Qena University Hospital

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Abstract

Background: Allergic rhinitis is a common disease of immune origin. It affects the quality of life of patients negatively.

Objectives: To evaluate the changes in iron profile in allergic rhinitis patients.

Patients and methods: This study was conducted on thirty patients with allergic rhinitis. All of the participants were subjected to clinical evaluation and the following investigations: Complete blood picture, Serum ferritin, Serum iron and total iron binding capacity (TIBC) and IgE. Visual analogue scale (VAS) score was used to measure the severity of allergic rhinitis.

Results: Among the studied patients, there were 18 males (60%) and 12 females (40%), the mean age of studied patients was 11.3 ± 4.2 (SD) years with mean onset age of 4.6 ± 3.01(SD) years and mean duration of disease of 6.7 ± 2.9 years. There were 8 patients (26.7%) with positive family history in the studied patients. The incidence of iron deficiency and iron deficiency anemia was significantly higher in children with severe allergic rhinitis compared with mild cases. Also we found statistically significant difference (p-value = 0.037) between mild, moderate & severe cases of allergic rhinitis as regard Hb, MCH, HCT, ferritin, serum iron and TIBC. A statistically significant difference (p-value = 0.015) was noted between mild, moderate & severe cases as regard IgE. Serum IgE is correlated with the severity of allergic rhinitis in children.

Conclusion: Prevalence of iron deficiency anemia in pediatric patients with allergic rhinitis is higher than in patients without atopic disease. Iron deficiency anemia increases markedly with severity of allergic rhinitis. Serum IgE is correlated with the severity of allergic rhinitis in children.

Keywords: Allergic rhinitis; IDA; IgE.

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Introduction

Rhinitis is defined as inflammation of the nasal mucosa and is characterized by nasal symptoms including sneezing, anterior or posterior rhinorrhea, nasal congestion and/or nasal itching. Allergic rhinitis is a global health problem leading to serious illness and disability worldwide. Allergic rhinitis (AR) is the most common form of non-infectious rhinitis and is associated with an IgE-mediated immune response to allergens. In addition to nasal inflammation, allergic rhinitis also has systemic inflammation (**Dogru et al., 2016).**

Allergic rhinitis is currently viewed primarily as Th2 inflammation with central role of Th2-derived cytokines in disease etiology and its clinical manifestations. Various cytokines have been shown to induce, maintain, and enhance inflammatory allergic inflammation, promoting the synthesis and release of IgE It recruits eosinophils to the nasal mucosa, increasing mucus production and airway hyperreactivity, as well as acting to upregulate adhesion molecule specially for eosinophils (**Cezmi et al., 2015**).

Iron is an essential nutrient used in almost all aspects of normal cell function. All cells require iron for replication, and iron is essential for DNA biosynthesis, protein function, and cell cycle progression. Iron deficiency is probably the most common cause of anemia, clinically defined as an insufficient circulating red blood cell mass and in public health defined as a hemoglobin concentration below the WHO threshold **(Nairz et al., 2016).**

Atopic diseases are associated with chronic inflammation. In patients with inflammatory diseases, immune activation and iron deficiency can lead to anemia due to disruption of iron homeostasis (**Nairz et al., 2016**). Regarding allergy, several epidemiological studies have shown that there is a greater degree of iron deficiency in allergic individuals than in non-allergic individuals **(Drury et al., 2016).**The aim of our study was to evaluate the changes in iron profile in allergic rhinitis patients.

Patients and methods

Thirty patients with allergic rhinitis were diagnosed according to the allergic rhinitis guidelines **(Klimek et al., 2019)** enrolled in the study.

I. Inclusion criteria

1. All patients presented with positive clinical Symptoms of allergic rhinitis
2. Patients accept to participate in the study

II. Exclusion criteria

1. Patients with history of trauma or major bleeding or blood donation within last 2 months.
2. Patients on iron supplementation
3. Patients with disorders of liver including hemochromatosis.
4. Patients with autoimmune disorders.
5. Patients who use medications that influence iron status such antibiotics and proton pump inhibitors (PPIs).

All patients were subjected to the following:

I. History and Clinical Examination

1. Complete medical history including personal history , history of present illness, and history of other comorbid conditions.
2. Clinical examination (ear, nose, throat and chest examination), was performed. General condition assessment, abdominal, chest, and cardiac examinations were evaluated with a focus on symptoms of anemia.

II. Laboratory Investigations

Blood samples were collected from patients and submitted to the following:

1- Complete Blood Picture.
2- Serum ferritin.
3- Serum iron and total iron binding capacity (TIBC).

4- Total IgE in serum.
5- Quantitative measurement of total IgE in the serum.

III. Assessment of Severity of AR

The visual analogue scale (VAS) score for overall assessment of the severity of nasal and non-nasal symptoms was used to determine the severity of AR. Allergic rhinitis patients were asked to rate the combination of the nasal and non-nasal symptoms on a scale (0–10 cm) as follows: Mild: 0–3; Moderate: 3.1–7; Severe: 7.1–10 **(Klimek et al., 2019).**

IV. *Diagnosis of Iron Deficiency Anemia* (IDA)

Diagnosis of IDA was based on decreased blood hemoglobin level below the WHO threshold for IDA, (thresholds of Hb level determined by WHO: Hb < 110 g/L in children aged less than 6 years, Hb < 115 g/L in children aged 7-12 years, Hb < 130 g/L for boys and Hb < 120 g/L for girls in children aged 13-18 years) and reduced MCV < 75 fL**.**

The study was approved by the local Ethics Committee, Faculty of Medicine, South Valley University and all subjects involved in the current study were informed about the nature and details of the current work and a written consent was obtained for each participant. **Ethical approval code:** SVU-MED-ENT030-1-22-3-358.

Statistical analysis

Data were analyzed using Statistical Software for Social Sciences (SPSS) version 26.0. Quantitative data were presented as mean ± standard deviation (M ± SD) compared with Student's t-test. Qualitative data were expressed as frequency and percentage number (%) . Chi-square test was used to compare nonparametric data. P < 0.05 was considered significant.

Results

About the description of the demographics of the studied patients , there were 18 males (60%) and 12 females (40%), the mean age was 11.3 ± 4.2 years with mean onset age of 4.6 ± 3.01 years and mean disease duration of 6.7 ± 2.9 years. There were 8 patients (26.7%) with positive family history in the studied patients as shown in (**Table.1**).

Regarding clinical manifestations in the studied patients. There was rhinorrhea in 20 patients (66.7%), nasal congestion in 20 patients (66.7%), sneezing in 19 patients (63.3%), itchy nose in 14 patients (46.7%) and postnasal drip in 10 patients (33.3%). The disease was mild in 16 patients (53.3%), moderate in 9 patients (30%) and severe in 5 patients (16.7%) as shown in (**Table.2).**

According to our finding, children with severe allergic rhinitis had a significantly higher incidence of iron deficiency and iron deficiency anemia than mild cases. Also we found statistically considerable difference (p-value = 0.037) between mild, moderate & severe cases of allergic rhinitis as regard Hb, MCH, HCT, ferritin, serum iron and TIBC as shown in (**Tables 3,4** & **Figs. 1,2,3,4**).

Our results showed a statistically considerable difference (p-value = 0.015) between mild, moderate & severe cases of allergic rhinitis as regard IgE as shown in (**Table.5).** Serum IgE is correlated with the severity of AR in children. It was 278.2 ± 78.6 in mild cases, 325.6 ± 86.1 in moderate cases and 401 ± 54.4 in severe cases. We suggested that the IgE level might be a reliable biomarker for symptom severity in patients with AR.

Table 1. Demographic data of the studied patients

Variables		Studied patients (N = 30)	
Sex	Male	18	60%
	Female	12	40%
Age (years)	Mean ±SD	11.3 ± 4.2	
	Min - Max	6 – 21	
Age of onset (years)	Mean ±SD	4.6 ± 3.01	
	Min - Max	1 – 15	
Disease duration (years)	Mean ±SD	6.7 ± 2.9	
	Min - Max	3 – 15	
Family history	No	22	73.3%
	Yes	8	26.7%

Table 2. Disease severity of the studied patients

Variables		Studied patients (N = 30)	
Disease severity	Mild (0-3)	16	53.3%
	Moderate (4 - 7)	9	30%
	Severe (> 7)	5	16.7%

Table 3. Relation between Disease severity and Hb and RBCs indices among the included patients

Variables		Disease severity			P-value
		Mild (n = 16)	Moderate (n = 9)	Severe (n = 5)	
Hb	Mean	12.2	11.5	9.7	**0.037 S**
	±SD	1.2	1.6	0.2	
MCV	Mean	72.6	71.1	67.5	0.147 NS
	±SD	3.9	5.8	6.0	
MCH	Mean	32.4	28.4	29.5	**0.026 S**
	±SD	3.2	3.0	4.8	
HCT	Mean	32.6	29.0	26.1	**0.014 S**
	±SD	3.3	5.7	4.2	

KW: Kruskal Willis test; S: p-value < 0.05 is considered significant; F: F value of ANOVA test; NS: p-value > 0.05 is considered non-significant.

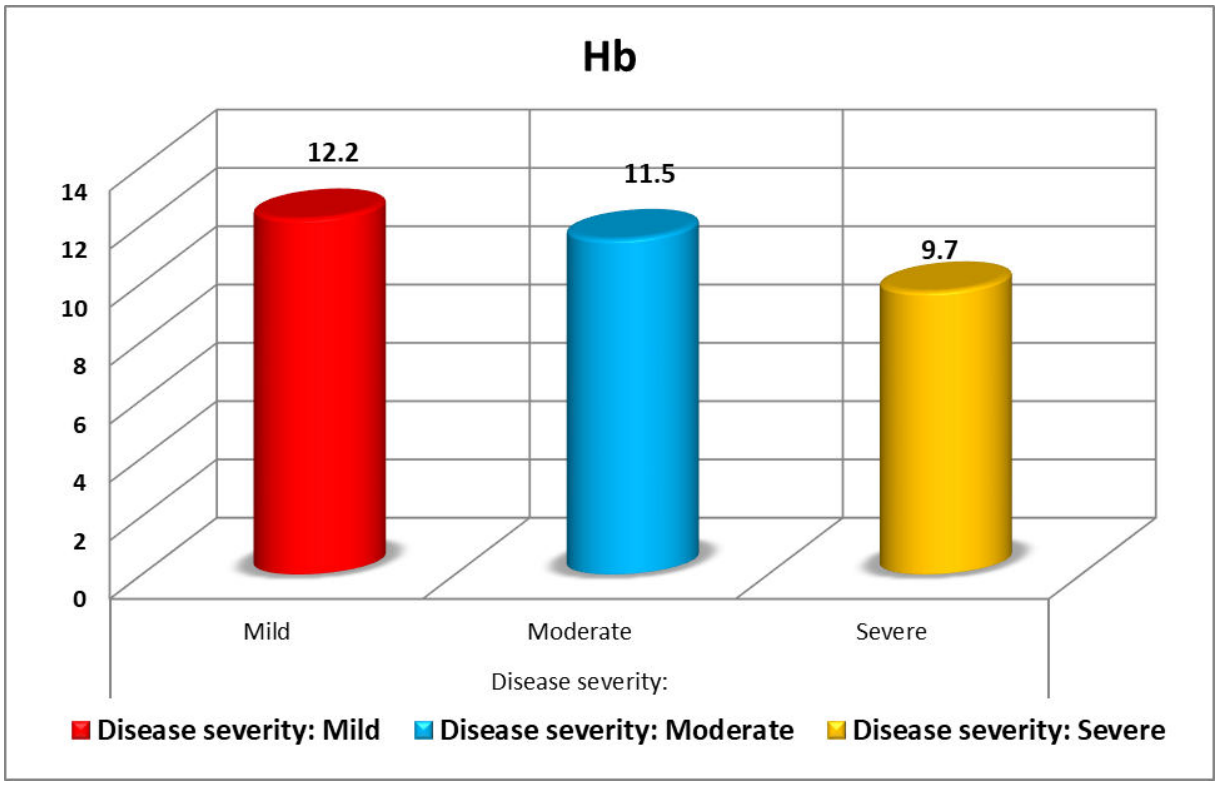

Fig.1. Relation between disease severity and Hb

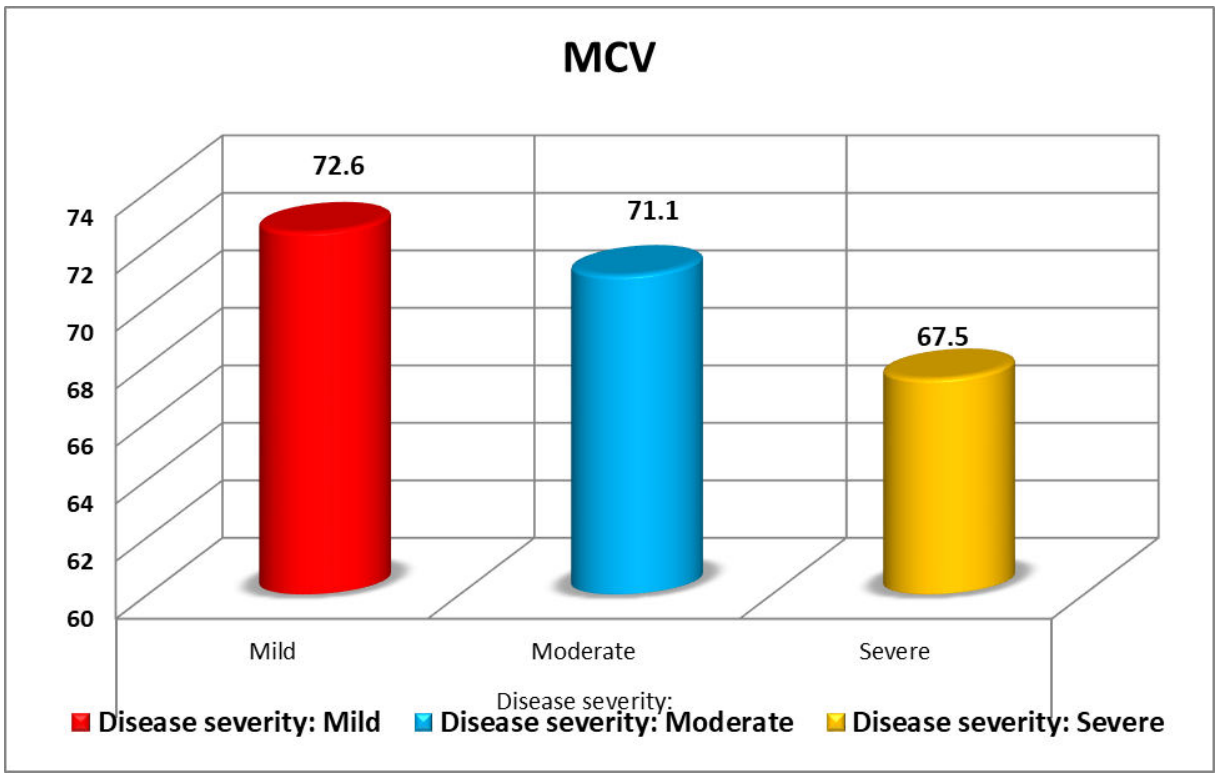

Fig.2. Relation between disease severity and MCV

Table 4. Relation between Disease severity and iron profile

Variables		Disease severity			P-value
		Mild (n = 16)	Moderate (n = 9)	Severe (n = 5)	
Ferritin	Mean	28.4	17.8	9.6	0.043 S
	±SD	15.2	12.7	1.1	
Iron	Mean	64.4	47.7	28.0	0.036 S
	±SD	13.5	20.7	23.9	
Transferrin Saturation	Mean	32.2	23.8	14.0	0.035 S
	±SD	6.7	10.3	12.0	
TIBC	Mean	336.5	417.2	485.0	0.228 NS
	±SD	100.9	109.5	69.9	

KW: Kruskal Willis test; S: p-value < 0.05 is considered significant; NS: p-value > 0.05 is considered non-significant.

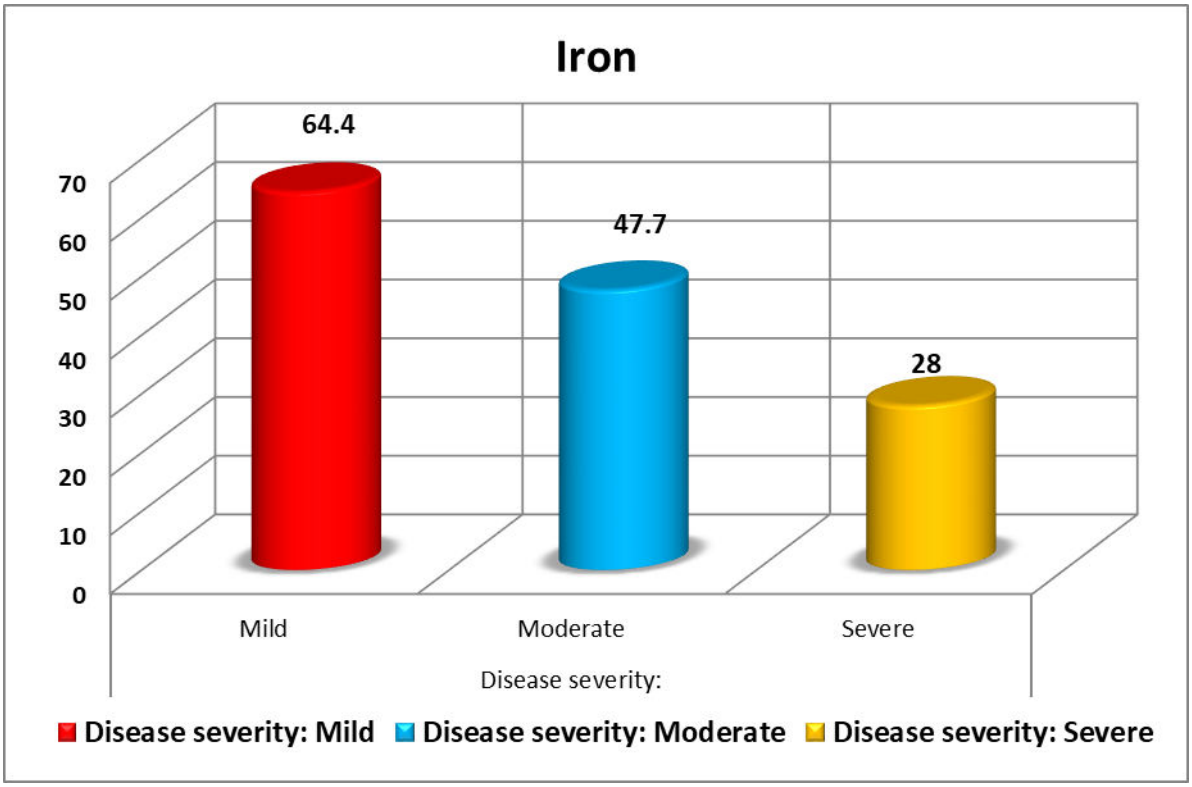

Fig.3. Relation between disease severity and serum iron level

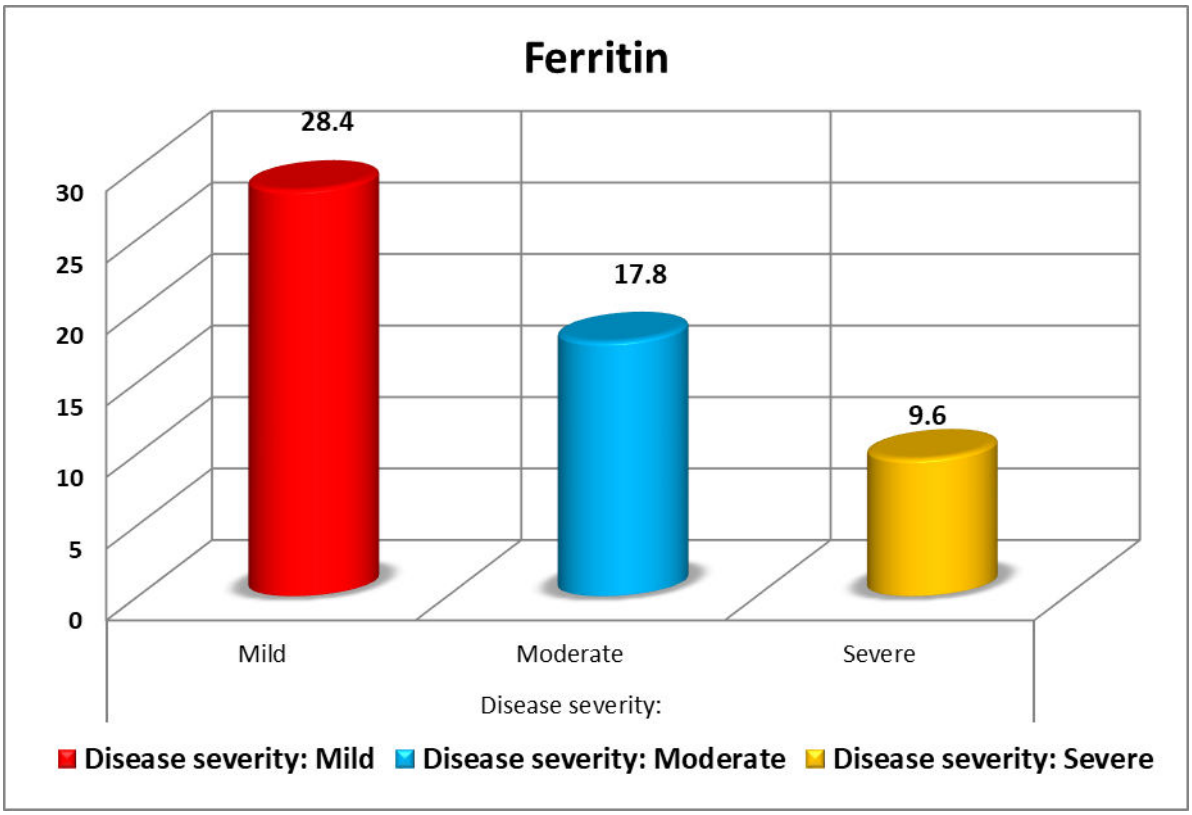

Fig.4. Relation between disease severity and ferritin level

Table 5. Relation between Disease severity and IgE

Variables		Disease severity			P-value
		Mild (n = 16)	Moderate (n = 9)	Severe (n = 5)	
IgE	Mean	278.2	325.6	401	0.015 S
	±SD	78.6	86.1	54.4	

F: F value of ANOVA test; S: p-value < 0.05 is considered significant.

Discussion

According to our findings, children with severe allergic rhinitis were substantially more likely to experience iron deficiency and iron deficiency anaemia than children with mild instances. Also we found statistically considerable difference (p-value = 0.037) between mild, moderate & severe patients as regard Hb, MCH, HCT, ferritin, serum iron and TIBC.

Our study was in agreement with the cross-sectional study conducted by **Rhew et al.(2020)** who stated that the prevalence of IDA/AI was higher in patients with allergic rhinitis, or asthma.

We also agreed with the study conducted by **Rhew and oh (2019)** which revealed that there was association between allergic rhinitis and IDA**.** The study was conducted using the Korean Health Insurance Review and Assessment Service (HIRA) pediatric dataset.

The results of our study are concordant with the published data of **Yang et al. (2022)** in which results suggest that allergic diseases were related to anemia in children. a logistic regression

model was used to assess the relationship between anemia and allergic diseases.

Similar results were reported in the cross-sectional study conducted by **Drury et al.(2016)** which reported that atopic diseases were associated with higher odds of anemia, particularly microcytic anemia.

Our study agreed with the study conducted by **Chang et al.(2020)** which indicated that a patient with IDA had a significantly greater prevelance of allergic rhinitis.

Our findings are in accordance with recent work by **Dananah et al.(2020)** in which the incidence of anemia was considerably higher in patients with severe allergic rhinitis than those with mild type. Our results showed statistically considerable difference (p-value = 0.015) between mild, moderate & severe patients of allergic rhinitis as regard IgE. Serum IgE is correlated with allergic rhinitis severity in children.

In accordance with our results, we agree with **Corsico et al.(2017)** who evaluated 217 patients with AR. They found a significant difference in IgE levels in patients with mild , moderate , severe symptoms ($p < 0.05$)**.**

Similarly, we agree with the study conducted by **Chen et al.(2006)** in which *serum IgE* in children with AR was considerably different from those in non-allergic children. *serum IgE* was related to allergic rhinitis severity in bivariate correlation analysis.

Our study agrees with the control study conducted by **Bener et al.(2015)** in which they found that lower Hb levels were associated with more allergic disease and elevated serum IgE. The study revealed that Hb level, iron and ferritin deficiencies were significantly higher in children with allergic diseases compared to healthy children.

Conclusion

Prevalence of iron deficiency anemia in pediatric patients with allergic rhinitis is higher than in patients without atopic disease. Iron deficiency anemia significantly increases with severity of allergic rhinitis. Serum IgE is correlated with allergic rhinitis severity in children.

Conflict of Interest

The authors declare that they have no conflict of interests.

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