ORIGINAL ARTICLE

Studying The Role of IgA Among Egyptian Asthmatics in Terms of Association and Differentiation

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Abstract

Background: ***Asthma is a chronic inflammatory disease that impacts the airways of the lungs in both adults and children. It begins with inflammation and tightness of the muscles surrounding the small airways in the lungs, which narrows the airways.***

Aim and objectives: ***To find out how frequent IgA deficiency among asthmatics(if any). Correlating its level with exacerbations is a trial to help us answering the question, is it related to asthma severity or to recurrent infection.***

Patients and methods: ***For this case control study, researchers in Egypt surveyed ninety individuals between January 2023 and March 2024 at two different allergy and immunology centers: Al-Azhar University and Al-Hussein Immunology and Allergy Clinic, and were divided according to clinical and pulmonary function parameters into 3-groups.***

Results: ***Concerning the percentage of IgA deficiency in asthmatic patients, 12(40%) of asthmatic patients with exacerbation, 3(10%) of stable asthmatic patients, and one(3.3%) of controls had IgA deficiency. Group I had a significantly greater rate of IgA deficit when compared to groups II and III, when looking at the percentages of IgA deficiency among the three.***

Conclusion: ***Asthmatic patients had IgA deficiency more than controls, and IgA was inversely associated with total leucocytic count. Also, serum IgA can differentiate asthmatic patients with exacerbation from stable asthmatic patients and controls. Furthermore, Immune factors and immunoglobulin, particularly IgA, which has demonstrated a strong correlation with both the prevalence and severity of asthma attacks, play a part in the disease's underlying mechanism.***

Keywords: IgA; Egyptian asthmatics; Differentiation

1. Introduction

An inflammatory condition that affects the airways over an extended period of time is known collectively as asthma. Respiratory symptoms like wheezing, dyspnea, chest tightness, and coughing are hallmarks of this illness, which is further defined by an expiratory airflow limitation that varies in severity and duration. Over time, airflow limitation can be maintained for an extended period.[1]

The greater permeability at mucosal surfaces may explain why there is a correlation between IgA deficiency and allergies: higher amounts of circulating antigens.[2]

Managing asthma effectively requires a personalized approach that takes into account both the severity and phenotypic features of the condition. The fact that the genetic diversity of asthma has been better understood because of the discovery of its clinical manifestations is encouraging.[3]

Mucosal infections, heightened atopic illness risks, and an increased prevalence of autoimmune diseases are all strongly linked to IgA deficiency.[4]

At the mucosal surfaces of the digestive and respiratory systems, IgA is crucial for immune defense.[5]

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It is suggested that in asthmatics without detectable IgA (or other) immunodeficiency, disease progression may be affected by minor changes in mucosal immune defense, as the clinical manifestations related to IgA deficiency are probably associated with compromised IgA-dependent protection at mucosal interfaces.[6]

Finding out how common IgA insufficiency is in asthmatic patients is the main goal of this investigation. Comparing its level with exacerbations can teach us more about its association with asthma severity and recurrent infections.

2. Patients and methods

According to the ethical guidelines set out by the Ethics Unit of the Faculty of Medicine at Al-Azhar University in Cairo, Egypt, a case-control study involving ninety Egyptian subjects was carried out between January 2023 and March 2024. The subjects were seen at the allergy and immunology centers at Al-Azhar University and Al-Hussein. The study was divided according to clinical and pulmonary function parameters into: Group I: 30 Asthmatic patients with exacerbations; Group II: 30 stable asthmatic patients; and Group III: 30 healthy subjects.

Inclusion criteria:

Age from 18 to 50 years, males and females, all patients having mild to moderate asthma according to Global Initiative for Asthma (GINA) 2019 guidelines.

Exclusion criteria:

Factors that can lead to an insufficiency of IgA include smoking, some drugs (such as gold salts, azathioprine, or systemic steroids), certain co-morbid illnesses (such as SLE or RA), and being pregnant.

Method:

Here are the things that every patient goes through:

Thorough medical history and physical examination were conducted to rule out any related conditions (such as diabetes or high blood pressure) or medications that could impact the study's outcomes. Inhaled corticosteroids were extensively examined, along with any sensitivities the patient might possess. An extensive assessment of the respiratory system was performed, and a chest x-ray was conducted to exclude any other pulmonary pathology.

Pulmonary function test:

Conventional spirometry was employed to assess the pulmonary function of each participant using a portable dry rolling SpiroBank spirometer (nSpire Health™, Medics MGA USB, Germany). The reference values were determined according to the American Thoracic Society recommendations. With the use of spirometry, we may determine the forced vital capacity (FVC) and the forced expiratory volume in one second (FEV1), and then divide the two by one another to get the forced expiratory volume in one second (FEV1/FVC).

An enzyme-linked fluorescence assay kit (ELFA) from Vidas, France, was employed to conduct a total serum IgE assay, while serum IgA, IgG, and IgM assays were executed using an immunoturbidimetric assay from Roche Diagnostics, Germany, with a Cobas c311 analyzer. Turbidimetric assessment of complexes generated by anti-immunoglobulin antibodies and sample antigens; the Beckman Coulter LH 750 hematology analyzer from the USA was employed to determine the total leukocyte count with differentiation.

Ethical consideration:

Tables and appropriate graphics were used to present the collected data, which was examined using normal statistical procedures.

Statistical Analysis

The data were entered into SPSS version 21.0, SPSS Inc., Chicago, Illinois, USA, for statistical analysis. Numbers and categories were used where needed. Mean, standard deviation, and range were our quantitative data. Frequency and percent with 95% confidence intervals work for qualitative data.

Two qualitative variables were compared using chi-square and fisher exact tests. Comparing non-normal quantitative data with normal data using the Student t-test and Mann Whitney test of means and standard deviation. The correlation showed the outcomes of comparing two continuous variables. The r-value shows correlation. For statistical reasons, p-values below 0.05 were significant.

3. Results

Table 1. Demographic attributes within the examined cohorts.

		GROUP ONE (N=30)		GROUP TWO (N=30)		GROUP THERE (N=30)		TEST VALUE	P-VALUE
		No.	%	No.	%	No.	%		
GENDER	Male	11	36.7%	9	30.0%	9	30.0%	X2=	0.882
	Female	19	63.3%	21	70.0%	21	70.0%	0.407	
AGE (YEARS)	Mean±SD	34.40±5.57		31.73± 6.89		28.70±8.02		F=	0.008*
	Range	22-45		22-44		20-46		5.121	
POST HOC ANALYSIS		P1=0.298, P2=0.005, P3=0.210							

A significance level of *p≤0.05, **p≤0.01, or p>0.05 is denoted as non-significant. "SD" refers to the typical variation. Comparing Groups I and II, Group I and III, and Group II and III, respectively, using post hoc analysis with the Tukey Test, X2 the Chi-Square Test, and F the One-Way ANOVA Test

In group one, females made up the majority of patients (63.3%), with an average age of 34.40±5.57 years. Group two had an average age of 31.73±6.89 years and had 70% female

participants, as seen in the tables. The average age in Group there was 28.70±8.02 years, with 70% of the subjects being female.

Although there was no statistically significant distinction in gender between the groups (p>0.05), the control group had significantly younger asthmatic patients (p=0.008) who experienced exacerbations, table 1.

Table 2. Comparison between the studied groups regarding clinical history.

	GROUP ONE (N=30)		GROUP TWO (N=30)		GROUP THERE (N=30)		CHI-SQUARE TEST	
	No.	%	No.	%	No.	%	Test value (X2)	P-value
HTN	3	10.0%	3	10.0%	2	6.7%	0.274	>0.999 MC
DM	2	6.7%	2	6.7%	1	3.3%	0.424	>0.999 MC
IHD	3	10.0%	3	10.0%	2	6.7%	0.274	0.791MC

p≤0.05 indicates statistical significance, p≤0.01 indicates extremely significant, while p>0.05 indicates statistical non-significant. MC: Monte-Carlo correction, IHD: Ischemic heart disease, and X2: Chi-Square test P1, P2, and P3: Comparisons of Group one and Group two, Group one and Group there, and Group two and Group there, respectively

In terms of hypertension, diabetes mellitus, and ischemic heart disease, there were no statistically significant distinctions among the three groups (p>0.05), table 2; figure 1.

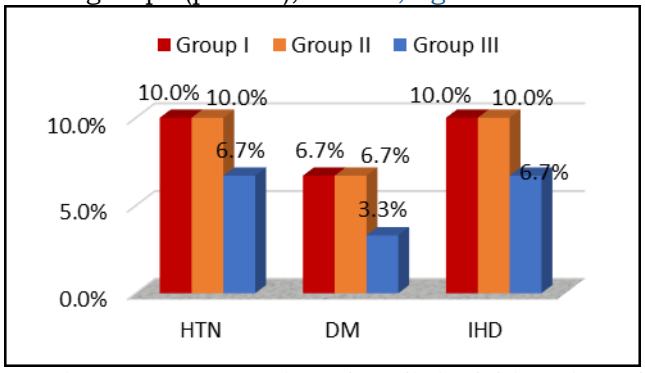

Figure 1. Comparing the clinical histories of the study groups.

Table 3. Disease duration among group one and group two.

		GROUP ONE (N=30)		GROUP TWO (N=30)		TEST VALUE	P-VALUE
		No.	%	No.	%		
DURATION OF ASTHMA(YEARS)	Mean±SD	10.67±2.94		10.80±3.11		ZMWU=0.261	0.771
	Median (IQR)	12 (9-13)		11.5 (9-14)			
	Range	5-14		4-14			

*p≤0.05 indicates significance, **p≤0.01 indicates high significance, p>0.05 indicates non-significant, and SD stands for standard deviation. ZMWU: Mann-Whitney U-Test and X2: Chi-Square Test

Upon comparison of groups one and two for the duration of asthma, no significant distinctions were seen between the two groups (p>0.05), as illustrated in Table 3 and Figure 2.

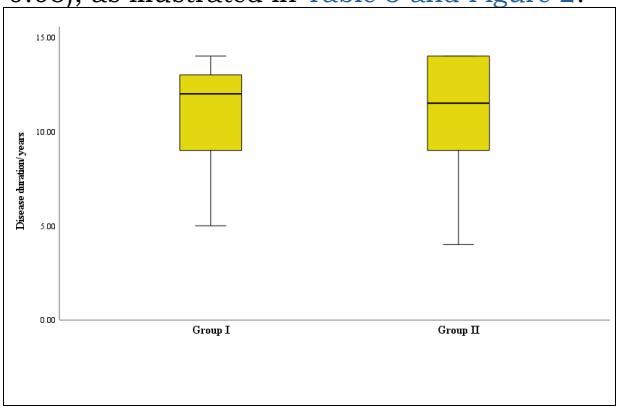

Figure 2. Comparison between group one and group two regarding duration of asthma.

Table 4. Comparison of the groups under study with respect to laboratory data.

	Group one (N=30)				Group two (N=30)				Group there (N=30)				Test value	P-value
	Mean	±SD	Median	Range	Mean	±SD	Median	Range	Mean	±SD	Median	Range		
Hb (g/dL)	13.38	1.60	13.70	10.0-16.3	12.78	1.63	12.85	10.3-16.5	13.34	1.05	13.40	11.6-15.1	F= 1.35	0.327
PLT (10^3/uL)	245.87	60.52	240.0	165.0-410.0	264.62	60.71	263.0	112.3-362.0	266.2	34.9	264.3	189.0-345.0	F= 1.35	0.266
TLC (10^3/uL)	7.23	1.89	7.1	4.3-11.9	5.53	2.31	4.60	3.85-12.6	4.73	2.73	5.0	1.0-9.0	KW	<0.001**
Post hoc analysis	P1= 0.008, P2<0.001, P3=0.583													
Eosinophil (×10^9)	14.77	6.18	15.0	4.0-30.0	12.87	5.94	11.5	4.0-30.0	4.55	2.61	4.5	1.0-9.0	KW= 43.71	<0.001**
Post hoc analysis	P1= 0.303, P2<0.001, P3<0.001													

A significance level of *p≤0.05, **p≤0.01, or p>0.05 is denoted as non-significant. Using the abbreviations P1, P2, and P3, we can compare Group one with Group two, Group one with Group there, and total leucocyte count (TLC) and platelet count (PLT), respectively

A significantly different pattern emerged across the three groups (p<0.001), with group one displaying a significantly higher TLC than groups two and there. Groups one and two had

significantly higher eosinophilic counts than group there, and this difference was statistically significant (p<0.001). Nevertheless, there was no statistically significant difference (p>0.05) in hemoglobin and platelet counts across the three groups, table 4; figures 3&4.

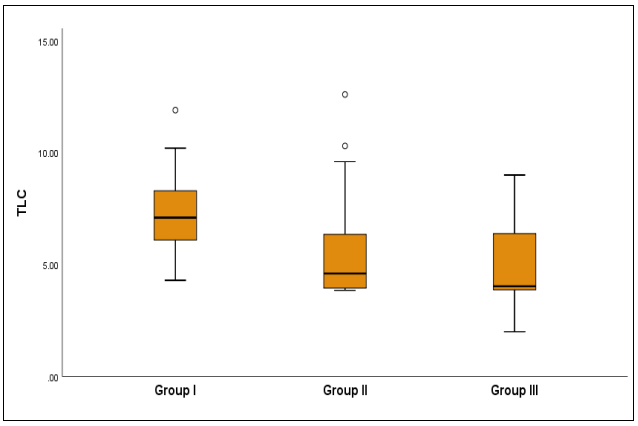

Figure 3. Comparison between the study groups regarding TLC.

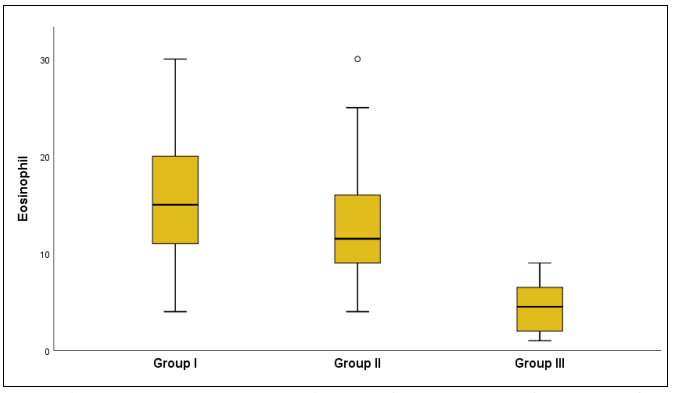

Figure 4. Comparison between the study groups regarding eosinophil count.

Table 5. Comparison of the various serum immunoglobulin levels among the groups under study.

	Group one (N= 30)				Group two (N= 30)				Group there (N= 30)				Test value	P-value
	Mean	±SD	Median	Range	Mean	±SD	Median	Range	Mean	±SD	Median	Range		
Serum IgE (IU/mL)	327.57	129.4	326.5	150.0-877.0	264.31	91.04	251.5	112.4-422.0	111.77	82.66	83.0	26.0-268.0	F= 34.76	<0.001**
Post hoc analysis	P1=0.051, P2<0.001, P3<0.001													
Serum IgM (mg/dl)	1161.67	1573.662	632	200 50.0-9000	300.0	424.717	254.8	83.92-342.5	150.0	200	1250	430-836.7	121.40	2593.55.769
Serum IgG (mg/dl)	336.51	00.0	42.0-1453	200.07									KW= 5.59	KW= 6.0 0.061	0.051

Findings that are significant are denoted by *p≤0.05, **p≤0.01, and p>0.05, whilst results that are not significant are represented by p>0.05. First, a comparison of groups one and two; second, a comparison of groups one and there; and third, a comparison of groups two and there; KW stands for Kruskal-Wallis Test; F for One-Way Analysis of Variance

There was a substantial difference between the three groups, as indicated by significantly higher serum IgE levels in groups I and II compared to group III (controls) (p<0.001). The difference between groups I and II was minimal, nevertheless. There was no significant difference (p>0.05) in IgM and IgG levels among the three groups, table 5; figure 5.

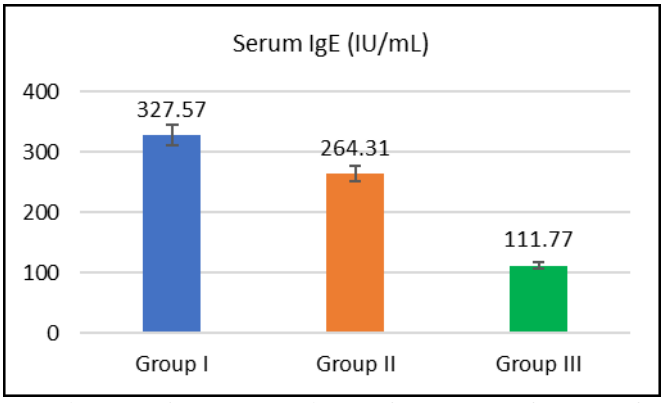

Figure 5. Comparison between the study groups regarding IgE.

Table 6. Comparison between the studied groups according to serum IgA & percentage of IgA deficiency.

		GROUP ONE (N=30)		GROUP TWO (N=30)		GROUP THERE (N=30)		TEST VALUE	P-VALUE
		No.	%	No.	%	No.	%		
SERUM IGA (MG/DL)	Mean±SD	98.13±42.93		155.27±57.66		226.17±87.54		KW= 36.22	<0.001**
	Median(IQR)	85.0		155.5		219.0			
	Range	20.0- 218.0		58.0- 289.0		35.0-384.0			
POST HOC ANALYSIS		P1=0.003, P2<0.001, P3=0.058							
SERUM IGA	Normal	18	60.0%	27	90.0%	29	96.7%	X2= 15.66	<0.001**
	Low	12	40.0%	3	10.0%	1	3.3%		
POST HOC ANALYSIS		P1=0.007, P2=0.001, P3=0.612							

At p>0.05, it is not significant; at *p≤0.05, it is significant; and at **p≤0.01, it is highly significant. Distinct variables' standard deviations The post hoc analysis included the following tests: X2 for chi-square, KW for Kruskal Wallis, P1 for comparisons between

Groups one and two, P2 for comparisons between Groups one and there, and P3 for comparisons between Groups two and there

The levels of serum IgA were significantly lower in group I compared to groups II and III, suggesting a noteworthy disparity among the three groups ($p<0.001$). A total of twelve patients, or 40% of the asthmatic population, exhibited IgA deficiency; three patients, or 10% of the stable asthmatic population, and one control patient, or 3.3% of the total, did not. There was a statistically significant difference between groups II and III when it came to the percentages of IgA deficiency. Group I had the highest proportion, table 6; figures 6&7.

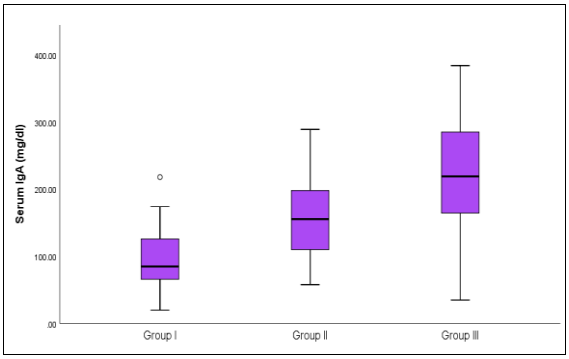

Figure 6. Comparison between the study groups regarding IgA.

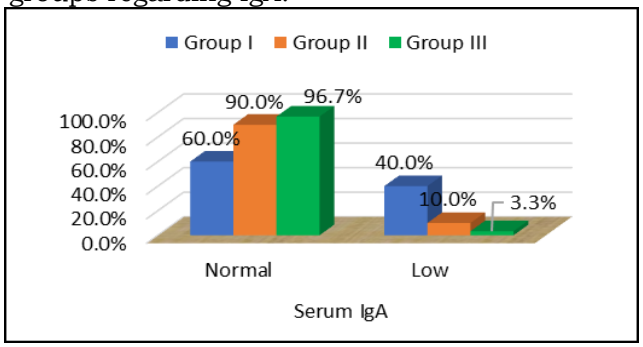

Figure 7. Comparison of the IgA deficiency percentages among the groups under study.

4. Discussion

Adults and children alike can suffer from asthma, a chronic inflammatory illness that affects the airways of the lungs, when inflammation and tightening of the muscles around the tiny airways in the lungs lead to airway narrowing.[7]

Asthma symptoms include coughing, wheezing, difficulty breathing, and tightness in the chest, which are brought on by this. Every now and then, you might feel these symptoms, and they seem to flare up when you're exercising or sleeping.[8]

According to this study, the average age of the participants in group I was 34.40±5.57 years, and the majority of them (63.3%) were female. Group II had a mean age of 31.73±6.89 years, with 70% of the subjects being female. There were 70% female participants and an average age of 28.70±8.02 years in Group III.

Also, our findings were in line with Abo Ali et al.,[9] who presented with the objective of determining the frequency of selected IgA deficiency as well as its relationship to the frequency of infections experienced by asthma patients. Twenty asthmatics who had recurring chest infections made up Group A, twenty asthmatics who did not have recurrent chest infections made up Group B, and forty healthy controls made up Group C. The study used a case-control design. The average age of Group C was significantly younger than that of Group A. With a p-value of only 0.022, Group A had an older mean age than Group C. However, there isn't a clear disparity between the sexes in the categories.

Our results showed a statistically significant difference between groups I and II based on serum IgE levels, while group III (controls) had much lower levels. The two groups were indistinguishable from one another. Furthermore, the levels of IgG and IgM did not differ significantly ($p>0.05$) among the three categories.

Similarly, our results were consistent with those of Ali et al.,[10] They collected blood samples from asthma patients and compared their levels of serum IgA and IgE antibodies to those of healthy controls. Compared to controls, they found that asthmatic patients had a considerably greater amount of immunoglobulin (IgE).

Group I had substantially lower serum IgA levels than groups II and III, according to the present investigation. Twelve patients with asthma who were experiencing an exacerbation, three individuals with stable asthma, and one control patient all exhibited IgA deficiency. The prevalence of IgA insufficiency was much greater in group I than in groups II and III.

In agreement with our findings, Darwesh,[11] found that, in comparison to healthy individuals, asthma patients had lower levels of IgA.

In the first group of asthmatic patients experiencing an exacerbation, we found that serum IgA was positively correlated with the asthma control test ($r=0.379$, $p=0.039$), and negatively correlated with TLC ($r=-0.462$, $p=0.01$).

In agreement with our results, Urm et al.,[12] carried out a case-control research within a community to determine whether there was a connection between a history of asthma and the diagnosis of sIgAD/CVID. Their research showed that sIgAD/CVID is more common in people with asthma compared to those without the condition. Asthmatics are at a higher risk of bacterial infections, and this association might explain why.

4. Conclusion

Asthmatics patients had IgA deficiency more than controls and IgA was inversely associated with total leucocytic count. Also, serum IgA can differentiate asthmatic patients with exacerbation from stable asthmatic patients and controls. Additionally, there is a correlation between the incidence and severity of asthma, suggesting that immunoglobulins and immune components, particularly IgA, play a role in the disease's pathogenesis.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article

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Conflicts of interest

There are no conflicts of interest.

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