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Serum IgE Levels in Asthmatic Children

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Summary

Aderele WI, Salimonu LS, Oduwole O, Odunuga SO and Bamgboye EA. Serum IgE Levels in Asthmatic Children. *Nigerian Journal of Paediatrics* **1984; 11:7.** Serum concentrations of immunoglobulin E (IgE) were determined by the radial immunodiffusion technique in 47 asthmatic children, aged 3–14 years and in the same number of controls. The mean log serum IgE level of 2.307 in the asthmatics was significantly higher ($p<0.01$) than 1.836 in the controls. Twenty-four asthmatics with positive allergy skin tests had insignificantly higher mean log IgE (2.7269) than 22 others (2.3349) with negative skin reactions. Similarly, asthmatics with stool helminthiasis had higher but insignificantly different mean log IgE (2.5996) than those with normal stools (2.0256). The mean log IgE level was not related to the frequency of asthmatic attacks. It is concluded that while serum IgE as determined in this study, is of diagnostic value in children with suspected bronchial asthma, it is not useful in predicting the frequency of acute attacks and thus, the severity of the disease.

Introduction

SERUM levels of immunoglobulin E (IgE), a reaginic antibody, which is associated with antigen-antibody reactions leading to bronchospasm and other associated changes in asthmatic attacks,[1] have been determined in both atopic and non-atopic children from various parts of the world.[2–4] Reports of these determinations show that a high percentage of asthmatic children have increased serum IgE levels, thus indicating the potential value of IgE assay for diagnosis in this condition. However, several factors are known to affect immunoglobulin levels in health and disease. These include environmental factors, such as infection,[5–8] nutrition,[9] geographical location,[10] seasonal changes[11] and altitude.[12 13] Furthermore, helminth infestation, which is prevalent in Nigeria significantly elevates IgE levels.[6 14] To our knowledge, no studies on the levels of IgE in Nigerian asthmatic children have been published to date. The present study was therefore, carried out to determine the IgE levels in asthmatic children and to examine the usefulness of serum IgE levels in the diagnosis and grading of severity of bronchial asthma.

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Materials and Methods

The 47 subjects (27 males, 20 females) were asthmatic children aged, 3–14 years, who had been attending the paediatric asthma clinic, University College Hospital (UCH), Ibadan, for 1–8 years. The duration of asthma varied between one and twelve years (mean, 6 years). The diagnostic criteria for asthma included most or all of the following:

(*a*) an initial history of at least, three distinct episodes of cough, breathlessness and wheezing which in many cases, had responded to bronchodilators, and

(*b*) confirmation of the diagnosis during subsequent attendances at the follow-up clinic by (*i*) auscultatory findings of widespread expiratory rhonchi which responded to bronchodilator therapy; (*ii*) a minimum of 20% increase in the respiratory peak flow rate as measured by Wright's peak flow meter, after the administration of a bronchodilator in those who subsequently presented in acute attacks and (*iii*) demonstration of bronchial lability by exercise test.

For the purpose of the present study, the grading of severity of asthma which was based on the frequency of acute attacks over the previous twelve months, was a modification of an earlier one used by Aderele.[15] Those who had had an average of less than one acute attack of asthma per month were graded as having mild asthma, while those whose attacks averaged one and above per month were regarded as having severe asthma. The subjects had not received steroid therapy for at least, the previous 6 months, neither was any of them currently on therapy with cromoglycate or ketotifen. The controls consisted of apparently healthy children with no known personal or family history of atopy. They were matched for age, sex and social class,[16] with the asthmatic cases. Informed consent was obtained from the parents of both the asthmatics and the controls.

Two to five millilitres of venous blood were obtained from each subject or control and centrifuged within an hour of collection, in order to obtain serum which was then stored at —20°C (with a drop of sodium azide) until analysed for the immunoglobulin levels. Early morning faecal specimens obtained from the subjects within 48 hours of blood samples being taken, were examined microscopically for helminths. Analysis of IgE levels in relation to stool helminthiasis was limited to the asthmatics since, through lack of cooperation, stool specimens obtained from the controls were too few for meaningful analysis. Skin sensitivity tests, carried out only in the asthmatics, were performed by the prick method, using commercially prepared antigen solution as previously described.[17]

Quantification of IgE levels was carried out by a modification of the single radial immunodiffusion technique in agar as previously described by Salimonu *et al.*[18] Serum IgE levels were quantified using commercially prepared monospecific immunoplates supplied by *Hoechst Nigeria Ltd.*, Lagos. The coefficient of variation of the measurements which was computed, using the formula: $100t_{n-1}$ (SD/mean) (where t=Student's t test and n–1 is the degree of freedom) was ±18%. Serum IgE levels were transformed into the logarithm scale to stabilize the variability in the original measurements. While the Student's t test was used to compare the mean log values between subjects and controls, the chi-square test was used to detect association between important attributes.

Results

Serum IgE

Table I compares the mean log IgE values in asthmatics and controls. The mean log IgE values in male asthmatics (2.448) and in all the asthmatics taken as a group (2.507), were significantly higher than corresponding mean values (1.776 and 1.836, respectively) in the controls ($p<0.05$; $p<0.01$, respectively). However, there

was no significant difference between the mean log IgE values in the female asthmatics (2.5859) and female controls (1.927). Similarly, there were no significant differences in the mean log IgE values in male asthmatics or controls when compared with corresponding levels in female asthmatics or controls ($p>0.1$; $p>0.1$, respectively) (Table I).

IgE level and severity of asthma

Twenty-three (49%) of the 47 patients had severe asthma, while the remaining 24 (51%) suffered from mild asthma. The mean ages of the mild and severe asthmatics were 7.5 (±2.9) and 8.65 (±2.5) years, respectively ($p>0.1$). The mean log IgE levels (Table II) were not significantly different between the children with mild asthma (2.4317) and those with severe asthma (2.5849).

IgE levels and skin sensitivity reactions

Twenty-four (52%) of 46 asthmatics had positive skin reactions to various antigens, while the remaining 22 did not react to any of the antigens which numbered at least, eight. These antigens always included *D. Pteronyssinus*, house dust and feathers. The mean log IgE (Table III) in those with positive reactions was 2.7269 compared with 2.3349 in those with negative reactions ($p>0.1$).

IgE levels and stool helminthiasis

Twenty-four (77%) of 31 asthmatics had helminthiasis as revealed by the isolation of various worms, principally, ascaris, from the stool. The mean log IgE in the asthmatics with helminthiasis was similar to the mean in those without helminthiasis (Table IV).

TABLE I

Serum IgE Levels in Asthmatics and Controls

	Asthmatics			*Controls*			
	No. of Cases	*Mean log Value*	*SE*	*No. of Cases*	*Mean log Value*	*SE*	
*Males	27	2.4480	0.221	27	1.776	0.218	<0.05
*Females	20	2.5859	0.272	20	1.927	0.292	>0.05
Total	47	2.507	0.170	47	1.836	0.174	<0.01

*Asthmatic Males vs Asthmatic Females, $t = 0.1379$; $p>0.1$

*Control Males vs Control Females, $t = 0.4140$; $p>0.1$

SE = Standard Error.

TABLE II

Mean IgE Levels According to Severity of Asthma

Severity of Asthma	*No. of Cases*	*Mean log IgE*	*Standard Error*	*p*
Mild	24	2.4317	0.236	
				>0.5
Severe	23	2.5849	0.250	

TABLE III

Mean IgE Levels in Asthmatics in Relation to Skin Sensitivity Reactions

	No. of Cases	*Mean log IgE*	*Standard Error*	*p*
Positive skin test	24	2.7269	0.235	
				>0.1
Negative skin test	22	2.3349	0.246	

TABLE IV

Mean IgE Levels in Asthmatics in Relation to Stool Helminthiasis

	No. of Cases	*Mean log IgE*	*Standard Error*	*p*
Stool containing helminths	24	2.5996	0.258	
				>0.1
Stool without helminths	7	2.0256	0.484	

Discussion

Since there were no established values for serum IgE in Nigerian children of ages similar to our subjects, we have compared the values obtained in our asthmatic subjects with those obtained in controls. This comparison has revealed a significantly higher mean log IgE level in the asthmatics, particularly, the males, than in controls. This finding is in keeping with those of European workers[1 2] who have reported raised concentrations of IgE in asthmatic children. It needs to be emphasized however, that such elevated values are in themselves, not diagnostic of the disease, since other allergic disorders such as eczema and hayfever, as well as non-allergic conditions like the collagen diseases and parasitic infestations may also be associated with elevated IgE values.[14]

Previous workers[3 4 14] have reported normal levels of serum IgE for European children. These workers and others[19–21] have observed that levels of serum IgE in African children from Ethiopia, Gambia and Tanzania, respectively, were much higher than those obtained in European children. The mean IgE levels in both asthmatics and controls in the present series, though higher than reported levels in European children, were not as high as those in the African children referred to above. Although there is no obvious explanation for these differences, it has been shown that intestinal helminthiasis, which is more prevalent among African children, causes a rise in serum IgE levels, thus explaining the higher levels reported in African children.[3 14 21] It is therefore, possible, that the reason for the difference between the IgE levels in the present series and those in other African children was due to a greater infestation rate among their subjects compared to the subjects in the present series. However, although we were unable to relate serum IgE levels with stool helminthiasis in the controls in the present study, this explanation seems unlikely since the helminthiasis infestation

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