

Allergy and parasites: the measurement of total and specific IgE levels in urban and rural communities in Rhodesia

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Summary

Eighty adult asthmatics living in an African city had a significantly higher serum IgE level (799 u/ml) than the control group (350 u/ml). A high proportion (78.7%) of the asthmatics had demonstrable circulating mite-specific IgE antibodies. The rural population of a filariasis endemic region was investigated and although no allergic subjects were identified, the group had a significantly higher IgE level (1613 u/ml) than the asthmatics and also showed a relatively high incidence of grass pollen-specific IgE antibodies (35%). The discrepancy between clinical history and laboratory results supports the mast cell saturation hypothesis and suggests: (a) an explanation for the susceptibility to allergy of African and Asian immigrants to Great Britain, and (b) a practical approach for preventing allergic reactions *in vivo*.

Introduction

Elevated levels of circulating immunoglobulin E (IgE) are indicative of either allergic disease (Ishizaka, Ishizaka & Hornbrook, 1966), or parasitic infection (Johansson, Mellbin & Vahlquist, 1968). Asthma surveys conducted in parasite endemic areas can lead to conflicting results as to whether it is allergic subjects or the non-allergic controls who have the higher serum IgE levels. For example, in the Nigerian Savanna region the adult asthmatics had the lower levels (Warrell *et al.*, 1975), but in Gambian schoolchildren the asthmatics had the significantly higher levels (Godfrey, 1975). In both surveys the house dust mite was identified as the major cause of asthma, and furthermore both suggested that parasitic infection and asthma are mutually exclusive.

We have similarly surveyed adult urban and rural communities in Rhodesia, and also observed that asthma is prevalent among town-dwellers but not villagers. However in addition we have identified specific IgE antibodies in the control as well as asthmatic subjects and the relevance of these findings are discussed in relation to the hypothesis that parasitic IgE can block the allergic response.

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Methods

Patients

The allergic histories of African subjects participating in this survey were completed at interviews conducted by one of us (J.C.), usually with the aid of an interpreter. The urban population (Salisbury, Rhodesia) included eighty asthmatics and sixty-five non-allergic controls, drawn from similar backgrounds, i.e. municipality and industrial workers, and army personnel. Average ages of the two groups were 36 years (range 8–61) and 34 years (range 18–75) respectively. The 100 subjects attending a rural clinic in a filariasis endemic region west of Salisbury were predominantly female (eighty-two), the average age was 27 years (range 8–58) and none presented with evidence of allergic disease.

IgE measurements

Total serum IgE levels were measured by a double antibody radioimmunoassay (Merrett & Pantin, 1975) with a coefficient of variation of 8.1% within assay and 10.7% between assay. IgE values followed an almost normal distribution when plotted logarithmically and so geometric means are quoted. Student's *t*-test was used to assess the difference in population means, and *P* values of less than 0.05 were considered significant. Serum levels of IgE antibodies specific for house dust mites (*Dermatophagoides pteronyssinus*, *Dermatophagoides farinae*), grass pollens (Meadow and Bermuda), and moulds (*Aspergillus fumigatus*, *Alternaria tenuis*, and *Cladosporium herbarum*) were measured by the radioallergosorbent test (Wide, Bennich & Johansson, 1967) (RAST, Pharmacia GB Ltd.). In addition the possibility of false positive RAST results was checked by using insolubilized human serum albumin instead of a specific allergen. Results were expressed on a score system 0,1,2,3,4, where 2 or more was regarded as positive.

Results

Urban community

Asthmatics had significantly higher total IgE levels (799 u/ml) than the non-allergic controls (350 u/ml). When sera were screened by RAST 72.5% of asthmatics were positive to *D. farinae* compared with 3.1% of controls, but only 7.5% were positive

Table 1. The frequency distribution of RAST scores among an urban population of 80 asthmatics and 65 control subjects

Allergen tested	Asthmatics' RAST scores					Controls' RAST scores				
	0	1	2	3	4	0	1	2	3	4
<i>D. Pteronyssinus</i>	16	1	5	37	21	—	—	—	—	—
<i>D. Farinae</i>	20	2	12	45	1	59	4	1	1	0
Bermuda grass	74	2	4	0	0	56	6	3	0	0
Meadow grass	73	3	4	0	0	57	4	4	0	0
<i>A. fumigatus</i>	80	0	0	0	0	65	0	0	0	0
<i>Alternaria tenuis</i>	80	0	0	0	0	65	0	0	0	0
<i>Cladosporium herbarum</i>	80	0	0	0	0	65	0	0	0	0

to grasses compared with 7.7% of controls, while mould tests were negative for both groups. The distribution of RAST scores is summarized in Table 1: *D. pteronyssinus* was obviously a more potent allergen than *D. farinae* (78.7% positives).

Rural community

This group (100 subjects) had a significantly higher mean IgE level (1613 u/ml) than the urban asthmatics. Positive RAST scores were commonly found, thirty-five of the villagers being positive to grasses and nine to mites, but none to human serum albumin, i.e. no false positives. The distribution of RAST scores among the rural population is shown in Table 2, and in six subjects IgE antibodies to both grass and mite were identified. The mean IgE level (2694 u/ml) of the RAST positive subjects was significantly greater than the RAST negatives (1178 u/ml).

Table 2. The frequency distribution of RAST scores among a rural community (n = 100)

Allergen tested	RAST scores				
	0	1	2	3	4
<i>D. farinae</i>	82	9	6	3	0
Bermuda grass	73	12	15	0	0
Meadow grass	53	13	25	9	0

Discussion

This study has confirmed: (a) that asthma is a problem among the urban populations of African countries (Anim & Edoo, 1972; Buchanan & Jones, 1974; Godfrey, 1975; Warrell *et al.*, 1975), about 0.5% of the Salisbury population being asthmatic, (b) that asthma is a rare occurrence among rural Africans (Godfrey, 1975), and (c) that the IgE levels of asthmatics are significantly higher than urban controls, yet significantly lower than the rural population (Godfrey, 1975).

In addition it has shown that normal, i.e. non-allergic, rural Africans have measurable circulating levels of grass and mite specific IgE antibodies. This suggests that the change from a rural to an urban environment results in an increased susceptibility to allergy, and it is to be noted that although asthmatics have lower IgE levels than villagers a higher proportion of their IgE is allergen-specific. A parallel can be drawn with African and Asian immigrants to Great Britain, many of whom become hypersensitive to either grass pollen or *D. pteronyssinus*.

It has been proposed that parasites may prevent allergic symptoms (Preston, 1970; Stanworth, 1971; Bazara, Orgel & Hamburger, 1973), because mast cells would be saturated with parasitic IgE and insufficient allergen-specific IgE could be attached to concentrate the allergen on the cell surface and thus trigger the release of vasoactive amines (Ishizaka *et al.*, 1970). Our data support this hypothesis and suggest mast cell saturation by either non-specific IgE or a fragment thereof (Hamburger, 1975) as a treatment for allergic diseases.

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