

Asthma, IgE and environment in northern Nigeria

**J. T. MACFARLANE,* MARGUERITE BACHELOR, J. B. RIDYARD
and P. A. J. BALL**

*Department of Medicine, Ahmadu Bello University Teaching Hospital,
Zaria, Nigeria*

(Received 29 November 1978; accepted for publication 5 December 1978)

Summary

Sixty-four asthmatics and seventy-five control subjects from rural villages and various urban settings have been investigated. Rural asthmatics had a significantly higher IgE level than both urban asthmatics and village controls. Urban asthmatics had similar IgE levels to urban controls. There was no relationship between IgE levels and the results of skin tests for asthma allergens. Stool parasites were found as frequently in asthmatics as in controls. Our findings do not support the theory that parasitic infestation, high IgE levels or rural living protect from asthma.

Introduction

It has been suggested that high serum IgE levels due to parasitic infection protect the individual from asthma and atopic disease (*Anon.*, 1976) and that stimulation of IgE by parasitic antigen might be effective in preventing asthma (Godfrey, 1975; Stanworth, 1971).

Studies from Africa showing asthma to be rare in the rural setting where parasite exposure is high (Stanworth, 1971; Merrett, Merrett & Cookson, 1976) support this hypothesis.

However, IgE measurement in African asthmatics and non-allergic controls have produced conflicting findings. Asthmatics have been found to have lower serum IgE levels (Warrell *et al.*, 1975), significantly higher levels (Merrett, Merrett & Cookson, 1976), or similar IgE levels to controls (Godfrey, 1975; Carswell, Meakins & Harland, 1976).

We have studied the relationship of habitat, atopy, serum IgE and parasites in patients attending an asthma clinic in Zaria, northern Nigeria, using as controls unrelated people living in the same household as the patients.

* Present address and correspondence: Room 16, Nuffield Department of Medicine, Radcliffe Infirmary, Oxford.

Methods

Habitat and people

The asthma clinic of Ahmadu Bello University Teaching Hospital (ABUTH) in Zaria, northern Nigeria, serves several distinct areas. These include the large, modern, Western-style university and administration site, the cramped, severely over-crowded new town areas, the relatively spacious, traditional, old, walled city, and the many small villages out in the bush, separate from Zaria town.

Adult patients attending the ABUTH asthma clinic were interviewed, together with at least one non-related adult member of their household to act as a control. Sixty-four asthmatics and seventy-five controls were seen over a single 10-week period. All asthmatics gave a convincing history of variable airways disease. In fifty-seven patients a variation of peak expiratory flow (PEF) of greater than 15% was documented and a further seven patients had noted a subjective improvement of their asthmatic symptoms with bronchodilators, although this had not been recorded during clinic attendances. The mean age of asthmatics was 31 (± 11 s.d.) and that of the controls 29 (± 10.3 s.d.). Males constituted 56% of the asthmatic group and 47% of the control group. There was no evidence of asthma in the controls.

A detailed social and clinical history was taken from both patients and controls. A senior medical social worker (M.B.), who did not know the clinical or laboratory findings of the subjects, analysed the completed personal and social questionnaires and placed the asthmatics into four groups:

- (a) senior staff group comprising ten professional university and government employees;
- (b) thirty-one subjects living in the new town settlements (thirteen junior government employees, sixteen traders, two students);
- (c) nine inhabitants of the traditional, old, walled city (three farmers, two junior government employees, four traders);
- (d) fourteen village dwellers, living in small villages completely separate from Zaria town (thirteen farmers, one junior government employee).

Standards of education and living conditions varied from being highest in group (a) to lowest in group (d). Age and sex of asthmatics and controls were comparable within each of these subgroups.

Stools

Single fresh stool specimens were collected from thirty-two patients and their controls and were examined for ova of parasites by the Stoll dilution technique (Stoll & Hausheer, 1926). The coded samples were examined by one observer (P.A.J.B.), who did not know their origin.

Skin tests

Immediate hypersensitivity prick tests were performed with twelve antigens and a negative control (Bencard); responses of more than 2 mm greater than control were regarded as positive.

IgE

Blood was collected from all subjects and serum stored at -20° . The total serum IgE

was measured using the radioimmunosorbent method (Phadebas kits, Pharmacia). IgE levels are quoted as geometric means and statistical analysis was performed by Wilcoxon's rank sum test.

Results

Asthma, environment and total IgE

Asthmatics came from all four habitat areas, and fourteen (22%) lived in an entirely rural village setting (Table 1). The village asthmatics had higher serum IgE levels than all three urban asthmatic groups, only the difference from the old Zaria city group not being significant.

There was no difference between the IgE levels of asthmatics and their controls for the three urban groups, but the village asthmatics had significantly higher IgE levels than their controls. This was more marked for the seven male village asthmatics, whose mean IgE level (6260 u/ml) was significantly greater ($P < 0.05$) than the seven female village asthmatics (1420 u/ml). However, there was no significant overall difference between male and female IgE levels for all asthmatics (male IgE 2180 u/ml; female IgE 1400 u/ml) or for the village controls (male IgE 1230 u/ml; female IgE 1710 u/ml).

Skin tests

The proportion and type of positive skin tests in asthmatics and controls were very similar to that reported previously from this region (Warrell *et al.*, 1975). Fifty (80%) of the asthmatics and thirty-nine (53%) of the controls showed one or more positive reactions. There was no correlation between IgE level and the results of positive skin tests in controls or asthmatics and no trend for prick test results to vary with environment. There was no significant difference in mean IgE between controls with positive skin tests (IgE 1490 u/ml) and those without (IgE 980 u/ml).

Table 1. Serum IgE levels in asthmatics and controls (geometric mean u/ml)

	Asthmatics	Controls
All subjects	1620 ($n=64$)	1520 ($n=75$)
Senior staff group	1220 ($n=10$)	1370 ($n=12$)
New town group	1460 ($n=31$)	1840 ($n=34$)
Old city group	1260 ($n=9$)	1090 ($n=11$)
Rural village group	2980 ($n=14$)	1410 ($n=17$)

Both senior staff and new town asthmatic IgE levels were significantly less than village asthmatics ($P < 0.025$). Village asthmatic IgE levels were significantly greater than village controls ($P < 0.05$).

Table 2. IgE levels of subjects with or without parasites in the stool (geometric mean u/ml)

	Asthmatics	Controls
IgE level in stool-positives	1590 (<i>n</i> = 11)	2240 (<i>n</i> = 12)
IgE level in stool-negatives	1550 (<i>n</i> = 21)	700 (<i>n</i> = 18)

IgE levels in stool positives versus stool-negatives in the control group were significantly different ($P < 0.025$).

The proportion of parasitized asthmatics and controls was not significantly different (χ^2 test).

Stool examination

Table 2 shows that parasites were found with comparable frequency in asthmatics and controls. Unlike the asthmatic group, the controls with parasites had a significantly higher IgE than controls with no parasites, as Johannsson, Melbin & Vahlquist (1968) found in Ethiopia. There was no relationship between atopy and parasites in either group.

Discussion

This study shows that adult rural Africans do have asthma in spite of having significantly higher IgE levels than urban asthmatics from varying social classes. Recently Carswell *et al.* (1977) have also reported finding asthmatics amongst a group of rural schoolchildren in East Africa. We found no difference in demonstrable parasites in the asthmatics and their control group, as noted before (Warrell *et al.*, 1975; Carswell, 1977). Thus neither rural life, parasitic infection nor high IgE levels are incompatible with having asthma.

It has previously been suggested from Prausnitz-Küstner testing of patients with high IgE (Bazaral, Orgel & Hamburger, 1973) that no atopic allergy should exist in individuals infected with parasites. However, we found no inverse relationship between skin test atopy and either IgE levels or the presence of parasites in asthmatics and controls.

We were unable to show any difference in the IgE levels between urban asthmatics and their controls, in agreement with findings from the Gambia (Godfrey, 1975). The selection of our controls perhaps explains why our findings differ from those in a previous study from Zaria in which asthmatics were found to have a lower IgE than controls (Warrell *et al.*, 1975). As in that study, some of our controls had positive skin tests, perhaps related to prolonged exposure to allergens, a situation known to cause sensitization in non-atopic subjects (Frankland, 1953). However, the presence of positive skin tests in our non-asthmatic controls did not significantly affect their IgE levels, and therefore did not invalidate their use as controls.

Rural asthmatics had significantly higher IgE levels than their controls, a finding reported also from the highlands of New Guinea (Turner, Baldo & Anderson, 1975). This was particularly the case for men and a similar trend has been noted in Tanzania (Carswell *et al.*, 1977). While male farmers are probably more frequently exposed to

parasites, particularly hookworm, than their womenfolk, who are largely confined by custom to their compounds, we found no difference in serum IgE between the sexes in the rural subjects who were not asthmatic. Thus something other than the direct effect of parasites on IgE production (Johansson *et al.*, 1968) may have contributed to the high levels in our rural asthmatics. One possible mechanism might be the adjuvant-like effect which can, under certain circumstances, be exerted by parasitic infection on the reaginic response to other antigens (Orr, Riley & Doe, 1971; Jarrett & Bazin, 1974).

In fact this suggests that proposed treatment of allergic disorders by IgE stimulation with parasitic antigen (Godfrey, 1975; Stanworth, 1971) may be positively harmful (Augustin, 1976) and our findings do not support the hypothesis that high IgE levels from parasitic infestation protect against asthma.

Acknowledgments

We wish to thank the medical interpreters of the asthma clinic for assisting in this study, Mrs R. M. Macfarlane for her help in performing skin tests and Drs B. M. Greenwood and D. A. Warrell for their advice. Financial support was given by the Medical Research Council.

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