

Research Letter

Antibody Responses and Resistance against Ascaris lumbricoides Infection among Venezuelan Rural Children: The Influence of Ethnicity

Summary

We studied the production of anti parasite antibodies and the resistance against *A. lumbricoides* infection among the school population of three different Venezuelan ethnic groups: Warao Amerindians, Afro- Americans and white 'Creole' descendants. The prevalence and intensity of *A. lumbricoides* were determined before and after 1 year of anthelmintic treatment. Parasitic loads were associated to pre-treatment serum levels of anti *A. lumbricoides* IgE and IgG4 antibodies. The intensity of the infection and the proportion of re-infected children were significantly lower ($p < 0.0001$) among the Warao Amerindians, exhibiting higher levels of IgE ($p < 0.0001$) and lower levels of IgG4 ($p < 0.0001$) compared to their non-Amerindian counterparts. IgE levels correlated inversely with the proportion of re-infected children, whereas the levels of IgG4 were positively associated. These results suggest that ethnicity may influence the balance of IgE/IgG4 levels, modulating the intensity of *A. lumbricoides* and the resistance to the infection.

Introduction

An atopic condition may favor the production of elevated levels of anti *A. lumbricoides* IgE, conferring protection against this parasite in rural children [1], whereas elevated anti- parasite IgG4 levels have been associated to high parasitic loads and persistence of the infection [2]. We studied whether differences in ethnicity among distinct groups of rural children would affect the production of these antibodies and their effectiveness on protection against this infection.

Material and Methods

We evaluated 401 school children belonging to three well-defined ethnic groups [3]: Warao Amerindians from the Delta of the Orinoco River, Afro-Americans from the Central coast and white 'Creole' from the Venezuelan Andes. The groups shared similar socio-economic conditions and

comparable prevalence of *A. lumbricoides* (Table 1). Stool examinations were performed by the Kato-Katz technique before and 6 months after 1 year of bi-monthly treatment with Albendazole (400 mg in single dose). Parasitic loads were associated to pre-treatment levels of IgE and IgG4 against *A. lumbricoides* antigens determined by an ELISA assay [4]. Statistical analysis was done by Graph-pad Instat 3 Software.

Results

The intensity of the infection and the proportion of re-infected children were significantly lower ($p < 0.0001$) among the Warao Amerindians, exhibiting higher levels of IgE ($p < 0.0001$) and lower levels of IgG4 ($p < 0.0001$) compared to their non-Amerindian counterparts (Table 1). IgE levels correlated inversely with the intensity of the infection (Spearman $r: -0.673; p < 0.0001$) and the proportion of re-infected children (Spearman $r: -0.563; p < 0.0001$), whereas the levels of IgG4 were positively associated to the increase in these parameters ($r: 0.691; p < 0.0001$ and $r: 0.582; p < 0.0001$, respectively).

Discussion

A genetic background in the stimulation of high IgE levels has been reported among different populations of tropical ancestry including Amerindians [5] and African descendants [6]. This situation may represent an efficient strategy to fight helminthic infections. However, differences in life style among distinct ethnic groups may modulate the development of such immune responses. For example, the Warao people constitute small nomad fishing communities living in wood houses built at the border of the Orinoco River, placing the children in less contact with soil transmitted parasites thus leading to a mild or seasonal pattern of infection. This condition may favor their capacity to produce IgE [7], protecting them against re-infection. In contrast, children living in tropical mainland farms are subject to different environmental conditions favoring chronic exposure to these parasites, which may promote a more tolerant profile characterized by high levels of blocking IgG4 antibodies, limiting immunopathology driven by IgE dependent mechanisms [8] but allowing continuous re-infection. Nevertheless, the link between different genetic components and the resistance to this infection has not been elucidated and would be an important subject of following investigations.

TABLE 1
Socioeconomic conditions A. lumbricoides infection and antibody levels in different groups of Venezuelan rural children

	Creole (145)	Afro-American (170)	Warao Amerindian (115)	Statistical significance (95% CI)	Statistical significance ^a (95% CI)
Percentage of children without sanitary facilities and access to tap water	65	72	68	$\rho = 0.2946$ (0.875–1.655)	$\rho = 0.505$ (0.599–1.275)
Prevalence of <i>A. lumbricoides</i>	69	70	68	$\rho = 0.4046$ (0.636–1.188)	$\rho = 0.697$ (0.532–0.673)
Geometric mean No. eggs/gr faeces (geometric mean + 1SD)	6750 (13 600)	8700 (16 500)	2120 (4380)	Welch <i>t</i> -test: 2.11 $p = 0.036$ (0.005–0.16)	Welch <i>t</i> -test: 4.93 $p < 0.0001$ (–0.26 to –0.11)
Percentage of <i>A. lumbricoides</i> re-infected children after anti-helminthic treatment	45	48	21	$p = 0.572$ (0.729–1.182)	$p < 0.0001$ (1.273–1.914)
Median anti <i>A. lumbricoides</i> IgE Levels (ODU) (25th percentile–75th percentile)	0.305 (0.200–0.532)	0.273 (0.221–0.358)	0.705 (0.546–1.125)	Mann Whitney U: 13 729 $p = 0.6671$	Mann Whitney U: 997.5 $p < 0.0001$
Median anti <i>A. lumbricoides</i> IgG4Levels (ODU) (25th percentile–75th percentile)	0.768 (0.423–1.98)	0.592 (0.305–1.092)	0.23 (0.085–0.632)	Mann Whitney U: 13 118 $p = 0.6671$	Mann Whitney U: 9633.0 $p < 0.0001$

^aStatistical significance between the Warao Children and the non-Amerindian groups.

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