Abstract

Objective: to assess the relation between children with asthma and ascariasis in the low income neighborhood of Pedregal, in Campina Grande (Paraíba, Brazil).

Material and Method: the International Study of Asthma and Allergies in Childhood (ISSAC) standard questionnaire was distributed to 1,095 children but only 742 of them answered it and provided stool samples for parasite examination. The cross-sectional study included those 742 children, whose age ranged from 2 to 10 years. The association between asthma and ascariasis was studied through Kappa rating. Demographic and clinic variants comparing the two groups were analyzed by chi-square test ($\chi^2$) or Student test.

Results: among the 742 children analyzed, 51.9% (385) were males and 48.1% (357) females. The prevalence of asthma was 59.7% (443) and that of ascariasis was 56.3% (418). The frequency of asthma in the ascariasis group (60.5%) was similar ($\chi^2 = 0.27, p > 0.06$) to the frequency of asthma in the non-infected group (58.6%).

Conclusion: despite the high prevalence of the diseases studied, there is no apparent relation between asthma and ascariasis in the population studied.


Introduction

Asthma is a very frequent chronic disease among children, interpreted as episodes of pulmonary wheezing, and it is becoming increasingly serious in many countries worldwide. It is well known that genetics is the strongest risk factor, but many others participate, such as environmental factors, nutritional habits, tobacco use, industrialization and increased pollution in large cities. The prevalence of asthma in Brazil has been studied, using the “International Study of Asthma and Allergies in Childhood” (ISAAC) standardized questionnaire. Among children from Recife, Salvador, São Paulo, Curitiba and Porto Alegre the prevalence of “ever had wheezing or whistling” varied from 39.0% to 47.0%.

Ascaris is one of the most common parasites in Brazil, especially in rural areas where prevalence has been observed of 74.8% and 75.2%, by Lucena & Magalhães Neto and Pereira et al. respectively in Pernambuco. In another population, from Campina Grande, with similar social
characteristics, Pereira et al. found an ascariasis prevalence of 54.2%. Also in Northeast Brazil, in the large cities (Recife), with the chaotic settlement of the suburbs, with no basic sanitary infrastructure, it is believed that there is a significant increase in intestinal parasites, with prevalence of 56% to 76.8%.

The possible association between asthma and ascariasis, was proposed by Lynch et al. (1998), studying two groups of children from the same socio-economic level and with equal exposure to intestinal worms, differing only in the prevalence of asthma. Despite equal living condition, the intensity of parasitic infection was greater among the non-allergic children. In earlier work it had been observed that in areas of endemic ascariasis and after anthelmintic treatment, there was a reduction in total IgE and IL-4 serum levels, in contrast with increased specific IgE serum levels and cutaneous reactivity among allergic people.

Despite the medical and social relevance of asthma and ascariasis, no other study of a population of Brazilian children was found which revealed whether or not there is an association between these two health problems. In Campina Grande (Paraíba State), the elevated frequencies of these complaints motivated the study of the association between asthma and ascariasis which is described in literature.

Material and Methods

The population studied was made up of children of between 2 and 10 years of age resident in the district of Pedregal, in the town of Campina Grande (Paraíba). According to data provided by the Municipal Health Secretary 2,655 are registered with the Family Health Program (PSF - Programa de Saúde da Família), and the population is estimated at 10,706 inhabitants. Of this total it is estimated that children of the age group from 2 to 10 years make up 14.9% (n = 1,600) of the residents.

The work began on 1 July and concluded on 30 October of 2001. The standardized ISAAC questionnaire (asthma module) was used to identify possible asthmatics. It was completed by the legal guardians of 1,095 children during a home visit when recipients for the collection of stools were delivered. Before the ISAAC standardized questionnaire was filled in the Free and Informed Consent form was read and explained until there were no further doubts on the part of the guardian. Seven hundred and forty-two (67.8%) children were included who had submitted fecal samples for the performance of the parasitological exam at the Clinical pathology Laboratory of the Hospital Universitário Alcides Carneiro (HUAC) of the Universidade Federal da Paraíba (Campina Grande, PB). Three hundred and fifty-three (32.2%) children were lost due to the closure of the collection point in their district or because they did not submit fecal specimens for the parasitological tests. The technician responsible for the parasitological tests did not know to which group the child belonged (asthma or non-asthma).

The standardized ISAAC questionnaire was applied to assess the prevalence of asthma and its symptoms, with asthma carriers being defined as those children presenting sibilance at some period in their lives. In testing for Ascaris lumbricoides eggs in stools the spontaneous sedimentation method of Lutz, Hoffman, Pons and Janner was used. All of the children who had nematode eggs were treated with mebendazole (100 mg, 2x per day, for three days), as were those diagnosed as carriers of other intestinal parasites.

For the statistical analysis of the variables evaluated (sex, age, family income, family history of atopic diseases, diagnosis of asthma and of Ascariasis) SPSS (Statistical Package for Social Sciences) version 9.0 for Windows software was used. For analysis of agreement (association) between diagnoses of asthma and of infection by A. lumbricoides the Kappa index was applied. For the analysis of the remaining variables, depending on their type, the chi-square ($\chi^2$) test or the Student t test for paired samples were applied. When interpreting the statistical tests, statistical significance was assumed if the probability (p) of type I error ($\alpha$) was equal to or less than 5.0% ($p \leq 0.05$).

Results

The average age of the 742 children was 5.6 ± 2.7 years, and 51.9% (n = 385) were male and 48.1% (n = 357) female. As Table 1 illustrates, the predominant age group (32.1%) was from 8 to 10 years and the majority (56.5%) had a monthly income of one (1) minimum salary.

The observed prevalence of ascariasis was 56.3% (418/742) and of asthma 59.7% (443/742). For the group of children originally included in the study (n = 1,095), the frequency of asthma was 60.5% (663/1,095) and among those later excluded 62.3% (220/353), but these differences were not statistically significant ($\chi^2 = 0.69; p > 0.70; g.1=1$).

Table 1 also illustrates, for each group, the results of the ISAAC questionnaire (with or without asthma), and that the distribution of ascariasis did not differ (p > 0.28) with respect to the sex of the children, average age, age group or family income. However, in the group without asthma, the girls with ascariasis (60.1%) were more frequent than the boys (49.3%), although this difference was on the limit of statistical significance (p = 0.06).

With respect of asthma and its symptoms, as table 1 shows, the frequency of “ever had wheezing or whistling at any time in the past” was 59.7% (443/742); “wheezing or whistling in the last 12 months” was 34.8% (258/742); for “number of crises”, 13.7% (101/742) presented more than 12 crises in a year; 31.0% (229/742) had “difficulty speaking”; 29.4% (218/742) experienced “wheezing after exercise” and 62.7% (465/742) had a “nocturnal cough”.

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These symptoms did not differ statistically (p > 0.20), between the groups with or without ascariasis.

Comparing the agreement (52.2%; 387/742) of diagnoses of asthma and ascariasis (253 children) and of absence of both (134 children), with the disagreement (47.8%; 355/742) of the diagnoses (165 children with ascariasis and without asthma; and 190 with asthma and without Ascaris), the Kappa index was 0.019 - which is within the limits of weak or very low agreement (k 0.0 to 0.20).

Analyzing the history of allergy in families (Table 3), the frequencies for parents, grandparents and uncles and aunts with a similar history did not differ (p > 0.07) between the groups of children with or without asthma. However, children with asthma presented frequencies significantly (p < 0.0001) greater (68.2%) of siblings with histories of allergy, when compared with the frequency (31.8%) of those without.

**Discussion**

Asthma and ascariasis are considered frequent complaints all over the world. In Brazil, where socio-economic conditions interfere, directly, in the quality of life of people, exposing them to all types of risk and exacerbating, ever more, poverty and a two-tier society, the elevated prevalence (56.3%) of ascariasis in the community of the district of Pedregal, may be another indicator of the precarious social and sanitary conditions. Furthermore, this prevalence is greater than those found in Curitiba (42.7%)\(^9\) and Salvador (31.2%)\(^10\) and also in an earlier study performed in Campina Grande (54.2%).\(^11\)

In contrast, asthma is studied throughout the world as a result, not just of its elevated prevalence, but also because it is very common among the child populations of developed countries.\(^15\) In Brazil, the prevalence of asthma in children from other Brazilian cities (Porto Alegre, Curitiba, São Paulo, Uberlândia, Itabira e Recife)\(^16\) was less than 50%, with the highest figure being for São Paulo 49.3%.\(^16\) This, therefore, proves that the observed prevalence (59.7%) of asthma among the children of the district of Pedregal (Campina Grande, Paraíba), in addition to being elevated, affects a population which is extremely vulnerable to other complaints and which has difficulty accessing health services.

Both ascariasis and asthma, among the children studied, presented homogenous distribution with relation the variables studied; i.e. there was no significant difference between the frequencies of the two complaints studied in terms of sex, age and socio-economic level as expressed by
Despite this there are reports in extant literature which describe asthma as more frequent among boys,\textsuperscript{12} predominating between 6 and 7 years of age\textsuperscript{13} and among more deprived families or low income families.\textsuperscript{14,15}

In this manner, the non-observance of a greater frequency of ascariasis among older male children from lower income families induces the speculation that the risks of infection by \textit{A. lumbricoides} are common in both domestic and extra-domestic environments in the district of Pedregal, where sanitary conditions are those of localities with indicators of a low level of human development. This is because, if ascariasis were to predominate among older boys from lower income families it could be explained by these characteristics being those which facilitate a greater exposure to extra-domestic environmental factors, where environmental pollution is usual, and, consequently, contamination by larvae of \textit{A. lumbricoides}. However, the homogenous nature of the population studied also denounces

### Table 2 - Symptoms associated with asthma in the children living in the neighborhood of Pedregal, in Campina Grande (PB), distributed according to the presence of ascariasis

<table>
<thead>
<tr>
<th>ISSAC Questionnaire</th>
<th>Ascariaisa</th>
<th>Yes (n) (%)</th>
<th>No (n) (%)</th>
<th>Total (n) (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>One wheezing episode</td>
<td>Yes</td>
<td>253 (57.1)</td>
<td>190 (42.9)</td>
<td>443 (59.7)</td>
<td>&gt; 0.60*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>165 (55.2)</td>
<td>134 (44.8)</td>
<td>299 (40.3)</td>
<td></td>
</tr>
<tr>
<td>Wheezing episodes in the last year</td>
<td>Yes</td>
<td>143 (55.4)</td>
<td>115 (44.6)</td>
<td>258 (34.8)</td>
<td>&gt; 0.71*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>275 (56.8)</td>
<td>209 (43.2)</td>
<td>484 (65.2)</td>
<td></td>
</tr>
<tr>
<td>12 crises in one year</td>
<td>Yes</td>
<td>51 (50.4)</td>
<td>50 (49.6)</td>
<td>101 (13.6)</td>
<td>&gt; 0.20*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>367 (57.3)</td>
<td>274 (42.7)</td>
<td>641 (86.4)</td>
<td></td>
</tr>
<tr>
<td>Speaking difficulty</td>
<td>Yes</td>
<td>125 (54.6)</td>
<td>104 (45.4)</td>
<td>229 (31.0)</td>
<td>&gt; 0.52*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>293 (57.1)</td>
<td>220 (42.9)</td>
<td>513 (69.0)</td>
<td></td>
</tr>
<tr>
<td>Wheezing after exercise</td>
<td>Yes</td>
<td>117 (53.7)</td>
<td>101 (46.3)</td>
<td>218 (29.4)</td>
<td>&gt; 0.34*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>301 (57.5)</td>
<td>223 (42.5)</td>
<td>524 (70.6)</td>
<td></td>
</tr>
<tr>
<td>Nocturnal cough</td>
<td>Yes</td>
<td>154 (33.1)</td>
<td>123 (26.5)</td>
<td>465 (62.7)</td>
<td>&gt; 0.75*</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>264 (95.3)</td>
<td>201 (72.6)</td>
<td>277 (37.3)</td>
<td></td>
</tr>
</tbody>
</table>

* Chi-square.

### Table 3 - Distribution of family history of allergy in relatives of children living in the neighborhood of Pedregal, in Campina Grande (PB)

<table>
<thead>
<tr>
<th>Allergy history</th>
<th>Asthma in the child</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (n) (%)</td>
</tr>
<tr>
<td>Father</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Mother</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Siblings</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Grandparents</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Uncles and aunts</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>

* Chi-square.
the equal chances of infection by *A. lumbricoides* and even the uniformity of the lack of access to public services and other goods and services.

Coincidentally, the elevated frequency of symptoms associated with asthma observed among the children of the district of Pedregal, are also common in localities with hot climates that are humid and have indicators of low socio-economic level, where a great number of environmental risk factors are present.\(^4\) In such areas the disorganized manner by which urbanization is achieved means that urban agglomerates grow in a chaotic way with highly vulnerable physical infrastructure, habitations and services.\(^19\) In such environments, gastro-intestinal infections (parasitical, bacterial and viral) are considered by some authors,\(^17\) to be factors protective of the Th1 immunoresponse and, consequently, function as regulatory mechanisms resulting in less occurrences of asthma among the population exposed to them.

Notwithstanding, this does not apparently occur with the children studied, because, in addition to the elevated percentage of asthma cases, parasitical infectious diseases are common, and, even more so, the conditions associated with human poverty are the greatest factors predisposing these children towards health problems, very probably, since the prenatal period.

In agreement with the assumption that factors which result in a predisposition to childhood asthma are equally distributed throughout the community studied, there was a significant association of cases among those with siblings also suffering from atopic diseases, including asthma, in contrast with descriptions by Moraes et al.\(^18\) However, this same association was not observed among adult relatives (parents, grandparents, uncles and aunts) which, independent of genetic and familial factors, could be explained to a certain extent by the different type and intensity of the environmental exposure, among other factors, normal for each age group.\(^14,17,18\)

Under these conditions, it would even be surprising to observe greater occurrence of asthma cases amongst those who are also suffering from ascariasis, as described by other authors.\(^6,7\) As a multifactorial disease, asthma is triggered or encouraged by many different aeroallergens, bacterial and viral infections, and other environmental and genetic factors.\(^2\) Therefore, to estimate which environmental factors are most associated with asthma would require a well-planned cohort study, made up of different groups according to type of exposure, in an attempt to explain the best model for the disease. Even thus, the peculiarities and multiplicity of environmental factors including those that are local or regional, and also the diversity of the genetic constitution of human populations, make this type of study practically impossible to perform, even if available resources were unlimited. As this is the case, and assuming that it is also the case for infection by *A. lumbricoides* which occurs continuously with variable intensity, having favorable economic conditions, other study models, with the exception of transverse ones, suffer from serious restrictions in terms of the possibility of their being executed, especially if sample size, the necessary adherence and the number of parasitological tests necessary to increase the sensitivity of Ascaris diagnosis are all taken into account. In this study, for example, even though it was based upon a single fecal sample and counted on the active participation of the Pedregal district Family Health Unit teams, approximately a third (32.2%) of the children were not included in the study because either they did not submit a fecal sample, or they did so immediately before the collection post was closed in the Pedregal district. Despite this, according to populational data obtained, more than 50% of the target population was evaluated.

In conclusion, despite the lack of evidence for an association between asthma and ascariasis among the children studied, the elevated observed prevalence of these complaints indicate the necessity for the adoption of urgent sanitary measures and of programs for the promotion of health and for the prevention of diseases, which not only fall to all three levels of government but must also be necessary for a great number of other, similar populations in Brazil, especially in the North and Northeast.

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References


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