

Prevalence of Symptoms of Asthma and Allergies in Schoolchildren in Gondar Town and Its Vicinity, Northwest Ethiopia

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Summary. A low level of allergic disorders has been generally reported in children from developing countries. A survey was conducted to determine the prevalence of symptoms of asthma and allergies among schoolchildren in Gondar, northwest Ethiopia. A standardized self-administered questionnaire developed by the International Study of Asthma and Allergies in Children (ISAAC) was used. In total, 3,365 children aged 13–14 years were surveyed at school, with a response rate of 98.4%. The female to male ratio was 1.5:1. The 12-month-period prevalences of wheeze (16.2%), rhino-conjunctivitis (14.5%), and eczema (10.9%) were comparable to findings from Addis Ababa, but significantly higher than reported from Jimma. A striking seasonal pattern of rhinitis symptoms is observed during the months of September–December with a peak in November, corresponding with the main pollen season of the area. Overall, about 36% of the children reported symptoms of atopic disorders. However, the prevalence of diagnosed atopic diseases (8.6%) is less than a quarter of the symptom prevalence rate. This may reflect a generally poor awareness and low health service utilization, or underdiagnosis by health facilities. In conclusion, it appears that the prevalence of atopic diseases in Gondar area is high, and there is also wide variation within the country. This calls for further epidemiological studies with more objective assessments of atopy, such as allergen and bronchial hyperresponsiveness tests and ecological analysis. **Pediatr Pulmonol.** 2003; 35:427–432. © 2003 Wiley-Liss, Inc.

Key words: asthma; child; allergy; Africa.

INTRODUCTION

There is great geographical variation in the prevalence of childhood wheeze and asthma among and within countries.¹ The reported prevalence of wheezing illness in Western countries varies from as low as 5% in Sweden² to as high as 25–30% in Australia and New Zealand.³ Asthma and other allergic diseases are reported to be rare in poor countries, and to become more common as lifestyles become more urbanized and “Western.”⁴ Figures from developing countries also show wide variation: 0.007% in Papua New Guinea, 3.3% in rural Tanzania, 9.8% in urban Abidjan, 11.4% in Nairobi, and 20% in the Maldives.^{5–9}

There is very limited information on asthma in Ethiopia. Yemaneberhan et al.¹⁰ reported a 3.6% and 1.3% prevalence of asthma in urban and rural Jimma, respectively. All respiratory symptoms were rare in children, and significantly less common in the rural community.¹⁰ Rosenberg et al. reported asthma rates of 2.5% among Ethiopian Jews at the time of immigration to Israel, with an increase to

about 17% (three times the rate of 5.8% in the general population) after 8–17 years in their new country.¹¹

There is considerable concern that the prevalence of asthma and other allergic diseases is increasing in

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Western and developing countries.^{5–7} Despite considerable research, the etiology of asthma and allergic diseases remains poorly understood. Thus, the International Study of Asthma and Allergies in Childhood (ISAAC) was founded in 1991 to facilitate multicenter studies using a standardized protocol. The objective of the ISAAC phase I study was to determine the prevalence and severity of asthma, rhinitis, and eczema in schoolchildren, using a self-administered standardized questionnaire.¹

Estimates of the prevalence of hay fever in surveys from different countries vary between 0.5–28% for children, and between 0.5–15% for adults.¹²

Little was known about the global epidemiology of atopic dermatitis, and surveys from European countries suggest that around 10–20% of children in developed countries suffer from eczema.¹³

This cross-sectional study was undertaken to determine the prevalence of asthma and allergies in schoolchildren in Gondar town and its environs. This type of epidemiological study is a preliminary step in identifying important environmental risk factors, which could explain differences in the prevalence of these conditions.

METHODS

The study was conducted in January 1997 in Gondar town and its environs, northwest Ethiopia. A cross-sectional survey was conducted among 13–14-year-old schoolchildren in Gondar Town and four neighboring districts (Gondar Zuria, Dembia, Wegera, and Lai-Armachiho) to determine the prevalence of symptoms of asthma, rhino-conjunctivitis, and atopic eczema. Gondar is located 750 km north of the capital, Addis Ababa. It is a highland area lying 2,300 m above sea level, and has a temperate climate. There are seasonal rains (May–September). Even in Gondar Town, most people live in mud-walled houses with thatch or tin roofs, open solid-fuel cooking, and abundant domestic animals.

The study design was the ISAAC phase I protocol and was registered with the ISAAC Coordinating Centre (Auckland, New Zealand). This multicenter study required a sample size of 3,000 children in order to provide sufficient precision to detect a 2% difference of severe asthma between two centers, with a study power of 90% at a 99% significance level.^{1,14} Eight schools were chosen by simple random sampling from the 24 junior-secondary schools in the study area. Three of the selected schools were in Gondar, while the remaining five were out of Gondar Town. Instructions were given by the investigators before questionnaires were filled out. All 7th and 8th grade students in the selected schools and within the

specified age group self-completed the questionnaire, which had been translated into Amharic according to the stated guidelines of the ISAAC translation manual.¹⁴ Age was documented according to class registers, since exact birth dates were not known (registered) for the majority

The ISAAC questionnaire consists of standardized core questions on asthma, rhino-conjunctivitis, and atopic eczema. In relation to clinically confirmed asthma, the ISAAC questions had a sensitivity of 85%, specificity of 91%, and positive and negative predictive values of 61% and 94%, respectively.¹⁵ Wheezing during the previous 12 months was the main-stem question for asthma. This was followed by inquiries on the frequency of attacks, sleep disturbance, speech limitation during attacks, exercise-induced wheezing, nocturnal cough, and history of asthma. Questions pertaining to allergic rhino-conjunctivitis included sneezing, or a runny or blocked nose (in the absence of flu), and itchy-watery eyes in the last 12 months. The presence of an itchy, relapsing skin rash in the preceding 12 months that had affected the flexural areas was considered atopic eczema.¹⁴ Some sociodemographic variables were included. Ethical clearance was obtained from the Gondar College of Medical Sciences Ethics Committee. The consent of the children was implied by their completion of the questionnaires.

In total, 3,365 students participated in the study, with a response rate of 98.4%, and all the approached schools agreed to participate. The data thus collected were coded, entered, and analyzed using EPI-INFO version 6 software. Data were forwarded to the ISAAC sub-Saharan Africa Office (Nairobi, Kenya). Chi-square tests were used to evaluate differences between subsets of children.

RESULTS

Of 3,365 children aged 13 and 14 years who completed the questionnaire, there were 1,348 male and 2,017 female students, with a female to male ratio of 1.5:1. Of the respondents, 1,398 (41.5%) were 13 years old, while the remaining 1,967 (58.5%) were 14 years old. Five hundred forty-five children (16.2%) reported having wheeze during the preceding 12 months (current wheeze). Of those reporting current wheeze, 16.7% (91 of 545) also had current symptoms of other atopic diseases, leaving 83.3% reporting current wheeze alone. The majority of wheezing children had mild symptoms. One hundred and seventy-four (5.2% of the total population) had experienced four or more attacks of wheeze during the preceding 12 months, while 181 (5.4%) reported sleep disturbance 1 night or more per week. Speech disturbance due to wheeze was reported by 235 (6.9%) of schoolchildren. However, only 74 (2.2%) children claimed to have a label of bronchial asthma, and 27 (0.8%) had taken anti-asthma drugs in the past (Table 1). Both sexes were equally af-

ABBREVIATIONS

ISAAC International Study of Asthma and Allergies in Children

TABLE 1—Prevalence of Wheeze, Wheeze-Related Symptoms, and Diagnosed Asthma Among Schoolchildren in Gondar, Ethiopia (n = 3,365)

Details	Number	%
Wheeze		
In last 12 months	545	16.2
Not in last 12 months	162	4.8
Never	2,658	79.0
Number of wheezing attacks in last 12 months ¹		
1–3	371	11.0
4–12	95	2.8
>12	79	2.3
Sleep disturbed by wheeze in last 12 months ¹		
Not at all	182	5.4
Less than once per week	184	5.5
One or more nights per week	181	5.4
Speech-limiting wheeze in last 12 months ¹		
Yes	235	6.9
No	310	9.3
Diagnosed asthma		
Yes	74	2.2
No	3,291	97.8

¹Of those who reported wheeze in last 12 months.

fected. Exercise-induced wheeze was reported by 962 (28.6%) and nocturnal cough by 1,016 (30.2%) of the schoolchildren.

The 12-month prevalence of rhino-conjunctivitis in these children was 14.5% (488), while 5.1% (170) reported having seasonal hayfever. Moderate to severe interference with daily activities by rhinitis symptoms was reported by 5.3% (178) of respondents (Table 2). The highest reports of rhinitis symptoms were recorded during September–December, with a peak in November. Female sex ($P < 0.001$) was significantly associated with rhino-conjunctivitis symptoms.

Three hundred thirty-six children (10.9%) had a recurrent itchy rash involving the flexural areas in the preceding 12 months. Ninety children (2.7%) reported having eczema (Table 3). One hundred six (3.2%) children reported severe disease, which kept them awake at least 1

TABLE 2—Prevalence of Rhino-Conjunctivitis Symptoms, Their Severity, and Reported Hay Fever

Details	Number	%
Rhino-conjunctivitis symptoms in last 12 months		
Yes	488	14.5
No	2,877	85.5
Interference with daily activities		
Not at all	157	4.7
A little	153	4.5
A moderate amount	128	3.8
A lot	50	1.5
Reported having hay fever		
Yes	170	5.1
No	3,195	94.9

TABLE 3—Prevalence of Eczema Symptoms, Its Severity, and Reported Eczema

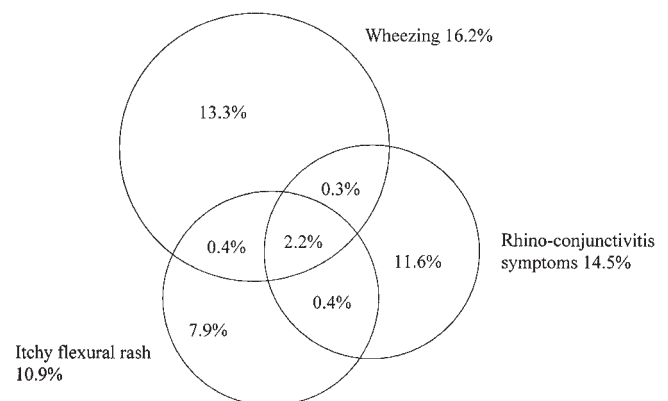
Details	Number	%
Recurrent itchy rash involving skin flexures in last 12 months		
Yes	366	10.9
No	2,999	89.1
Sleep disturbed by itch in last 12 months		
Never woken	128	3.8
Less than 1 night per week	132	3.9
One night or more per week	106	3.2
Reported eczema		
Yes	90	2.7
No	3,275	97.3

night per week. Female sex was significantly associated with eczema ($P < 0.05$).

Overall, 36% (1,214) children reported having one or more of the three main atopic symptoms in the last 12 months. The majority of the children (32.8%) had symptoms of a single disorder, with all the three symptoms reported by 2.2% of the children (Fig. 1). On the other hand, 288 children (8.6%) reported that they had been diagnosed as having an atopic disease, which accounted for only 23.7% of those reporting allergic symptoms.

DISCUSSION

This survey was conducted as part of the ISSAC multicenter study, and is the third of its kind in Ethiopia. Comparison of the findings of this study was made with the results of the various ISAAC centers, locally and globally. We documented a high prevalence of symptoms of asthma, rhino-conjunctivitis, and atopic eczema in schoolchildren aged 13–14 years. Overall, 36% of the surveyed children were found to have atopic disorders. This figure is higher than the ISAAC global report of 26.2%,¹⁶ but lower than reported from the UK (47.6%).¹³ The majority (90.9%) of symptomatic children reported symptoms of only a single

**Fig. 1. Twelve-month prevalence of symptoms of asthma, rhino-conjunctivitis, and atopic eczema in children in Gondar, Ethiopia (n = 3,365).**

atopic condition. Accordingly, the rate of symptom overlap (9.1%) was significantly lower than the ISAAC average of 27%¹⁶ and the findings from the UK, where 43% of children with wheezing reported current symptoms of other atopic conditions.¹⁷ This phenomenon may be partly a result of the high prevalence of nonatopic conditions in our setting such as infections and infestations of the respiratory tract and the skin, or the effects of indoor air pollution, which could account for some of the reported symptoms. No smoking was reported by the children themselves.

The prevalence of self-reported wheezing (16.2%) is similar to studies done in Capetown, South Africa (16.1%) and Kuwait (17%), but higher than reported from Addis Ababa (10.7%), Nairobi, Kenya (10.4%), and Jimma, in the South of Ethiopia (1.9%).^{18–20} However, it is significantly lower than reported from the UK (33.3%).¹⁷ The majority of wheezing children had mild symptoms, and both sexes were equally affected. The higher report of wheeze in our children, in the face of low symptom overlap, may indicate the possible role of nonatopic wheeze related to viral infections or indoor air pollution from domestic solid-fuel cooking, which is a common practice in our community. This is suggested by the observation that wheeze was more commonly reported (although not significantly) by children from rural compared with urban schools. Despite the data reported here, clinical observations in the Gondar area suggest that severe clinical asthma is uncommon in young children below age 13 years, but common in adults. This observation is consistent with evidence from Jimma, where wheeze and asthma were rare in children but more common among older individuals, and especially urban dwellers.¹⁰ This may be related to the common occurrence of high-intensity parasitic infestation in children, which is thought to prevent asthma symptoms in atopic individuals.²¹

Similarly, the prevalence of features of rhino-conjunctivitis (14.5%) is higher than reported from Addis Ababa (10.6%) and Jimma (2.2%), but comparable with findings from Capetown, South Africa (15.1%) and Algeria (18.2%).²² A striking seasonal aggregation of rhinitis symptoms was reported during the months September–December, which may indicate a seasonal allergen, since it corresponds with the main flowering and harvest season of the area. A similarly higher attack of rhinitis during October–December was also reported from Jimma.²⁰

The prevalence of features of atopic eczema (10.8%) is similar to Kenya (11.4%), but lower than reported from Addis Ababa (19.9%), Ibadan, Nigeria (17.7%), and Yorkshire, UK (18.7%).^{23,24} The findings from African cities, such as Addis Ababa and Ibadan, suggest that international patterns for the prevalence of atopic eczema symptoms differ in some way from those for asthma and rhinitis.^{16,23} However, the high prevalence of various skin infections and infestations in many developing world set-

tings could produce an itchy rash, leading to an overestimate of the prevalence of atopic eczema. The overall female sex preponderance in rhinitis and eczema symptoms has also been observed in other ISAAC centers.¹⁶

The wide discrepancy in the reported prevalence rate of symptoms between Gondar and Addis Ababa vs. Jimma is not explained. This result may represent a real finding related to ethnicity or an unidentified environmental modifier. In a prospective analysis of 204 adult asthmatics from Jimma hospital, 85% of the patients were not members of the ethnic group indigenous to the locality, and 64% of them developed the disease within 5 years of their arrival in the area.²⁵ This may raise the possibility of some protection in the indigenous community for the development of atopic symptoms. Some of the observed variation may be related to differences in understanding the questionnaire or differences in the local awareness of atopic symptoms and diagnostic labels. One factor which may contribute to this effect is the absence of an exact equivalent of “wheeze” in the Amharic language, which was used for the survey in all three centers. The key questions in the three surveys were identical. Amharic is the principal language in Addis Ababa and Gondar but not Jimma, a possible explanation for the great discrepancy in repeated wheeze in Jimma. Interestingly, there is a direct translation of “asthma” in Amharic. The prevalence of reported asthma was identical in all three Ethiopian centers.

The reported rates of diagnosed allergic conditions in children in the three Ethiopian centers were comparable: asthma (2.2%, 2.8%, and 2.2%), hay fever (5.1%, 7.5%, and 4.5%), and eczema (2.7%, 11.2%, and 5.6%) in Gondar, Addis Ababa, and Jimma, respectively (Table 4). Less than a third of those with severe wheezing reported a diagnosis of asthma, and even fewer had received asthma drugs. This sharply contrasts with the UK finding, which showed that over two-thirds of current wheezers had received asthma drugs in the preceding 12 months.¹⁷ This suggests a high level of underdiagnosis and undertreatment of asthmatics in our setting.

From this survey, the following conclusions may be drawn. The prevalence of allergic symptoms is fairly high in the Gondar area. There is wide variation in the reported prevalence of these symptoms in different centers within Ethiopia and elsewhere. This observation is consistent with the report of the ISAAC Writing Group, who documented wide variation in prevalence among different centers worldwide: a 20-fold variation in reported wheeze (range, 1.6–36.8%), a 30-fold variation in rhino-conjunctivitis (1.4–39.7%), and a 60-fold variation in atopic eczema symptoms (0.3–20.5%). Generally, the prevalence is low in Africa and Asia, intermediate in Europe, and high in Anglo-Saxon countries.¹⁶ We found a remarkably low report of diagnosed atopic conditions of 8.6%, which is less than a quarter of the symptom

TABLE 4—Prevalence of Self Reported Symptoms of Asthma and Allergies in Schoolchildren Aged 13–14 Years in the Three Ethiopian ISAAC Centers: Gondar, Addis Ababa, and Jimma

Details	Gondar	Addis Ababa	Jimma
Month and year of survey	January 1997	June 1995	September 1995
Language used for survey	Amharic	Amharic	Amharic
Sample size	3,365.0	2,951.0	3,027.0
Male (%)	40.1	47.2	69.9
Female (%)	59.9	52.8	30.1
Asthma symptoms (%)			
In last 12 months			
Wheeze	16.2	10.7	1.9
Wheeze 4 or more attacks/year	5.1	5.6	0.9
Sleep disturbance/more nights/week	5.4	2.5	0.3
Speech-limiting wheeze	6.9	7.3	1.0
Ever having			
Exercise, induced wheeze	28.6	27.3	2.0
Nocturnal cough	30.2	27.3	2.0
Diagnosed asthma	2.2	2.8	2.2
Rhinitis symptoms (%)			
Rhinitis other than common cold in last 12 months	24.6	29.5	3.2
Rhinitis with conjunctivitis	14.5	10.6	1.8
Marked interference with daily activities	5.3	21.6	2.2
Hay fever as a diagnosis	5.1	7.5	4.0
Eczema symptoms (%)			
Itchy flexural rash in last 12 months	10.8	19.9	3.2
Severe eczema	3.2	2.6	0.8
Diagnosed eczema	2.7	11.2	5.6

prevalence of 36%. This may reflect a generally poor awareness of these conditions and low health-service utilization, or underdiagnosis by health facilities. The majority of children had mild symptoms, which could be explained by other forms of respiratory disease, such as respiratory infections or effects of air pollution.

These findings call for further epidemiological studies with objective assessments of atopic sensitization, bronchial hyperresponsiveness, and concomitant environmental analysis. In this regard, the role of endotoxin as a potential protector against allergic sensitization, or conversely as cause of nonallergic respiratory symptoms, should be explored.²⁶ However, perhaps the most important issue relates to questionnaire methodology. Even in the UK, understanding of terms such as “wheeze” has been called into question.²⁷ The popular understanding of such terms is a vital part of any future survey work of this type.

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