Original Article

Prevalence of Bronchial Asthma in School Children of 6-13 Years of Age in Shimla City

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ABSTRACT

Background. Asthma is a major public health problem worldwide. However, there is limited data on asthma prevalence among school children in Shimla. The present study was undertaken to determine the prevalence of asthma in Shimla city and also to examine the different factors influencing its occurrence.

Methods. This was a questionnaire-based study (International Study of Asthma and Allergies in Childhood [ISAAC] protocol) carried out in four randomly selected schools in the city of Shimla. The questionnaire was pre-tested in 50 school children. The age group included in the study was 6-13 years. The questionnaire was distributed to all the children (n=1136). A response rate of 89.5% was achieved. The socio-economic status was determined on the basis of monthly income (cumulative square root value method). The ISAAC questionnaire was given standard scores. Various factors influencing the prevalence of asthma, such as socio-economic status, history of asthma and other allergic disorders in the family, type of cooking fuel used, history of active and passive smoking were elucidated from the history.

Results. Overall prevalence of asthma in our study was found to be 2.3 percent. Boys had a higher prevalence (3.1%) than girls (1.4%). We found a significant association between asthma prevalence and family history of asthma and other atopic manifestations. There was no significant association of socio-economic factors and exposure to smoking with prevalence of asthma.

Conclusion. In the present study, the prevalence of bronchial asthma in school children in the age group of 6-13 years is 2.3 percent. **[Indian J Chest Dis Allied Sci 2010;52:145-148]**

Key words: Asthma, Children, Gender, Atopy, Prevalance.

INTRODUCTION

Asthma is a major public health problem worldwide with wide differences in prevalence and severity throughout the world. Significant increases in the prevalence and the severity have been noticed globally over the past few decades in certain geographical regions. However, recently evidence has emerged that the increase in asthma prevalence in the past few decades has been slowed or stabilised.[1] The rise in asthma prevalence noticed in the past decades has been too rapid to implicate genetic basis for the changes. However, various environmental factors or lifestyle factors have been implicated and in the last decade, hygiene hypotheses[2] has been put forward as an explanation for the increased prevalence of asthma. Beggs and Bambrick[3] also proposed that anthropogenic climatic changes might also be responsible for the recent upsurge in asthma prevalence. Wu *et al*[4] in a large population-based, birth cohort study comprising of 95,310 children found a causal relationship between winter virus infection during infancy and development of early childhood asthma. This study[4] also demonstrated for the first time that infant age at the time of winter virus peak independently predicts asthma development with the highest risk reported in infants born four months before winter viral infections.

Asthma is the commonest chronic disease in children leading to disability as well as school absence. Its impact on the family and childhood is considerable due to the chronic nature of the disease. Though, there are several epidemiological studies available, direct comparisons among studies are often limited by differences in methodologies used. In an attempt to overcome this limitation, a standardised protocol has been developed by the International Study of Asthma and Allergies in Childhood (ISAAC) Committee that comprises a standardised written questionnaire for self-completion by teenage children. This method is well validated in the epidemiological

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studies of bronchial asthma. Jenkins *et al*[5] in a population-based study reported that questionnaire-based survey had higher sensitivity, specificity, positive predictive value and Youden's index which is the best single measure of validity. This method is cheap,[6] widely acceptable and convenient requiring no special equipment. Only a few epidemiological studies have been carried out in our country to study the prevalence of asthma, but none in Himachal Pradesh. Therefore, the present study has been carried out to assess the prevalence of bronchial asthma in school children of Shimla, located at an altitude of 2250 meters. We also studied some of the factors that may be associated with the occurrence of bronchial asthma.

MATERIAL AND METHODS

Four schools of Shimla city were identified for the study using random tables. In all, 1017 school children of Shimla city in the age group of 6-13 years were included. The study population included children of all ethnicity settled in Shimla. It was a questionnaire-based study followed by general physical and systemic examination of the students. The study was carried out in the month of October and November keeping in view the weather conditions in Shimla. A standard questionnaire based on ISAAC guidelines was used in the study. The questionnaire was pre-tested among 50 school children. It was printed in both Hindi and English. With the help of school teachers, the questionnaire was distributed to all children in the age group of 6-13 years present on that particular day. The students were then explained in detail the contents of the questionnaire and the usefulness of the study. For children in the age group of 6-9 years, the questionnaire was filled up by the parents and in the age group of 10-13 years the questionnaire was filled up by the students themselves. This was followed by complete general physical and systemic examination of the children. Age was verified from the school register. Various factors that may influence the prevalence of asthma, such as socio-economic status, history of asthma and other allergic disorders in the family, type of cooking fuel used, history of active and passive smoking were also elucidated from the history. The socio-economic status of the children was determined on the basis of monthly income in accordance to the cumulative square root value method[7] and based on this method the subjects were divided into three groups: low socio-economic group (income less than Rs.7035 per month), middle socio-economic group (income Rs.7036-12,493 per month) and high socio-economic group (income more than Rs.12,493 per month). The information on residential accommodation was used to determine overcrowding. Active smoking[8] was defined as smoking of presently or at least one cigarette per day for the last one year. Passive smoking[9] was defined by exposure to smoking by either of the parents. Children with a positive history of asthma were subjected to spirometry using a portable vitalograph. It was performed by a trained technician. Trial demonstrations were given to each child to make them familiar with the proper procedure.[10] The ISAAC questionnaire format was given standard scoring system as suggested by Sole, *et al*.[11] This scoring system has also been validated by the same author. In the 6-9 years age group, a global cut-off score of more than or equal to five was established as diagnostic of asthma and for the age group of 10-13; the cut-off score was six or more.

Statistical Analysis

The statistical analysis was done using MSTAT software. The frequency analysis was done to assess the prevalence of bronchial asthma and various factors affecting it. Chi-square test was used to get the p-value. Yate's correction was applied in the case of 2x2 table. A p-value of <0.05 was considered significant.

RESULTS

Out of the 1136 students who received the questionnaire, 1017 students responded by returning these. Thus, the response rate of 89.5% was achieved. The response rate in the 6-9 years age group (161 males and 118 females) was 91.78 percent and in the 10-13 years age group (368 males and 370 females) it was 88.7 percent. Out of the total 1017 students who responded, 529 (52.2%) were males and 488 (47.9%) were females. The highest number of children were of 11 years of age, (214; 21.1%) and the least number of children were in the age group of six years (11; 1.1%). According to the socio-economic status, 528 (51.9%) were in the low socio-economic group, 301 (29.6%) were in the middle-income group, and 188 (18.5%) were in the high-income group.

On the basis of ISAAC scoring, 23 (2.7%) were found to be the cases of asthma. Out of the total 529 males, 16 (3%) were positive for asthma while among the 488 females, seven (1.4%) were positive for asthma. In the 6-8 years age group, out of the 10 cases, eight were males and two were females. In the age group of 10-13 years there were 13 cases (8 males and 5 females). Age and sex were not significantly associated with asthma ($p>0.05$). Maximum numbers of positive cases were found at the age of 8 and 13 years, 21.7 % of the total 23 positives cases. Out of the 23 positive cases, six (26.1%) had wheezing at the time of examination

and out of the remaining 994 non-asthmatic cases, eight had wheeze (p<0.0001). Out of the total 1017 children studied, 245 (24.1%) were exposed to passive smoking, out of which eight (3.3%) were found to have asthma. In the remaining 772 (75.9%) children who were not exposed to tobacco smoke, 15 (1.9%) were found to have asthma. However, the association between passive smoking and asthma was not significant (p>0.05) (Table).

Table. Association of different factors with prevalence of asthma

Factor	Category	No. of Subjects Studied	No. of Subjects Diagnosed to have Asthma	p Value on Chi Square Test
Expoure to smoking	Yes	245	8	>0.05
	No	772	15	
Family history of asthma	Yes	50	16	<0.0001
	No	967	7	
Other allergies	Yes	36	11	<0.0001
	No	981	12	
Type of fuel used for cooking	LPG	980	20	>0.05
	Kerosene	33	2	>0.05
	Coal	4	1	<0.01
Over-crowding	Yes	96	3	>0.05
	No	921	20	
Socio-economic status	Low	528	9	>0.05
	Medium	301	10	
	High	188	4	

LPG=Liquefied petroleum gas

There were 50 students with a positive family history of asthma, out of which 16 (32%) had asthma. Out of the 967 students who did not have a family history of asthma, seven (0.7%) were found to be positive for asthma (p<0.0001). When results were analysed for other allergic disorders, out of the total 1017 children, 36 suffered from other allergic manifestations; 11 (30.5%) of these were found to have asthma. Of the remaining 981 children without any other allergic manifestations, 12 (1.2%) had asthma (p<0.0001). The association with cooking fuel was not found to be significant in our study; 96.4% households were using liquefied petroleum gas (LPG) as the main cooking fuel. Although the percentage of asthma cases in the subjects using coal as a fuel was high, the association cannot be considered significant as the number of cases was very small. It was observed that 96 children of the study population were staying in over-crowded conditions and three (3.1%) of these had asthma and in the rest of the subjects where no over-crowding was present, 20 (2.2%) were diagnosed as asthmatics. Majority of asthmatic children had mild airways obstruction (n=10), six had moderate obstruction and two children were found to have very serve obstruction. Two children had no airways obstruction at the time of examination.

DISCUSSION

In the present study, the prevalence of asthma in Shimla city was found to be 2.3 percent. However, Chhabra *et al*[12] reported a much higher prevalence rate of 11.9% amongst Delhi school children. Similar higher prevalence rate was reported by Parmesh[13] who showed a prevalence of 29.5% in 1999 in Bangalore city. This high prevalence rate may be explained by different levels of air pollution, exposure to allergens and climatic conditions. Global warming has also got important role to play in the upsurge of allergic disorders worldwide over the last three decades. Increase[14, 15] temperature and carbon dioxide (CO_2) production due to climatic change will result in increased production of pollens and fungal spores that could exacerbate symptoms of allergic disease. There is also some evidence of significantly stronger allergenicity in pollen at increased temperature.[16]

Many asthma prevalence studies done across the globe have reported a male predominance of the disease. The overall male: female ratio in our study was 2.3:1. The male: female ratio in 6-9 years age group was 4:1 and in 10-13 years age group 1.6:1. The exact reason for male predominance is not known but several explanations have been offered. Male predominance may be related to a greater degree of bronchial lability in males. Airways in boys are also smaller[17] in comparison to their lung sizes when compared to girls. Another study from the Newzealand[18] showed higher rates of sensitivity to indoor allergens among males aged 13 years than their female counterparts as assessed by the skin prick test. Sensitivity to allergens was not examined in the present study.

Asthma develops due to interaction between gene and environment and a parental history of atopy/ asthma is an index of susceptibility to asthma. In the present study, a strong association between the presence of family history of asthma and the prevalence of asthma was observed. Sibbald *et al*[19] showed that when both parents had asthma, 80% children developed the disease, compared to 40% of children when one parent had asthma and when no parent had asthma, only 10% children developed asthma. Maternal influence[20] is probably more than paternal influence, particularly in children less than five years of age possibly due to trans-placental transfer of allergens or cytokines to the fetus.

In our study, we did not find any significant association between over-crowding and prevalence of asthma. Cardoso *et al*[21] in their case-control study reported that over-crowding places young children at a risk of lower respiratory tract infection but may give protection against asthma. This is consistent with the hygiene hypothesis. Similar results were obtained in

the study of Hassan *et al*[22] from Bangladesh who reported that children living in small households (≤3 members) were more vulnerable to asthma.

In our study we did not find any significant association between asthma prevalence and use of LPG or kerosene as fuel. Though, there was significant association with the use of coal, due to the very small number, it cannot be regarded as risk factor for the occurrence of asthma.

Exposure to smoking and prevalence of asthma is a subject of conflicting evidence in the literature. Though several studies have reported a significant association of asthma and smoking, our study did not show the significant association between smoking and asthma ($p>0.05$). It is possible that due to stigma, many children and parents did not report smoking.

In the present study, of the 36 children who suffered from other allergic manifestations, such as eczema, urticaria, rhinitis etc, 11 had asthma; suggesting a strong possibility of children suffering from other allergic manifestations to develop asthma.

The association between socio-economic status and prevalence of asthma was not statistically significant in our study. However, a study from Singapore[23] found the prevalence of parent-reported asthma to be greater among subjects of higher socio-economic status. However, in another study done among 6-7 years old children in Italy, prevalence of wheezing symptoms or physician diagnosed asthma was substantially unaffected by socio-economic status. Georgy *et al*[24] in a study of prevalence and socio-economic associations of asthma and allergic rhinitis in Egypt among 11-15 years old children found a higher prevalence and increased severity of asthma symptoms in children of lower socio-economic groups. However, Aligne *et al*[25] in a study of risk factors for pediatric asthma demonstrated that higher prevalence of asthma among black children was not due to low income but due to urbanisation.

CONCLUSIONS

The prevalence of bronchial asthma in the present study was found to be 2.3 percent. Our study will serve as the baseline for future monitoring of prevalence of bronchial asthma in Shimla city.

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