

Prevalence of various oculo-respiratory allergic conditions and their comorbid association: A cross-sectional observational study in children (6–18 years) from Jaipur

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Abstract

Context: There is very little literature available on prevalence of pediatric oculo-respiratory allergies.

Aims: This study aims to study the prevalence and to determine the association of allergic rhinitis (AR), bronchial asthma (BA), and allergic conjunctivitis (AC) as comorbidities in children of Jaipur district.

Settings and Design: A cross-sectional observation study was done among school going children (6–18 year) from 13 schools of urban and rural areas of Jaipur district chosen randomly.

Subjects and Methods: This study included 5002 children out of them 61.04% were male. A predesigned validated questionnaire containing various questions pertaining to oculo-respiratory allergies were distributed. Students and parents filled questionnaire and labeled as BA, AR, or AC according to their answers.

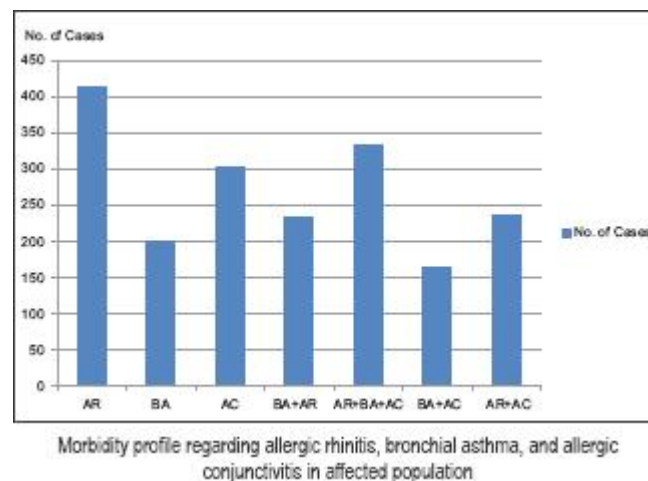
Statistical Analysis Used: Qualitative data were expressed in the form of percentage and proportion measured by Chi-square test. Quantitative data were expressed in mean and standard deviation scale measured by unpaired *t*-test.

Results: In our study, population 1883 (37.64%) of children were suffering from one or more of the allergic morbidities. About 21.99%, 10.67%, and 16.04% of children were suffering from AR alone, BA alone, AC alone, respectively. Nearly 12.37% of children were suffering from both BA and AR, 8.71% of children were suffering from both BA and AC, and 12.48% of children were suffering from both AR + AC, 17.74% of children were suffering from all three (BA, AR, and AC).

Conclusions: The study showed a high prevalence of children was suffering from one or more of the allergic diseases and there was a significant association between them.

Keywords: Bronchial asthma, comorbidity, rhinitis allergic

The prevalence of allergic diseases is rising dramatically worldwide in both developed and developing countries. These diseases include asthma; rhinitis; anaphylaxis; drug, food, and insect allergy; eczema; and urticaria (hives) and angioedema. This increase is especially problematic in children, who are bearing the greatest burden of the rising trend which has occurred over the last two decades. A steady increase in the prevalence of allergic diseases globally has occurred with about 30%–40% of the world population now being affected by one or more allergic conditions.^[1] Allergic rhinitis (AR), conjunctivitis, and asthma are three problems which commonly manifest together, yet affect three different organ systems.



AR is an inflammatory disorder of the nasal mucosa characterized by nasal congestion, rhinorrhea, itching, and often accompanied by sneezing and conjunctival irritation. The prevalence of AR has been estimated to be between 10% and 30% in various studies.^{[2],[3]}

Bronchial asthma (BA) is a chronic inflammatory disease of airways defined by more than three episodes of airflow obstruction, clinically evident as wheezing, cough, breathlessness, and chest tightness with airflow limitation, airway hyperresponsiveness, and airway inflammation. It is estimated that there may be additional 100 million people with asthma by 2025.^[4] The prevalence of asthma worldwide vary considerably, being less common in developing countries (1%–6%) whereas, in developed countries, it is more prevalent ranging from (7%–20%).^[5]

Allergic conjunctivitis (AC) is a broad group of allergic conditions involving inflammation of the conjunctiva. This typically results in itching, redness, burning, or tearing of the conjunctiva. Older population studies estimate a prevalence of 15%–20% of AC, but more recent studies implicate rates as high as 40%.^[6]

Asthma and AR and AC comorbidity refer to the association between asthma and AR and AC. This is due to their pathophysiological, epidemiological, and clinical similarities. It is well known that patients with AR have changes in the bronchial mucosa and conjunctiva despite the absence of asthma symptoms. Alternatively, patients with asthma have eosinophilic infiltrates in nasal mucosa despite the absence of AR symptoms. The fact that asthma and AR are manifestations of the same inflammatory disease affecting the entire airway is further suggested by the clinical improvement of asthma when AR is treated.

Epidemiologically, there have been reports – mostly in ambulatory-based studies – showing high prevalence rates of AR in asthmatic patients,^[5] with rates varying between 30% and 90%. However, population-based studies on the prevalence rates of asthma/AR/AC comorbidity are still scarce.

Subjects and Methods



Study design

This was a cross-sectional questionnaire-based observational study.

Study population

School going children (6–18 year) from 13 schools of urban and rural areas of Jaipur district were chosen randomly.

Sample size

This study included 5002 children.

Inclusion criteria

All children 6–18 years from the selected schools willing to participate in our study (parents in case of younger children).

Exclusion criteria

Age <6 and >18 years, craniofacial anomaly, history of recurrent cough with fever, not growing well, any structural anomaly of nose, history of local abusive drug inhalation, history of any local surgery, history of any head trauma with nasal discharge, and history of smoking were excluded from the study.

Questionnaire

Predefined validated questionnaire^[7] containing various questions pertaining to asthma and AR were distributed. Students and parents were explained by researcher in detail regarding the questions and how to fill the questionnaire. Questionnaires were filled by parents in case of 6–10 years and by students themselves in children above 10 years. We had different questionnaires for parents and students. The student questionnaire contained 9 questions while the parent questionnaire contained 10 questions. Questions 1–7 were related to asthma; we assigned a “1” for each “sometimes” or “a lot” response and add the scores. The total score 3 or more for any student was considered to have the asthma diagnosis. Questions 8 and 9 were related to AC and AR, respectively, and we assigned a “1” for each “sometimes” or “a lot” response and added the scores. A total score 1 or more was considered to have AR.

Statistical analysis

Qualitative data were expressed in the form of percentage and proportion. Quantitative data were expressed in mean and standard deviation scale. Difference and proportion in various groups, i.e.,

sex, rural/urban were measured by Chi-square test. Difference in means of age was measured by unpaired *t*-test. The level of significance was kept 95% for all statistical analysis.

Results

The study population demographic profile, i.e., age group, sex, rural/urban, and prevalence of AR, BA, and AC details were shown in [Table 1].

Characteristics	Numbers
Total	5002
Male (%), mean age	3053 (61.04), 14.39±2.63
Female (%), mean age	1949 (38.96), 14.63±2.65
Age groups (years) (%)	
6-9	612 children (12.24)
10-13	1541 children (30.81)
14-16	2182 children (42.62)
17-18	667 children (13.33)
Urban (%)	2985 (59.68)
Rural (%)	2017 (40.32)
Prevalence of one or more of the allergic comorbidities (%)	1883 (37.64)
Male (%)	1191/3053 (39.01)
Female (%)	692/1949 (35.51)
Prevalence of bronchial asthma (%)	932 (18.63)
Prevalence of allergic rhinitis (%)	1216 (24.31)
Prevalence of allergic conjunctivitis (%)	1035 (20.69)

Table 1: Demographic characteristics of study population and prevalence of oculo-respiratory allergic diseases

In our study, population 1883 (37.64%) of children were suffering from one or more of the allergic comorbidities in the study population. About 21.99% of children were suffering from AR alone, 10.67% of children were suffering from BA alone, 16.04% of children were suffering from AC alone, 12.37% of children were suffering from both BA and AR, 8.71% of children were suffering from both BA and AC, and 12.48% of children were suffering from both AR and AC, 17.74% of children were suffering from all three (BA, AR and AC). Overall, males had more affected than females [Table 2].

Serial number	Morbidity status	Number of cases			Percentage of cases
		Male	Female	Total	
1	AR alone	291	123	414	21.99
2	BA alone	143	58	201	10.67
3	AC alone	147	155	302	16.04
4	BA+AR	155	78	233	12.37
5	AR+BA+AC	223	111	334	17.74
6	BA and AC	100	64	164	8.71
7	AR and AC	132	103	235	12.48
8	Total	1191	692	1883	100
χ^2 , df	192.739, 6				
<i>P</i> <0.001 highly significant. AR=Allergic rhinitis, BA=Bronchial asthma, AC=Allergic conjunctivitis					

Table 2: Morbidity profile of oculo-respiratory allergy affected population

Our study shows the overall occurrence of BA to be (932/5002) 18.63%. The prevalence of BA is

increasing with age, i.e., 7.52% (6–9 years), 14.99% (10–13 years), 22.50% (14–16 years), and 24.59% (17–18 years) which is statistically significant. Out of 932 children, 21% children had only BA alone, 25% had BA and AR, 17.5% BA + AC, and 35% had BA + AR + AC.

Our study shows the overall occurrence of AR to be (1216/5002) 24.31%. The prevalence of AR is increasing with age, i.e., 10.46% (6–9 years), 18.17% (10–13 years), 29.79% (14–16 years), and 33.28% (17–18 years). Nearly 46.63% of AR children were found to have concomitant asthma while 60.40% asthmatic children had AR. The prevalence of AR and asthma as comorbidity was present in 11.34% children. Out of 1216 children 34% had only AR alone, 19.1% AR + BA, 19.3% had AR + AC, and 27.4% had AR + BA + AC.

Discussion



The present study was conducted in 5002 school going children of age group 6–18 years from 13 schools of Jaipur district from both rural and urban areas. The study was a questionnaire-based cross-sectional observational study.

Sharma *et al.*^[8] in a cross-sectional survey of 3321 school going children (5–15 years) using modified ISAAC questionnaire in Jaipur city showed 7.59% children to have asthma (2008–2009). Salvi *et al.*^[9] in their study in 15,500 school children from Pune and Nagpur showed the prevalence of BA 5.7% in age group of 6–7 years and 4.26% in age group of 13–14 years in Nagpur. The prevalence of BA was 6.55% in age group of 6–7 years and 1.89% in age group of 13–14 years in Pune. Redline *et al.*^[7] conducted a study in 190 USA children (7–13 years) and showed the prevalence of asthma 9.3%. The increased prevalence rate in our study is in agreement with the fact that the overall prevalence of BA is increasing in different age group during the last few years.

Behl *et al.*^[10] in the study in school going children ($n = 1136$) of Simla showed the prevalence of asthma 2.3%. The difference in the prevalence rate is probably because of the difference in the geographical area (high altitude) and also because of increasing prevalence of asthma in the last few years.

Our study shows the overall occurrence of AR is increasing with age. Salvi *et al.*^[9] in a study of prevalence of asthma and allergic diseases in 15,500 school children from Pune and Nagpur showed the prevalence of AR 9.51% in age group of 6–7 years and 12.72% in the age group of 13–14 years in Nagpur. The prevalence of AR was 14.78% in age group of 6–7 years and 8.92% in age group of 13–14 years in Pune. The increased prevalence rate in our study is again in agreement with the fact that the overall prevalence of AR is also increasing in different age group also during the last few years.

Ibáñez *et al.*^[2] from Spain reported that rhinitis was diagnosed in 42.5% of the children in their study. The higher prevalence in this study as compared to ours can be attributed to a different sociogeographical setting in Europe.

Our study shows that AR children suffer from asthma in 46.63% (567/1216) cases. Yamauchi *et al.*^[3] from Japan conducted a questionnaire-based study on children with AR ($n = 3945$) and reported that 49% of AR patients showed BA symptoms and 35% of them were diagnosed with BA. These observations are in concurrence with our observations. Saini *et al.*^[11] showed the prevalence of asthma as comorbidity in children with AR to be 19.16%. The difference in observations with our study is probably because of their small size of study group and only limited to urban area.

Our study shows that 567 out of 932 (60.40%) asthmatic children also suffer from AR. Yamauchi *et al.* [3] conducted a study among the patients with childhood BA ($n = 3283$), and observed that 68% AR symptoms and 60% were diagnosed with AR. Maio *et al.* [12] studied 995 asthmatic patients in Italy, of which 60.6% had concomitant AR (R + A), 39.4% had asthma alone. The findings of above studies are in concurrence with the observations of our study. Ibáñez *et al.* [2] from Spain reported that association between asthma and rhinitis was significantly higher in children than in adults (44.9% vs. 35.5%; $P < 0.05$). The difference in the observations of above studies could be because of different sample population.

Our study shows asthma and AR as comorbidities in (567/5002) 11.34% cases. Yuksel *et al.* [13] in a study from Turkey showed that 4.7% had asthma along with rhinitis. The above studies also confirm the association of both the conditions as comorbidities in a significant proportion of patients. The low rate of association in these studies as compared to us could be attributed to difference in social and geographical characteristics.

In our study, the prevalence of AC is 20.69% out of them 29.1% had only AC, 15.8% had only AC + BA, and 22.7% had AC + AR. Older population studies estimate a prevalence of 15%–20% of AC, but more recent studies implicate rates as high as 40%. [6] Kim *et al.* [14] conducted study in Korea and found the symptom rate of AC was 14.8% and the prevalence of rhinitis in children with conjunctivitis was 64.8% and that of conjunctivitis in children with rhinitis was 23.6%.

Limitation of study

The sample population was school going children only so that data representative of general population could not be obtained for generalization of observations. The children identified by only questionnaire-based method were not subjected for detailed physical examination and confirmation of diagnosis (due to large size study population); hence, the true prevalence of both diseases may differ from our data. An underestimate or overestimate of true population prevalence could have occurred, depending on symptoms prevalence in nonparticipating children. Asthma and AR remain a stigmatizing diagnosis in some segment of the population so some parents may have minimized symptoms to avoid that stigma.

Conclusions



In our study, 1883 (37.64%) of children were suffering from one or more of the allergic morbidities. These allergic diseases are existing as comorbidities in a significant proportion of children demanding a comprehensive strategic approach to deal with them. As it is one of the first study conducted in India with adequate study population in children having oculo-respiratory allergic diseases; hence, it may serve as a baseline data for further studies, and much larger studies are welcome to make generalization of data.

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Conflicts of interest

There are no conflicts of interest.

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