



## THE PREVALENCE OF ASTHMA AND ALLERGIC RHINITIS AMONG SCHOOL CHILDREN- A COMPARITIVE CROSS SECTIONAL STUDY

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### Abstract:

**Background:** the prevalence of allergy and asthma demonstrates a global discrepancy as a consequence of diverse interaction between genetic factors like ethnic composition, allergic sensitization, family history of allergic disorders and environmental risk factors.

**Objective:** to evaluate the prevalence of asthma and allergic rhinitis in high school children in a public school of Jammu.

**Methods:** This descriptive questionnaire-based study was performed on a total of 1040 school children of age range between 10-15 years of standard 6<sup>th</sup> to 10<sup>th</sup> students from a routine public school health check up camp. Five groups were made according to the age; 10-11, 11-12, 12-13, 13-14, 14-15 years. Two allergic conditions i.e. asthma and allergic rhinitis were observed according to their symptoms. The observation of each subject was recorded and data was analyzed by using SPSS version 21.

**Results:** The prevalence rates of current Allergic rhinitis in boys was 57.14% and girls was 42.86%. 23.1% girls and 28.1% boys were with asthma reported having hay fever in their life. 52 (5%) out of 1040 children were suffering from both asthma and allergic rhinitis. The most common causative agent was found to be rice/wheat husk (23.06%) followed by kitchen smoke (21.15%). Pollution (13.46%) and dust (11.53%) were moderately effective and least causative agents were pollens.

**Conclusion:** Allergic rhinitis and asthma can adversely affect every aspect of a patient's life, including sleep quality, mood and daily activities. Prevalence of allergic rhinitis symptoms was much higher in the 13-14 year-old group of students, a result that has not changed dramatically since the first phase of the study. Further studies are warranted to identify the causes of such a high prevalence.

**Keywords:** Allergic Rhinitis, Asthma, Causative Agent, School Children, Quality of Life.

### INTRODUCTION

Allergic Rhinitis (AR) is a chronic inflammatory disease that affects the upper respiratory tract and presents with at least one of the classic symptoms including sneezing, itching, nasal congestion and rhinorrhea.<sup>1,2</sup> The condition may be seasonal or indoor allergens such as mites, dust or an intermittent exposure to allergens.<sup>3</sup> The current prevalence of allergic rhinitis is 10-40%. Environmental changes mainly account for the increasing universal prevalence of allergic rhinitis and asthma<sup>4,5</sup> affecting a quarter of the world's population.<sup>1</sup>

There are wide variations in the prevalence of asthma and allergic rhinitis in different countries and even in different regions within India.<sup>6</sup> However, compared to asthma, allergic rhinitis appears to be a transient and somewhat milder disease. It can substantially affect various aspects of quality of life in patients, including work, education and productivity.<sup>7</sup> Moreover, allergic rhinitis is usually associated with other diseases of the respiratory tract, and the cumulative costs of controlling this condition can negatively affect the socioeconomic aspects of the patient's life.<sup>8</sup> Quality of life is reduced with this condition due to the direct effects of its primary symptoms on the patient's life. Allergic rhinitis also

tends to cause sleep disorders, fatigue, impaired memory, depression, etc., all of which contribute to a reduced quality of life.<sup>9</sup> Allergic Rhinitis and Asthma, the quality of life in patients with rhinitis dictates their rhinitis classification; for instance, sleep disorders are only associated with the moderate to severe form of rhinitis and not with its mild form.<sup>10</sup>

Asthma and allergic rhinitis (AR) are the two most common chronic disorders in early life, and their prevalence rates have doubled over the past decades. It has long been recognized that AR and asthma commonly coexist, due to their similarities in anatomy, physiology and immunopathology.<sup>2</sup> Surveys have shown that approximately 60 - 80% of children with asthma have symptoms of AR.

Quality of life (QOL) signifies wellbeing, welfare, and satisfaction of life; Health Related Quality of life (HRQOL) refers to the part of quality of life associated with health.<sup>11</sup> The assessment of quality of life has become a major area of interest for clinical research. QOL questionnaires have been developed to assess the effect of clinical management and of reducing the symptoms of chronic diseases on the patients' daily life, and to determine the effect of particular methods of treatment on controlling the disease.<sup>12,13,14</sup> The rhino conjunctivitis quality of life questionnaire (RQLQ) was prepared by Juniper and Guyatt in 1991 to assess the quality of life in patients with rhinoconjunctivitis.<sup>13</sup>

Rhinitis is defined as an inflammation of the lining of the nose and is characterized by nasal symptoms including anterior or posterior rhinorrhoea, sneezing, and nasal blockage and/or itching of the nose. These symptoms occur during two or more consecutive days for more than 1 h on most days.<sup>9,17</sup> Allergic rhinitis is the most common form of noninfectious rhinitis and is associated with an IgE-mediated immune response against allergens. It is often associated with ocular symptoms. Participants were classified as having allergic rhinitis if they had 2 or more recurrent nasal symptoms such as excessive sneezing, nasal itching, nasal discharge, or nasal congestion or obstruction that were reversible either spontaneously or with treatment in the preceding 12 months.<sup>1,6,22</sup> Although the use of questionnaires only to define allergic rhinitis has been associated with overestimation of the disease.<sup>1</sup> Validation studies performed in Europe have found that the combination of rhinitis symptoms and itchy-watery eyes is a useful epidemiological measure of the prevalence of allergic rhinitis.<sup>23,24</sup>

A condition in which a person's airway become inflamed, narrow and swelled, and produce extra mucus which makes it difficult to breathe. Asthma can be minor or it can interfere with daily activities. It causes difficulty in breathing, chest pain, cough and wheezing.

In adults, it has been shown that AR has a major impact on asthma morbidity, and that treatment of AR helps to improve asthma control.<sup>8</sup> Despite its high prevalence, there are surprisingly few studies on the effects of treatment of AR in children.<sup>9</sup>

Moreover, its impact on asthma in the paediatric age range has been poorly studied to date. A recent cross-sectional study by Cibella et al performed in 2015 reported that asthma showed symptoms of AR in 58% of the children, but no association with asthma severity was found.<sup>6</sup> Conversely, a study by S. Zeinbach et al in 2007, reported that exacerbations of upper and lower respiratory tract symptoms frequently coexisted, suggesting that AR does have an impact on asthma morbidity in children.<sup>5</sup> To date, no study has examined the impact of co-morbid AR on asthma control in children.

This cross-sectional observational study was done in routine public school health check up camp in a public school of Jammu city to determine the prevalence of asthma and allergic rhinitis in high school childrens of 10-15 year age.

## MATERIAL AND METHODS

This was an observational nonrandomized questionnaire based study conducted on high school children of 10-15 years of age in routine health check up camp held at public school. The study was performed in one year period from January 2015 to January 2017. Approval from Institutional ethical committee was taken before initiation of the study.

All 1040 5<sup>th</sup>-10<sup>th</sup> standard students were observed in the school health check up camp. All childrens were divided into five age groups i.e. 10-11 years, 11-12 years, 12-13 years, 13-14 years and 14-15 years age group.

The present cross-sectional study was conducted on patients over the age of 10 years old who suffered from symptoms of rhinitis such as nasal congestion, rhinorrhea, constant sneezing, and itchy nose for a minimum of four days per week and for a period of at least four weeks.<sup>10</sup>

The RQLQ was previously used in a study conducted by the researchers.<sup>2</sup> The RQLQ contains 16 items on the various aspects of quality of life, including general sleep problems, having trouble falling asleep,

morning symptoms, and performance problems during the day. There were 7 options for answering each item depending on the severity of the symptoms.

The mean score of each individual was calculated based on the answers to the QOL questionnaire and the mean scores for each individual were calculated. The researchers participated in the study without any costs. The participants were provided with all the necessary details on the questionnaires. The patients were interviewed and questionnaires were filled out by the researcher. The SPSS-16 software was used for the quantitative variables. P-values less than 0.05 were considered statistically significant.

**RESULTS**

All 1040 5<sup>th</sup>-10<sup>th</sup> standard students were observed in the school health check up camp. All childrens were divided into five age groups i.e. 10-11 years, 11-12 years, 12-13 years, 13-14 years and 14-15 years age group.

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**Table 1: Age groups and gender distribution of children.**

Age group (years)	Male (n=530)		Female (n=510)	
	No of children	Percentage	No of children	Percentage
10-11	108	10.38	102	9.80
11-12	105	10.09	100	9.61
12-13	109	10.48	103	9.90
13-14	103	9.90	101	9.71
14-15	105	10.09	104	10.00

Table 1 explains about percentage of boys and girls in each age group. Boy’s population was slightly higher than girls in each group.

**Table 2: Causative factors of asthma and allergic rhinitis.**

Factors	Asthma (n=124)		Allergic Rhinitis (AR) (n=160)		Asthma + Allergic Rhinitis (AR) (n=52)	
	No. of patients	Percentage	No. of patients	Percentage	No. of patients	Percentage
Dust	59	47.58	35	28.22	6	11.53
Cold weather	11	8.87	39	31.45	5	9.61
Smoke	28	22.59	40	32.25	4	7.69
Fuel	21	16.93	17	13.71	3	5.76
Pollution	36	29.03	23	18.54	7	13.46
Perfume	14	11.29	5	4.03	5	9.61
Pollens	16	12.90	6	4.83	0	0
Rice/wheat husk	26	20.96	12	9.67	12	23.06
Kitchen fumes	25	20.16	19	15.32	11	21.15

Most prevalent causative factor for the asthma was dust (47.58%) followed by pollution (29.03%), smoke (22.59%) and rice/wheat husk (20.96%) by farmers. The least common factors responsible for the asthma was cold weather (8.87%) followed by perfume (11.29%) and pollens (12.9%). Similarly most causative factor for allergic rhinitis was smoke (32.25%) and cold weather followed by dust (28.22%). The least causing agents were perfume (4.03%) and pollens (4.83%). 52 (5%) out of 1040 children were suffering from both asthma and allergic rhinitis. The most common causative agent was found to be rice/wheat husk (23.06%) followed by kitchen smoke (21.15%). Pollution (13.46%) and dust (11.53%) were moderately effective and least causative agents were pollens (0).

**Table 3: Gender wise Prevalence of the symptoms in Asthma and Allergic Rhinitis**

	Symptoms	Boys (N=192) (57.14%)	Girls (N=144)(42.85%)	All (N=336)	P
<b>Asthma</b>	Ever wheezed	28.9	34.3	31.3	0.01
	Wheeze in the past year	18.0	21.8	19.9	
	Wheezing with exercise last year	19.4	28.6	22.8	
	Persistent cough last year	19.1	22.6	20.4	
<b>Allergic Rhinitis</b>	Ever had rhinitis	32.1	35.4	32.8	0.01
	Rhinitis in the past year	27.5	31.7	28.9	
	Associated itchy eye in past year	16.1	21.3	17.7	
	Ever had hay fever	23.1	28.1	23.7	

CI, confidence interval; OR, odds ratio; *P* indicates significance between boys and girls

Asthma and asthma-like symptoms were additionally trouble in children who were exposed to smoke in their home atmosphere. Parents of children who smoke cigarettes, had considerably higher prevalence rates of ever wheezed, girls were additional liable to respiratory disease and hypersensitivity reaction current limitation of speech, current wheeze with exercise, and current night-time cough compared with children whose parents didn't smoke. There have been conjointly negative associations between paternal smoking and each current chronic rash and lifelong chronic rash. There was negative association between maternal smoking and each skin problem ever and rhinitis ever. Each a history of Allergic rhinitis within the past twelve months (or current rhinitis) and a history of unquiet rash within the flexural areas within the past twelve months (or current eczema) were considerably related to current wheeze and severe asthmatic attacks in these children. The prevalence rates of current Allergic rhinitis in boys was 57.14% and girls was 42.86%. 23.1% girls and 28.1% boys were with asthma reported having hay fever in their life.

## DISCUSSION

Allergic rhinitis is one of the most common allergic problems affecting 10-40% of the general population and its prevalence is increasing globally.<sup>4,5</sup> The present population in our study (42.85% female and 57.14% male) was in contrast to the previous study conducted by Shariat et al. in which 62% of the participants were female and 38% were male.<sup>2</sup> In a study by Hubert Chen et al., 37% of participants were female and 63% were male, which was consistent with the present study.<sup>8</sup>

Rhinorrhea was the most prevalent symptom among the participants. Other main symptoms of allergic

rhinitis included itchy nose, nasal congestion and watery eyes. According to the ARIA guidelines, patients were divided into four groups: a moderate to severe intermittent group that comprised the majority of the patients, a mild intermittent group, a moderate to severe permanent group, and a mild permanent group. Sinusitis was the most common concomitant disease of allergic rhinitis asthma; a poor sense of smell and a poor sense of taste were other concurrent conditions.

Although the present study found no significant relationships between the quality of life and symptoms (including nasal congestion, itchy nose and rhinorrhea) ( $p > 0.05$ ), rhinorrhea was found to be the most common (47.62%) symptom of allergic rhinitis. In a study conducted by Mohammadi et al rhinorrhea was also the most common symptom of allergic rhinitis, although the researchers did not investigate quality of life in those patients.<sup>9</sup> Nevertheless, Shariat et al. reported nasal congestion to be the most common symptom of the disease and found a significant relationship between nasal congestion and quality of life impairment in patients.<sup>2</sup>

Moderate to severe intermittent allergic rhinitis was found to be the most frequent (15.47%) type of the disease in the study group. This is different from a previous study in which Shariat et al reported the severe permanent type as the most frequent (34%) type.<sup>2</sup> The disparity of the findings may be attributed to climate differences. For instance, in Jammu symptoms are permanent due to apartment living and air pollution. This claim is supported by the fact that sneezing was the most common symptom of allergic rhinitis. However, nasal congestion was the most common symptom of the disease in the previous study, which is indicative of a permanent allergy.<sup>20</sup>

We can see that a total number of 336 (30.37%) patients out of 1040 students were found to have concomitant diseases, with the highest frequency pertaining to allergic rhinitis 160 (15.38%) and then asthma 124 (11.92%) and both diseases in 52 (5%) subjects. These findings are in accordance with the prior study by Shariat et al. which reported the prevalence of these two concomitant diseases with similar frequency percentages.<sup>2</sup> Inflammation of the nasal mucosa causes oedema and congestion of the sinus cavities, leading to sinusitis.

The results of the present study showed, in the majority of patients, that their quality of life had been affected by problems caused by allergic rhinitis, including general sleep problems, morning symptoms, and practical problems during wake time. In the studies conducted by Shariat et al<sup>2</sup> Hubert Chen et al,<sup>21</sup> and Monique et al,<sup>22</sup> more than 60% of the patients suffered from sleep problems and also problems when awake. In the present study, we found that patient quality of life was affected by severe sleep and daily routine problems in 54.88% of the patients.

Various studies were performed to assess QOL of AR patients.<sup>15,16</sup> Shariat et al<sup>2</sup> evaluated the quality of life in Iranian patients with allergic rhinitis living in Tehran using the RQLQ. Their study showed that the severity of the disease adversely affects the patients' quality of life. A study conducted by Silva et al (2009) showed that allergic rhinitis has adverse effects on psychological and physical health in children.<sup>4</sup> Allergic rhinitis in western part of Iran is relatively higher than the other regions.<sup>17</sup> According to the effects of allergic rhinitis on patients' quality of life, this assessment could help to improve healthier population.

In this study, no significant relationship was found between quality of life and gender ( $p=0.456$ ), although women had a better quality of life compared to men; this observation may be related to their presence in the home and less exposure to allergens. Shariat et al<sup>2</sup> did not find any meaningful relationship between gender and quality of life as well.<sup>2</sup> In a study conducted by Damian Leger,<sup>23</sup> no significant relationships were reported between gender and quality of life, but the overall performance of girls was better than boys.

In our study, significant relationships were observed between quality of life and nasal congestion, itchy nose, rhinorrhea and watery eyes. However, Shariat et al<sup>2</sup> and Meltzer et al<sup>15</sup> in 2009 found a significant relationship between quality of life and nasal

congestion.<sup>2</sup> The disparity of findings may be attributed to the difference in the type of rhinitis examined, as permanent rhinitis can affect the patients' quality of life more significantly while intermittent rhinitis did not affect the patients' quality of life significantly.

The results obtained from the present study showed a significant relationship between quality of life and severity of the disease. Patients with severe permanent or intermittent disease had a poorer quality of life since the severity of the disease and associated symptoms tended to affect the patients' physical and mental well-being, thus making their life more difficult. These observations are consistent with those from studies conducted by Shariat et al,<sup>2</sup> Carlos Henrico et al,<sup>24</sup> Damian Leger et al,<sup>23</sup> and Jaruvongvanich et al<sup>25</sup> showed that patients with a more severe type of the disease have a poorer quality of life.

## CONCLUSION

Our population based observational study concluded that Allergic rhinitis and asthma adversely has an effect on sleep quality, mood, and daily activities of general population. Both asthmatic and rhinitis children had more frequent wheeze attacks. Additional severe attacks of asthma can cause restricted speech, more visits to the general practitioner and bigger school absence. We have a tendency to discover variations within the associated risk and severity between allergic and non-allergic rhinitis. Given the numerous effects of those symptoms on the patients' quality of life, creating associate early diagnosing of the sickness is that the beginning to overcome it. The following steps area unit reducing environmental allergens and taking measures to stop the incidence of concomitant diseases, like respiratory illness like asthma and sinusitis.

## REFERENCES

1. T. Orban, H. Saleh, R. Durham. Allergic and non-Allergic rhinitis: Middleton's Allergy: Principles and Practice, 7th ed. Mosby Elsevier, Inc. 2009.
2. M. Shariat, Z. Pourpak, M. Khalesi, A. Kazemnejad, L. Sharifi, G. Souzanchi, M. Moin. Quality of life in the Iranian adults with allergic rhinitis. Iranian Journal of Allergy, Asthma, and Immunology. 2012; 11:4: 324- 8.
3. M.shiu. Allergy. In Essentials of pediatrics, Nelson, ed. (Elsevier). 2015; 282.

4. C.H.M.d. Silva, Tais Estevo da Silva, Karla P. Fernandes, Rogerio M. C. & Pinto. Quality of life in children and adolescents with allergic rhinitis. *Rev Bras Otorrinolaringol (Engl Ed)*. 2009; 75: 642- 9.
5. S. zeinbach, E. C. Seoane-Vazquez, A. Beyer, P. B. Williams. The impact of allergic rhinitis on work productivity. *Primary Care Respiratory Journal*. 2007; 6:2: 98-105.
6. F. Cibella, G. Ferrante, G. Cuttitta, S. Bucchieri, M.R. Melis, S. La Grutta, G. Viegi. The burden of rhinitis and rhino conjunctivitis in adolescents. *Allergy Asthma Immunol Res*. 2015; 7: 44-50.
7. M. Small, J. Piercy, P. Demoly, H. Marsden. Burden of illness and quality of life in patients being treated for seasonal allergic rhinitis: A cohort survey. *Clinical and Translational Allergy*. 2013; 3:1: 33.
8. C. Camelo-Nunes, D. Solé. Allergic rhinitis: Indicators of quality of life. *Jornal Brasileiro de Pneumologia*. 2010; 36:1: 124-33.
9. T. J. Craig, J. L. McCann, F. Gurevich, M. J. & Davies. The correlation between allergic rhinitis and sleep disturbance. *The Journal of Allergy and Clinical Immunology*. 2004; 114: 5: S139-S145.
10. C. Bachert, P. van Cauwenberge. The WHO ARIA (allergic rhinitis and its impact on asthma) initiative. *Chemical Immunology and Allergy*. 2003; 82: 119-26.
11. C. M. Van Oene, EJ Van Reij, MA Sprangers, WJ Fokkens. Quality-assessment of disease-specific quality of life questionnaires for rhinitis and rhino sinusitis: A systematic review. *The Journal of Allergy*. 2007; 62: 1359-71.
12. J. Bousquet. quality of life in allergic disease. *Revue Française' Allergologie*. 1998;38: S202-S205.
13. E. F. Juniper, G. H. Guyatt. Development and testing of a new measure of health status for clinical trials in rhino conjunctivitis. *Clinical and Experimental Allergy*. 1991; 21:1: 77- 83.
14. K. Thompson, E. Juniper, E. O. & Meltzer. Quality of life in patients with allergic rhinitis. *Annals of Allergy, Asthma & Immunology*. 2000; 85:5: 338- 47.
15. E. O. Meltzer, M. S. Blaiss, M. J. Derebery, T. A. Mahr, B. R. Gordon, K. K. Sheth, J. M. Boyle. Burden of allergic rhinitis: Results from the Pediatric Allergies in America survey. *The Journal of Allergy and Clinical Immunology*. 2009; 124:3:S43-S70.
16. Valero, E. Baró, J. Sastre, A. M. Navarro-Pulido, I. Izquierdo, E. Martí-Guadaño, J. Mullol. Reference values for facilitating the interpretation of the ESPRINT-15 questionnaire (Spanish version). *Journal of Investigational Allergology & Clinical Immunology*. 2009; 19:5: 396-403.
17. R. Nasiri, G. Homagostar, M. Tajik. Evaluation of Prevalence of Allergic Rhinitis Symptoms in Kurdistan, a Western Province in Iran. *International Journal of Pediatrics*. 2015; 3: 1039- 46.
18. Leung R, Wong G, Lau J, Ho A, Chan JK, Choy D et al. Prevalence of asthma and allergy in Hong Kong schoolchildren: an ISAAC study. *Eur Respir J* 1997; 10:2:354- 60.
19. K. Mohammadi, M. Gharagozlou, M. Movahedi. A single center study of clinical and paraclinical aspects in Iranian patients with allergic rhinitis. *Iranian Journal of Allergy, Asthma, and Immunology*. 2008; 7:3: 163-7.
20. T. Shiomori, T. Udaka, K. Hashida, T. Fujimura, N. Hiraki, N. Ueda, H. Suzuki. [Evaluation of quality of life in patients with allergic rhinitis]. *Journal of UOEH*. 2007; 29:2:159- 67.
21. H. Chen, P. P. Katz, S. Shiboski, P. D. Blanc. Evaluating change in health-related quality of life in adult rhinitis: Responsiveness of the Rhinosinusitis Disability Index. *Health and Quality of Life Outcomes*. 2005; 3:1: 68.
22. M. Monique, V. Edmund, D. Erwin, S. D. Lieke, O. Berend, M. Joris. Effects of Seasonal Allergic Rhinitis on Driving Ability, Memory Functioning, Sustained Attention, and Quality of Life. *The Open Allergy Journal*. 2008; 1:1:19- 25.
23. D. Léger, I. Annesi-Maesano, F. Carat, M. Rugina, I. Chanal, C. Pribil, J. Bousquet. Allergic rhinitis and its consequences on quality of sleep: An unexplored area . *Archives of Internal Medicine*. 2006; 166:16: 1744- 8.
24. Esamai F, Ayaya S, Nyandiko W. Prevalence of asthma, allergic rhinitis and dermatitis in primary school children in Uasin Gishu district, Kenya. *East Afr Med J* 2002; 79:10:514- 8.
25. V. Jaruvongvanich, P. Mongkolpathumrat, H. Chantaphakul, J. Klaewsongkram. Extranasal symptoms of allergic rhinitis are difficult to treat and affect quality of life. *Allergology International*. 2016; 65:2: 199- 203.
26. Kalmarzi, R., Khazaei, Z., Shahsavari, J., Gharibi, F., Tavakol, M., Khazaei, S., & Shariat, M. (2017). The impact of allergic rhinitis on quality of life: a

- study in western Iran. *Biomedical Research and Therapy*, 4:9: 1629-37.
27. Worldwide variations in the prevalence of asthma symptoms: the International Study of Asthma and Allergies in Childhood (ISAAC). *Eur Respir J* 1998; 12:2:315- 35.
  28. Beasley R, Crane J, Lai CK, Pearce N. Prevalence and etiology of asthma. *J. Allergy Clin Immunol* 2000; 105:2: 2:S466- S472.
  29. Asher MI, Keil U, Anderson HR, Beasley R, Crane J, Martinez F et al. International Study of Asthma and Allergies in Childhood (ISAAC): rationale and methods. *Eur Respir J* 1995; 8:3:483-91.
  30. Masoli M, Fabian D, Holt S, Beasley R. The global burden of asthma: executive summary of the GINA Dissemination Committee report. *Allergy* 2004; 59:5:469-78.
  31. The 2nd Iranian asthma meeting and the 5th biennial seminar of Iranian society of asthma and allergy. *Iranian Journal of Allergy, Asthma and Immunology* 2005; 4: S1-S9.
  32. Boskabady MH, Kolahejz GH. Prevalence of asthma symptoms among the adult population in the city of Mashhad (north-east of Iran). *Respirology* 2002; 7:3:267-72.
  33. Golshan M, Esteki B, Dadvand P. Prevalence of self-reported respiratory symptoms in rural areas of Iran in 2000. *Respirology* 2002; 7:2:129-32.
  34. Masjedi MR, Najafizadeh K, Dokouhaki P. Prevalence and Severity of Asthma Symptoms in Children of the Tehran-ISAAC Study. *Pediatric Asthma, Allergy & Immunology* 2004; 17:4:244-50.
  35. Mortazavi G, Moghaddam H, Akbari A, Saadatjoo R. Asthma in Iranian Schoolchildren: Comparison of ISAAC Video and Written Questionnaires. *Iran J Med Sci* 2005; 30:3:110-4.
  36. Rahimirad M, Hejazi ME, Salary S, Behroozian R. Prevalence and severity of asthma, allergic rhinitis and atopic eczema in 13 to 14 years-old schoolchildren in Uromia, Iran (An ISAAC study). *Eur Respir J* 2004; 24: 48: 389.
  37. Habibi-Kermani AR, Janghorbani M, Gozashti H, Samareh-Fekrei M. Prevalence of Asthma in Elementary School Children in Kerman in 1999. *Journal of Kerman University of Medical Sciences* 2002; 9:4:184- 93.
  38. Williams H, Robertson C, Stewart A, Ait-Khaled N, Anabwani G, Anderson R et al. Worldwide variations in the prevalence of symptoms of atopic eczema in the International Study of Asthma and Allergies in Childhood. *J Allergy Clin Immunol* 1999; 103:1:1:125- 38.
  39. Weiland SK, Husing A, Strachan DP, Rzehak P, Pearce N. Climate and the prevalence of symptoms of asthma, allergic rhinitis, and atopic eczema in children. *Occup Environ Med* 2004; 61:7:609- 15.
  40. Anderson HR, Ruggles R, Strachan DP, Austin JB, Burr M, Jeffs D et al. Trends in prevalence of symptoms of asthma, hay fever, and eczema in 12-14 year olds in the British Isles, 1995-2002: questionnaire survey. *BMJ* 2004; 328:7447:1052-3.
  41. Behbehani NA, Abal A, Syabbalo NC, Abd AA, Shareef E, Al Momen J. Prevalence of asthma, allergic rhinitis, and eczema in 13- to 14-year-old children in Kuwait: an ISAAC study. *International Study of Asthma and Allergies in Childhood. Ann Allergy Asthma Immunol* 2000; 85:1:58- 63.