Research Paper

Volume : 2 | Issue : 10 | October 2013 • ISSN No 2277 - 8179

Prevalence of Asthma and Risk Factors Inside the Poor Homes in India: A Sudy

Geography

KEYWORDS : Asthama, environmental factors, indoor pollutants, biomass fuels, substandard housing, indoor crowding

Abha Lakshmi Singh	Professor, (M.A Ph.D), Department of Geography, Aligarh Muslim University, Aligarh, 202002, Uttar Pradesh (India)
Saleha Jamal	Guest Lecturer, (M.Sc. Ph.D), Department of Geography, Aligarh Muslim University, Aligarh, 202002, Uttar Pradesh (India)

ABSTRACT

Asthma is multifactorial disease influenced by both genetic and environmental factors. A rapid increase in asthma in recent years cannot be attributed to changes in heritable factors but the focus of intrusions for the increased occurrence of asthma, therefore, should be on environmental factors. Asthma is extremely low in India's healthcare facilities especially for the poor. Poor families cannot prevent asthma because of the risk inside their homes. In present study an attempt has been made to find the prevalence of asthma among women inside low income homes. This study is based on primary sources of data collected through questionnaire interviews from 1,200 low income/poor households of Aligarh city located in the Gangetic tract of North India. Since women spend long hours inside their homes and are more involved in household activities like cooking they were chosen as respondents. The study examines the socio-economic conditions, prevalence of asthma on the basis of symptomatic and clinical reporting, identifies the risks inside the homes (establishes the association between risks like cooking conditions (use of biomass fuels/chulhas, cooking in multipurpose room, non-ventilated kitchen), substandard housing (living in kutcha/semi-pucca houses), indoor crowding) and finally monitoring of indoor air pollutants (SPM (PM10, PM2.5) and gaseous pollutants (CO, CO2, SO2, NO, NO2)). The results show that prevalence of asthma among women is greater because they spend long hours inside their home and they are more exposed to indoor air pollutants and the risks inside the homes helps in triggering asthma.

Introduction
Asthma is a condition that affects the airways –the small tubes that carry in and out of the lungs. It is a condition that is characterized by variable airflow obstruction, airways hyper - responsiveness (AHR) and chronic airway inflammation that usually has an eosinophilic component (Kay, 1996). When a person with asthma comes into contact with an asthma trigger, the muscle around the walls of the airways tightens so that the airways becomes inflamed and starts to swells often sticky mucus or phlegm is produced. All these reactions cause the airways to become narrower and irritated leading to the symptoms of asthma which are episodic cough, wheezing or whistling noise in the chest, breathlessness, a tight feeling in the chest etc. (Nicklas, 1997).

Asthma is a complex disease influenced by both genetic and environmental factors (Holgate, 1999). Recent researches suggest that genetic, lifestyle and environmental factors combine together often inextricably, to cause asthma. Other risk factors such as socio-economic status, family size, housing conditions, overcrowding in homes, exertion, allergies in air and food contributes to its onset and severity. According to World Health Organisation, 24 per cent of the global disease burden and 23 per cent of all the deaths are attributable to environmental factors (Ustum, P.A. et al, 2006). A number of studies (Castellsague, et al, 1995; Koren and Utell, 1997; B Jorksten, 1999; Lewis, et al, 2002; Mishra, 2003; Breysse, et al, 2010) have suggested that ambient air pollution especially exposure to indoor air pollutants can trigger asthma attacks. Women, children and elderly are most vulnerable with respect to potential indoor air pollution health effects because they spend more time in the home environment. Women spend more than five hours every day for cooking food (Singh and Jamal, 2012). Exposure to pollutants such as respirable particulate matter (PM_{10} and $PM_{2.5}$ microns), carbon monoxide (CO), nitrogen oxides (NO_2), sulphates, ozone (O_3) etc have been found to be associated with asthma, cardiovascular and respiratory diseases (Foster, 1996).

The WHO estimates that between 100 and 150 million people around the globe have asthma and over 180,000 people die worldwide each year due to asthma (WHO, 2000). Prevalence of asthma in developed countries (U.S., Australia, UK, New Zealand, Western Europe etc) is much higher than in developing countries. In U.S. the number of asthmatics has increased by over 75 per cent and since 1980 the deaths have doubled. In Western Europe asthma has doubled in last ten years. In Asia the rates of affliction are much lower, on an average about 8 per cent as compared to the global average of 14 per cent (Down to Earth, 2002). India has an estimated 15 to 20 million asthmatics. The prevalence of asthma in India varies from 1.2 per cent to 3.5 per cent (Guddattu, V. et al, 2010). Although asthma is increasing in both urban and rural areas of India, but the disease is one of the most under reported one. In urban areas, the increase is seen because of rise in the number of industries, number of automobiles and their emissions, density of population, overcrowding etc. all these lead to poor indoor air quality.

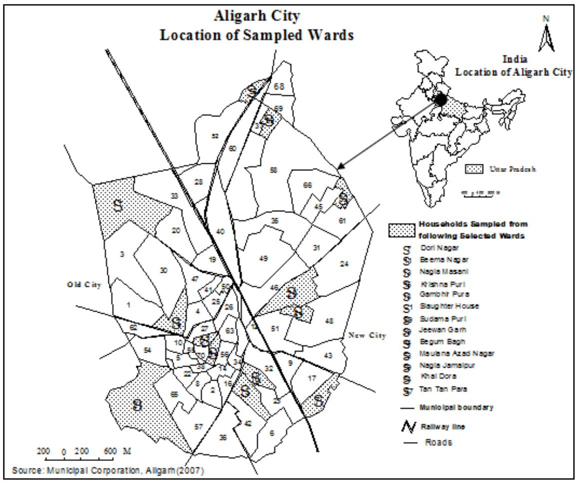
Asthma is extremely low in India's healthcare facilities especially for the poor. Poor families cannot prevent asthma because the risk is inside their homes (Mishra, 2003, Koren, 1995, Hajat, et al 1999, Jamal, 2012). In the present study an attempt has been made to find the prevalence of asthma among women, and to explore the risk inside the low income households of Aligarh (27°53'N latitudes and 78°4'E longitudes) a medium sized city located in the fertile Gangetic plain of North India (fig.1).

Database and Methodology
The study is mainly based on primary sources of data collected through surveys of 12,00 low income households (having an income of < Rs.5,000 per month (1 US$= Rs 65)). Field work was conducted during the years 2009 and '10.

The sample was selected from 14 wards (of the total 70 municipal wards of Aligarh city) located in the different parts of the city (fig.1). About 5 per cent low income households were selected from each of the selected ward. From each selected household, woman respondents were chosen because they know more about their household conditions. The total sample size consisted of 1,200 low income women respondents/households. A questionnaire was prepared with the help of questionnaires used in similar, studies (Bates, 1995, Baldi, et al, 1999; Bjorksten, 1999; Mishra, 2003; Breysse, et al, 2010, Guddattu, 2010) to gather information regarding the personal profile of the women respondents, prevalence of asthma among woman and risk factors inside their home.

Prevalence of asthma among the sampled women respondents was assessed on the basis of symptomatic and clinical reporting.

Level of indoor air pollutants SPM and gaseous pollutants emitted from biomass fuels and LPG were monitored. For monitoring of SPM (PM_{10}, $PM_{2.5}$), a handy sampler "Portable GRIMM Dust Monitor Series 1.109" was used. For monitoring of indoor gaseous pollutants CO, SO_2, NO, NO_2, portable "YES-205" multigas monitor was used and for monitoring of CO_2 portable"YES-206" Falcon IAQ monitor was used.



Discussion and Results

The analysis is based on 1,200 sampled women (table 1) in the age group of 15 to 45 years. Almost (90 per cent) all of them were married belonging to the low socio-economic strata (backward category 38 per cent and schedule cast 36 per cent). The proportion of illiterates was much higher (83 per cent), rest were educated mostly up to the primary level (69 per cent). Women with less education were at higher risk to have asthma than their counterpart. Only 30 per cent were employed and that too in the informal sectors as labourers, construction workers, domestic helpers, vegetable sellers, petty shopkeepers etc. which is characterized by long hours of work and low incomes.

Table 1: Personal Profile of the Sampled (1,200) Low Income Women Respondents

Characteristics			Percentages
(i)Age group	Years		
	15-24		25.64
	25-34		49.02
	35-45		25.34
(ii)Marital status	Married		90
	Unmarried		10
(iii)Caste	General		26.89
	OBC		37.7
	Sc		35.41
(iv)Educational status	Educated		17.80
		Primary	69.
		Secondary	16.80
		Higher	14.20
	Uneducated		82.80
(v)Employment status	Employed		31.10
	Unemployed		60.90

Source: Based on field survey 2009-10

Table 2 presents the prevalence of asthma among the low income women. On the basis of self reported symptoms of asthma such as episodic cough, wheezing or whistling, breathlessness, chest tightness, other symptoms (like worsening allergy symptoms like persistent running nose, dark circles under eyes, inflamed skin etc) its occurrence was examined. The overall prevalence of asthma among the total sampled women (1,200) was nearly 14.5 per cent or 175 women reported of asthma symptoms.

Table 2: Prevalence of Asthma among the Low Income Women: Based on Symptomatic and Clinical Reporting

Total sampled Low Income Women/ 1,200	Symptomatic Reporting (in percentages)						Clinical Reporting
	Episodic Cough	Wheezing/ Whistling	Breathlessness	Chest Tightness	Other symptoms	Average	
	25.33	13.83	14.11	7.86	11.86	14.59	6.34

Source: Based on field survey 2009-10

1. Identification of risks inside the low income households

Household surveys helped in identifying the risks for asthma among low income women in their homes. Ambient air pollution can trigger asthma attacks. The risk (table 3) which helped in provoking asthma were those which helped in lowering the indoor air quality. These include the use of biomass fuels and *chulha* for cooking, cooking in multipurpose room, absence of ventilation, long hours of exposure to smoke and pollutants, type of house living in substandard housing, indoor crowding etc.

Use of biomass fuels and *chulhas*

Household surveys have revealed that two types of fuels and stoves were being used by the poor women. Bulk (87.20 per cent) of women used biomass fuels (wood, agricultural residues, animal dung etc.) burnt in *chulhas* (u shaped small structure made of bricks and mud) or simple stoves that release most of the smoke and atleast 50 times more noxious pollutants than gas inside the homes. Because of their economic backwardness, illiteracy, cost factor, convenience, affordability these poor households preferred using biomass fuels. They were not aware of its ill effects. The use of unprocessed biomass fuels in inefficient *chulhas* are characterized by low combustion releases heat, smoke and harmful toxic pollutants. Very few households (8.73 per cent) used LPG (liquefied petroleum gas) and gas stoves. Due to poor maintenance, bad odour and smoke from gas stoves was reported by the respondents. Some households (4 per cent) reported of using a combination of both biomass fuels/*chulhas* and LPG/stoves (table 3 (1)). Most of the time they were cooking on biomass fuels due to high expenditures on purchasing gas. Even today the bulk of poor households use biomass fuels and *chulhas* which remains to be the most important source of indoor air pollution. There is evidence associating the use of biomass fuel with acute respiratory diseases and chronic obstructive lung diseases (Sing and Jamal, 2010). Thus, this has been identified as the major risk factor for indoor air pollution.

Cooking in multipurpose room

Various cooking conditions like place of cooking food, ventilation in kitchen, duration of cooking per day and exposure to smoke and heat play an important role in the level of indoor air pollution and exposure level. Every other cooking locations from multi-purpose rooms to cooking in *verandah* to open air were more frequently used by poor households. Table 3 (2) reveals that the bulk of low income households cooked food in an extended thatched *verandah* (36 per cent), multipurpose room (25.34 per cent) and in open space (24.15 per cent). Only few had separate kitchen. Most of the low income households had only one room which was used as living, sleeping, cooking i.e. all the activities were performed in this room. Thus, cooking space inside the living room or in a multipurpose room not only pollutes the cooking environment but also the living environment gets polluted. The potential for exposure was maximal in this place. Cooking in multipurpose room increases the time of exposure to toxic pollutants emitted from cooking fuels which can have adverse effects and consequences on health; as the pollutants get trapped within the room where the individuals spend most of the time after the cooking period also. A number of pollutants from cooking fuels gets concentrated within the multipurpose room which is also the living room

Volume : 2 | Issue : 10 | October 2013 • ISSN No 2277 - 8179

and is detrimental to health because the polluted air is inhaled for a longer duration after cooking.

Absence of proper ventilation
It has been observed that most of the lower income households burn biomass fuels in open fire places or *chulhas*. Combustion is incomplete in most of these inefficient stoves, resulting in substantial emissions which in the presence of poor ventilation produce very high levels of indoor air pollution (Air Quality Guidelines for Europe, 2000). Presence of proper ventilation both in living area and in cooking place is the best recommended way to reduce indoor air pollution. Ventilation ensures that the air flows outside to inside and vice-versa. Field survey revealed that (table 3 (3)) cooking places lacked ventilation facilities (77.74 per cent) or had improper ventilations (22.26 per cent).

Exposure to indoor air pollutants
Health effects are not only determined by the level of pollution but also, and more importantly, by the time people spend indoors breathing the polluted air, i.e. the exposure level (Bruce et al, 2000). It may be noted that due to traditional involvement in cooking women's exposure is very much higher as compared to men's. Women during cooking food stay in close proximity to hazardous pollutants. Table 3 exhibits that more than half of the sampled women spend more than 5 hours per day for cooking food and they were exposed to smoke and heat for more than 2 hours per day. The number of meals cooked, efficiency of cooking fuel/stove, amount of food to be cooked, size of family etc. determines the exposure time. Each time when fire is started especially biofuels, it produces a lot of smoke and toxic pollutants. If cooking is performed in an enclosed area with no ventilation, the exposure is much higher than cooking in open air. Most of the low income place of cooking food are environmentally harmful and unhygienic.

Living in substandard housing
The condition of most housing can be seen as highly questionable in terms of environmental quality. Field surveys revealed that the sampled households were found to be living in three types of houses (table 3 (5)); semi-*pucca* houses (38.65 per cent), *pucca* houses (35.27 per cent) and *kutcha* houses (26.08 per cent). The walls and roof of the *pucca* houses were made of bricks, cement and concrete; while the walls and roof of *kutcha* houses were made of bricks, mud, bamboo, thatched, tin sheets, polythene etc. The semi-*pucca* houses were made of a combination of both *pucca* and *kutcha* houses. One room was *pucca* while the *verandah* or the cooking place and toilet were *kutcha*. It was observed that in most of the semi-*pucca* houses kitchen was the neglected part, either it was built *kutcha* or semi-*pucca* having thatched roof. These built materials (used in *kutcha*/ semi-*pucca* houses) absorbs the smoke and other pollutants emitted from cooking fuels for longer period increasing the exposure duration of the individuals living in the house thus posing severe health risks (eg. sore throat, dry cough, phlegm and running nose symptoms of respiratory diseases). These substandard dwellings (*kutcha*, semi-*pucca*) were characterized by dampness and leaky roofs. Thus, the quality of the dwelling poses a great risk to the health of the dwellers.

Indoor crowding
Indoor crowding depends on both the number of people in the household and the way in which the residential space is managed. Crowding within the home is equally important and is analysed as one of the risk factors. Excessive crowding clearly affects the well being of a household, and many studies have indicated that it can also affect health (Bradley et al., 1991). Another characteristics common to most of the poorer homes is crowded, cramped conditions. Crowding and congestion affects health and hygiene of a person. In the poor homes there is often an average of 4 to 6 or more persons per room and in many instances less than 1 sq. m of floor space per persons. As indicated in table 3 (6) about 72.45 per cent households were having 5-10 members and 23.42 per cent households were having >10 members. Similarly 84.10 per cent of the households surveyed resided in only one room and many (77.74 per cent) reported of living more than 6 persons per room. This will aggravate asthma and it will be easily transmitted from one person to another.

Table3: Risks inside the Low Income Homes provoking prevalence of Asthma among Women

		Percentages
1. Use of biomass fuels/ chulhas	Biomass fuel/ Chulahs	87.20
	LPG/Gas stove	8.73
	A mix of biomass fuel and LPG	4.07
2.Cooking in verandah/ multipurpose room		
	Separate Kitchen	16.19
	Multipurpose Room	24.15
	Verandah	35.51
	Open Space	24.15
3.Absence of Ventilation in Kitchen		
	Absent	77.74
	Improper	22.26
4.Exposure to indoor air pollutants		
(i) Duration of Cooking per day	>5 hours	36.20
	<5 hours	63.80
(ii) Exposure to smoke per day	>2 hours	64.73
	<2 hours	35.27
(iii) Exposure to heat per day	>2 hours	75.85
	<2 hours	24.15
(iv)Time taken for smoke to exit from the house	>2 hours	53.64
	<2 hours	46.13
5. Living in sub-standard housing		
(i)House type		Percentages
	Kutcha	26.08
	Pucca	35.27
	Semi-pucca	38.65
6.Indoor crowding		
(i)Number of family members in a household	<5	
	5-10	4.13
	>10	72.45
(ii)Number of rooms household occupies	1 room	23.42
	>1 room	84.10
(iii)Crowding	>6person per room	15.90
	<6 person per room	77.74
		23.26

Source: Based on field survey 2009-10

2. Monitoring of indoor air pollution
The indoor air pollution was monitored and the results are presented in table 4, which shows the concentration of SPM and gaseous pollutants at various cooking places (separate kitchen (with/without ventilation), in *verandah*, in multipurpose room and in open air); and with different fuels (biofuels and LPG) used. Personal exposure to SPM while cooking with traditional/ biomass were greatest in open air cooking where it ranged between 380.90 μg·m−3 for PM10 and 249.35 $\mu g \cdot m^3$ for PM2.5 followed by cooking with biomass in *verandah*, which ranged between 264.81 $\mu g \cdot m^3$ for PM10 and 128.18 $\mu g \cdot m^3$ for PM2.5. The concentration at various locations of cooking with LPG depended on the type of kitchen. The mean exposure of SPM while cooking with LPG in *verandah* was recorded 167.7 $\mu g \cdot m^3$ for PM_{10} and 111.14 $\mu g \cdot m^3$ for $PM_{2.5}$, in separate kitchen with ventilation was recorded 122.91 $\mu g \cdot m^3$ for PM_{10} and 67.09 $\mu g \cdot m^3$ for $PM_{2.5}$ followed by 118.08 $\mu g \cdot m^3$ for PM_{10} and 50.94 $\mu g \cdot m^3$ for $PM_{2.5}$ in multipurpose room and 112.94 $\mu g \cdot m^3$ for PM_{10} and 54.65 $\mu g \cdot m^3$ for $PM_{2.5}$ in separate kitchen without ventilation. The highest concentration of gaseous pollutant was found in kitchen using biomass fuel for cooking *i.e.* 3.34 ppm, 509.71 ppm, 0.07 ppm, 0.10 ppm, 0.03 ppm for CO, CO2, SO2, NO, NO2 followed by kitchen in multipurpose room using LPG which was recorded 0.91 ppm, 440.32 ppm, 0.03 ppm, 0.10 ppm, 0.02 ppm for CO, CO2, SO2, NO, NO2, in *verandah* which was recorded 0.90 ppm, 410.36 ppm, 0.02 ppm, 0.04 ppm, 0.02 ppm for CO, CO2, SO2, NO, NO2, in non-ventilated kitchen it was recorded 0.9

ppm, 401.71 ppm, 0.02 ppm, 0.04 ppm, 0.02 ppm for CO, CO2, SO2, NO, NO2 and ventilated kitchen which was recorded to be 0.80 ppm, 398.61 ppm, 0.02 ppm, 0.04 ppm, 0.02 ppm for CO, CO2, SO2, NO, NO2.

Table 4: Monitoring indoor air pollution

Monitoring of Indoor Air Pollution	Mean Exposure during cooking					
Fuel used	Kitchen Location	PM_{10}		$PM_{2.5}$		
Biomass Fuel	Verandah	264.81		128.18		
	Open Air	380.9		249.35		
LPG	Separate Kitchen without ventilation	112.94		54.65		
	Separate Kitchen with ventilation	122.91		67.09		
	Verandah	167.7		111.14		
	Multipurpose room	118.08		50.94		
Fuel used	Kitchen Location	Gaseous pollutants				
		CO	CO_2	SO_2	NO	NO_2
Biomass Fuel	Kitchen	3.34	509.71	0.07	0.10	0.03
LPG	Separate kitchen without ventilation	0.90	401.71	0.02	0.04	0.02
	Separate kitchen with ventilation	0.80	398.61	0.02	0.04	0.02
	Varandah	0.90	410.36	0.02	0.04	0.02
	Multipurpose room	0.91	440.32	0.03	0.10	0.02

Source: Based on field survey 2009-10

The concentration of SPM was higher in open air cooking places, in *verandah*, in separate kitchen with ventilation because a great portion of particulates originating from the outdoor air enters the indoor environment but due to open space the concentration level soon gets dissipated in atmospheric air but the concentration of SPM in non-ventilated kitchen and in multipurpose room gets concentrated and remain indoor for longer duration thus increasing exposure time. The study reveals that the concentration of indoor pollutants especially par-ticulate matter, carbon dioxide, carbon monoxide, sulphur dioxide, nitrogen oxide, nitrogen dioxide is maximum when cooking is done using traditional/biomass fuels/*chulhas* in a multipurpose room and in non-ventilated kitchens. If we compare table 3 (showing the cooking conditions, place of cooking, ventilation at cooking locations, type of fuel/stoves used and exposure to smoke and heat) with mean concentrations of SPM and gaseous pollutants in different kitchen locations using different types of fuels, we find that most of the lower income women who cook in a multipurpose room, which is generally not properly ventilated using biomass fuels/traditional *chulhas* or simple stoves are highly exposed to the emitted pollutants. Thus, the lower income women are most vulnerable to these risk factors.

Conclusion

Results from this study suggest that exposure to toxic pollutants emitted from biomass cooking fuels burnt in *chulhas* is strongly associated with the prevalence of asthma among poor women. Poor families cannot prevent asthma because of the risks inside the poor homes such as use of biomass fuels and *chulhas* cooking food in a multipurpose room, absence of ventilation, long hours of cooking, living in a substandard housing, indoor crowding. The effect of these risks is greater for women than for men because women spend long hours inside their homes are more exposed than men

The findings from this study have important policy and program implications for countries such as India, where large proportion of the population still rely on polluting biomass fuels burnt in *chulhas* for cooking. Decreasing household biomass fuel use and increasing use of improved stove technology may decrease the health effects of indoor air pollution. There is the need for public information campaigns designed to inform people about the risks of exposure to cooking smoke and, where shifts to cleaner fuels are not feasible, programs to promote improved cookstoves designed to reduce exposure to smoke by means of improved combustion and improved venting. For such programs to be effective, local needs and community participation should be given high priority and in addition there is need to strengthen asthma prevention and treatment programs.

REFERENCE

1. Air Quality Guidelines for Europe. (2000). World Health Organisation, Regional office of Europe. Copenhagen. | 2. Baldi I. Tessier J.F., Kauffmann F., Jacqmin-Gadda H., Nejjari C., Salamon R., (1999). Prevalence of Asthma and Mean Levels of Air Pollution: Results from the French PAARC survey. European Respiratory Journal, 14,132–138. | 3. Bates, D.V. (1995). Observations on Asthma. Environmental Health Perspective, 103(suppl 6), 243–247. | 4. Bjorksten B. (1999). The Environmental Influence on Childhood aAthma. Allergy, 54,17–23. | 5. Bradley., D., Cairncross, S., Harpham, T., Stephens, C. (1991). A Review of Environmental Health Impacts in Development Country Cities. Discussion paper, Urban Management Program, World Bank, UNDP, UNCHS. | 6. Breysse, P.N., Diette, G.B., Matsui, E.C., Butz, A.M., Hansel, N.N., McCormack, M.C. (2010). Indoor Air Pollution and Asthma in Children. Proceedings of the American Thoracic Society, 7 (2), 102-6 | 7. Bruce, N., Prez Padilla, R., Albalak, R. (2000). Indoor Air Pollution in Developing Countries: A Major Environmental and Public Health Challenge. Bulletin of WHO, Ref. no. 00-0711, 78:,1080-92. | 8. Castellsague J, Sunyer J, Saez M, Anto JM. (1995). Short-term Association Between Air Pollution and Emergency Room Visits for Asthma in Barcelona. Thorax, 50, 1051–1056. | 9. Down to Earth. (2002). Gasping Millions, Cover Story. 10(16). January 15, 34-42. | 10. Foster, E. (1996). Health Effects of Suspended Particulate. Canterbury Regional Council, New Zealand, Report R96 (2) | 11. Guddattu, V., Swathi, A, Nair, S. (2010). Household and Environmental Factors associated with Asthma among Indian Women: A Multilevel Approach. Journal of Asthma, 47(4), 407-411 | 12. Hajat S., Haines A., Goubet S.A., Atkinson R.W., Anderson H.R. (1999). Association of Air Pollution with Daily GP Consultations for Asthma and Other Lower Respiratory Conditions in London. Thorax, 54,597–605. | 13. Holgate, S. T., Samet, J. M., Koren, H. S. & Maynard, R. L., eds. (1999). Air Pollution and Health (Academic, San Diego). | 14. Jamal, S. (2012). Indoor Air Pollution: Health Impacts from Household Energy. Neeraj Publishing House, New Delhi. | 15. Kay, A. B. (1996). Pathology of Mild, Severe, and Fatal Asthma. American Journal of Respiratory and Critical Care Medicine, 154, 66-69 | 16. Koren H.S., Utell M.J. (1997). Asthma and the Environment. Environmental Health Perspective, 105, 534–537. | 17. Lewis S.A., Weiss S.T., Platts-Mills T.A., Burge H., Gold D.R. (2002). The Role of Indoor Allergen Sensitization and Exposure in causing Morbidity in Women with Asthma. American Journal of Respiratory and Critical Care Medicine,165,961–966. | 18. Mishra, V. (2003). Effect of Indoor Air Pollution from Biomass Combustion on Prevalence of Asthma in Elderly. Environmental Health Perspective,111(1), 71-8 | 19. Nicklas, R. A. (1997). National and International Guidelines for the Diagnosis and Treatment of Asthma, Current Opinion in Pulmonary Medicine. 3, 51-55 | 20. Pruss-Ustum, A., Corvalan, C. (2006). Preventing Diseases through Healthy Environment towards an Estimate of Environmental Burdens of Disease. World Health Organisation, Geneva, Switzerland | 21. Singh, A.L., Jamal, S. (2012). A Study of Risk Factors Associated with Indoor Air Pollution in the Low Income Households in Aligarh City, India. E3 Journal of Environmental Research and Managemetnt, 1(3), 001-008. | 22. Singh, A.L., Jamal, S. (2010). Addressing the Links Between Indoor Air Pollution, Household Energy and Respiratory Health of Women in Aligarh City. Annals, National Association of Geographers, New Delhi, XXX(1), 13-26. | 23. Strachan, D.P. (1999). The Epidemiology of Childhood Asthma. Allergy, 54 (Suppl. 49), 7-11 | 24. World Health Organisation. (2000). Bronchial Asthma, The Scale of the Problem.S Fact sheet No. 206, January 2000, online: http://www.who.int/mediacentre/factsheets/fs206/en/ |