Household Survey on Determinants of Indoor Air Pollution (IAP) and Its Health Hazard Awareness among Women: A Cross-Sectional Study

Santhosh N Poojary[*], *Vinayak J Kempaller*[*], *N Udaya Kiran*[*], *Rashmi Kundapur*[*], *Nishanth Krishna K*[*]

Abstract

Introduction: In India, majority of the households still use biomass fuel. It is a major cause of death and disability in India.

Aims and objectives: To assess determinants of Indoor air pollution and its health hazard awareness among women in semi-urban Mangalore.

Methodology: 200 randomly selected households were recruited in two villages of Mangalore. A standard, structured questionnaire was administered after taking informed consent. Descriptive analysis of household area, cooking fuel usage, smoking status was done.

Results: Of the participants, mean age was 45.22 with standard deviation of 11.36 years and mean time spent in kitchen in a day was 3.4 hours with standard deviation of 0.80. 64.2% of the houses lack cross ventilation and 72.5% of houses had tiled roofs. 17.9% were using *chullah* as cooking media and firewood, sawdust as cooking fuel. Regarding hazards of indoor air pollution, over half (50.9%) of women were unaware of it and among those who were aware, only 37.6% knew that indoor air pollution causes respiratory symptoms. Around 57.3% participants replied that their respiratory complaints increased on exposure to smoke. Of those who complain of respiratory symptoms, 49.0% are women. Almost three-fourth (72.5%) houses were tobacco smoke-free.

Conclusion: participants' residence, pattern and fuel use were the probable determinants of exposure to indoor air pollution. Knowledge regarding ill effects of indoor air pollution (IAP) varied among women. The present study is limited to small sample size. Further studies with a large sample size are required to conclude the above findings.

Keywords: Tiles, Pollution, Biomass fuel, COPD, Chullah.

Introduction

Indoor air pollution (IAP) resulting from the use of solid fuels (wood, crop residue, animal dung, coal) for cooking and heating is a significant public health concern in developing countries where a substantial proportion of population relies exclusively on such fuels. In these areas, it has been estimated that IAP resulting from the combustion of solid fuels may be one of the leading contributors to the global burden of disease, among environmental risk factors.[1-3] In developing countries, the problem of IAP far outweighs the ambient air pollution. There are four principal sources of pollutants of indoor air:[4] (i) combustion, (ii) building material, (iii) the ground under the building, and (iv) bio-aerosols. In developed countries, the most important IAPs are radon, asbestos, volatile organic compounds, pesticides, heavy metals, animal dander, mites, molds, and environmental tobacco smoke. However, in developing countries the most important IAPs are the combustion products of unprocessed solid biomass fuels such as wood, dung, and crop residues.[5]

[*]Department of Community Medicine, K.S Hegde Medical Academy, Nitte University, Deralakatte, Mangalore-575018, Karnataka, India. ***Correspondence to***: Dr Santhosh N Poojary, K.S Hegde Medical Academy, Nitte University, Deralakatte, Mangalore-575018, Karnataka, India. ***E-mail Id:*** santu15july@gmail.com

Burning biomass in open-fire stoves and often with little ventilation, emits smoke containing large quantities of harmful pollutants, with serious health consequences for those exposed, particularly women involved in cooking and young children spending time around their mothers. Several recent studies have shown strong associations between biomass fuel combustion and increased incidence of chronic bronchitis in women and acute respiratory infections in children. In addition, evidence is now emerging of links with a number of other conditions including asthma, tuberculosis, low birth weight, cataract, and cancer of upper airways. Worldwide, exposure to smoke emissions from the household use is estimated to result in 1.6 million deaths annually.[6]

In India, out of 0.2 billion people using fuel for cooking, 49% use firewood; 8.9% cow dung cake; 1.5% coal, lignite, or charcoal; 2.9% kerosene, 28.6% liquefied petroleum gas (LPG); 0.1% electricity; 0.4% biogas and 0.5% any other means.[7]

While most media attention has focused on outdoor air pollution in the last few years, IAP is typically underreported and less regulated than its counterpart. The relationship between exposure to IAP and many health outcomes in children and home makers and adults has been examined closely in the epidemiological and experimental literature. Many literature reviews have been published by national and international organizations, as well as by researchers within the field. This study extends to know the determinants of IAP and its health hazard awareness among the rural population of coastal state in southern India.

Methods

The present study is a cross-sectional survey, which was executed in two villages of coastal state in southern India which is geographically and culturally similar to other coastal regions of South India. The study was conducted between May and June 2015. All the adult women, aged above 18 years were considered for the study. Women who were not available for the study during two separate visits on different days were excluded from the study. Ethical clearance was obtained from institutional ethical review board. Prior to study, village data (house list) was taken from village panchayat. Sample size was calculated from a previous similar study[8] and the sample size came to 200 households. From this sample size, 100 households from each village were selected by simple random method. The women involved in cooking were interviewed after taking informed written consent. The survey was done by using a structured questionnaire which was specifically constructed for the study and translated into Kannada, the local language. The tool consisted of close-ended questions related to demographic details, Characteristics of kitchen fuel used, usage, priority of fuel use, and IAP health hazard awareness. Validation of questionnaire and linguistic validation was done. The data so obtained were entered into Microsoft Excel and analyzed by rates, proportions and descriptive statistics using SPSS software version 16.

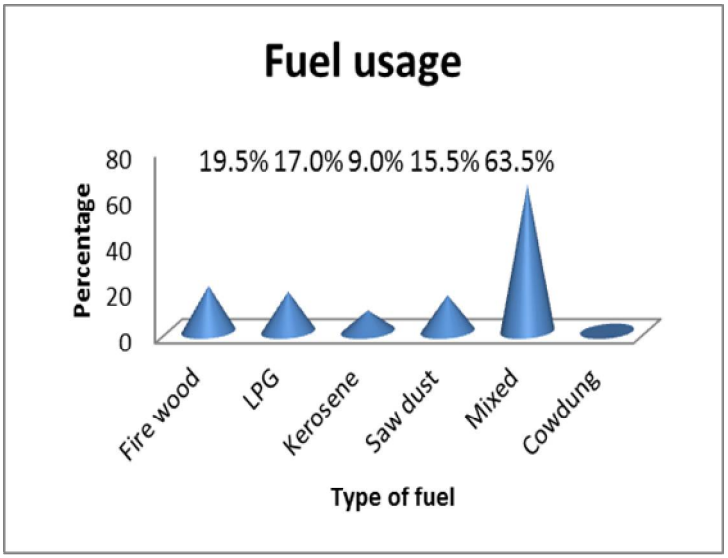

Figure 1.Household Fuel Usage

 ISSN: 2454-325X

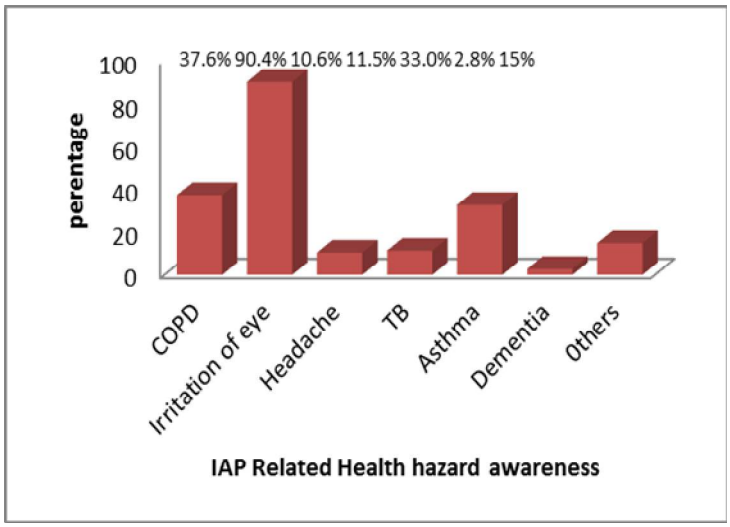

Figure 2.IAP-related Health Hazard Awareness

Characters	Respiratory symptoms			
	Yes	No	Total (%)	P value
Level of hearth				
Low	98 (60.8)	63 (39.1)	161 (80.5)	<0.001
High	31 (96.8)	1 (3.12)	39 (18.5)	
Chimney/exhaust fan in kitchen				
Yes	6 (66.6)	3 (33.0)	17 (18.5)	0.98
No	125 (68.3)	58 (31.6)	183 (91.5)	
Cross ventilation				
Yes	40 (71.4)	16 (28.5)	56 (28.0)	0.38
No	91 (65.0)	49 (35.0)	144 (72.0)	
Awareness regarding IAP				
Yes	71 (63.9)	40 (3.6)	111 (55.5)	0.61
No	60 (67.4)	29 (32.5)	89 (44.5)	
Smoking history among households (passive smoking)				
Yes	64 (76.1)	20 (23.80)	84 (42.0)	0.007
No	67 (57.7)	49 (42.2)	116 (58.0)	
Fire wood use				
Indoor	67 (77.0)	20 (22.9)	87 (43.5)	0.003
Outdoor	64 (56.6)	49 (43.3)	113 (56.5)	
Outdoor fire wood smoke enter inside the house				
Yes	82 (81.1)	19 (18.8)	101 (50.5)	<0.001
No	45 (50.5)	44 (49.4)	89 (44.5)	
Fuel usage				
Only LPG Yes	15 (44.11)	19 (55.8)	34 (17.0)	0.004
No	113 (70.1)	48 (29.8)	166 (83.0)	
Only Firewood Yes	32 (82.0)	7 (17.9)	39 (19.5)	0.015
No	99 (61.4)	62 (38.5)	161 (80.5)	
Mixed fuel Yes	84 (66.1)	43 (33.8)	127 (63.5)	0.801
No	47 (64.3)	26 (35.6)	73 (36.5)	

Table 1.Selected Determinants of IAP and Respiratory Symptom Exacerbation among Households

Results

Mean age of the participants was 45.22 with standard deviation of 11.36 years and mean time spent in kitchen in a day was around 3.4 hours with standard deviation of 0.80. 64.2% of the houses lack cross ventilation and 72.5% of houses had tiled roofs. 17.9% used predominantly *chullah* as cooking media and 35% of the households used traditional fuel (firewood, sawdust, coconut shell, and agricultural waste) as cooking fuel. On an average 2.3 with standard deviation of 0.55 times per day, women engaged in cooking and 1.1 with standard deviation of 0.45 times daily used firewood as a fuel. Only 26.0% of the study households exclusively used clean fuels such as kerosene and liquefied petroleum gas. Regarding hazards of indoor air pollution, 50.9% of the women were unaware of it and among those who were aware, only 37.6% knew that indoor air pollution causes chronic respiratory illness. Around 57.3% participants replied that their respiratory complaints increased on exposure to smoke. Those who complained of respiratory symptoms, 49.0% were women. Almost three-fourth (72.5%) of the houses were tobacco smoke-free.

Discussion

A study conducted by Yogeshgopal et al.[8] showed that prevalence of 100%. None of the kitchens had improved stoves with the presence of outlet pipeline. The average cooking hours for a day were 5.6 hours.[8] Upon analyzing, data it was found that only 35.0% were dependent on traditional biomass. Most of the houses were using clean fuel and, on an average, cooking hours for a day were 2.8 hours. It clearly states that a wide variety of cooking practices and food habits and availability of fuel vary from one geographical area to another, and their respective climatic conditions. Thus, the focus should be on these aspects while formulating any policies and acts and deciding alternative sources for cooking.

A study by Osagbemi[9] concluded that in their study 81.3% of respondents were aware of the hazards associated with IAP, whereas in the present study, over half of the women were unaware of IAP (55.5%). This shows the need for widespread campaigns in order to raise awareness among the community members about IAP and its effects to complement their attitude and practices.

The prevalence of clean fuel use was rare in the villages in Andhra Pradesh[10] but compared to this study, among the present study population, 26% households used clean fuel which clearly tells that sociocultural and housing design differences may thus contribute to regional differences in exposure in addition to type of fuel and stove combinations.

Though most of the studies have considered the use of traditional fuel use as the major contributing factor for IAP, there are a few studies from Bangladesh[11,12] which have shown that the materials used to build the house and presence of chimney in the kitchen can be also a major contributing factor for IAP.[9,10] The authors also came up with a similar finding. Out of the entire sample, in 80.5% houses with a low hearth, respiratory complaints exacerbated in 60.8% (P<0.001).

A study by Dutt et al.[13] concluded that cough and breathlessness were higher among biofuel users (p<0.05 for biofuels compared with LPG). This study also highlights similar findings; the difference was statistically significant (P=0.004) between biofuel and exclusively LPG users with 44.0% and 82.0% respectively.

According to Behera and Jindal,[14] higher occurrence of respiratory symptoms and lower lung function was seen in biofuel users compared to LPG or kerosene users, whereas, in this study the authors found that though more women (N=127) using mixed fuels (firewood, saw dust, LPG, kerosene, and coconut shell) reported that their respiratory symptoms increase on exposure to indoor smoke than women using only LPG (44.11%), the differences were not statistically significant (P=0.81), which may be due to that respiratory symptoms, being subject to a person's perception, were not correctly replied or observed by the participants

One of the striking results which the authors got was that out of 200 females, 40.2% females gave history of exposure to passive smoking in their home and among these 76.2% (P=0.007) women complained that their family members' respiratory symptoms increased on exposure to tobacco smoke. This shows that urgent public health measures are warranted to protect women and family members from exposure to passive smoking. Similar result was seen in a study conducted by Zhang[15] who found that women nonsmokers who lived with smoker husbands had an elevated prevalence of stroke, and prevalence increased with increasing intensity and duration of husbands' smoking.

Results in this study demonstrate the importance of prevention of IAP and increasing awareness programs through mass media, pamphlets and campaigns. We also have to attempt regular screening for health problems due to IAP. Use of clean fuel or alternative ways of fuel usage which cause less pollution should be

 ISSN: 2454-325X

advertised. Efforts should be made to give subsidy to clean fuel users, especially to those who are below poverty line.

The main study limitations include failure to investigate pulmonary function outcomes with respect to IAP and passive smoking.

Conclusion

Participants' residence, pattern and fuel use were the probable determinants of exposure to IAP. Knowledge regarding ill effects of IAP varied among women. The present study is limited to a small sample size, and if performed on a large sample size, could result in a better analysis.

Acknowledgment

The authors are grateful to the women who took part in this study.

Conflict of Interest: Nil

References

1. Sapkota A. Indoor air pollution from solid fuels and risk of hypopharyngeal/ laryngeal and lung cancers: A multicentric case-control study from India. *International Journal of Epidemiology* 2008; 37: 321-28.
2. Ezzati M, Lopez AD, Rodgers A et al. Selected major risk factors and global and regional burden of disease. *Lancet* 2002; 360: 1347-60.
3. Office of the Registrar General of India, Ministry of Home Affairs. Census of India. New Delhi, India. 2001.
4. Smith KR. National burden of disease in India from indoor air pollution. *Proc Natl Acad Sci, USA*. 2000; 97: 13286-93.
5. Behera D. Health effects of indoor air pollution due to domestic cooking fuels. *Indian J Chest Dis Allied Sci* 1995; 37: 237.
6. Das D. Income levels and transition of cooking fuel among rural poor in India. *Energy Science and Technology* 2012; 4(2): 85-91.
7. Kankaria A. Indoor air pollution in India: Implications on health and its control. *Indian J Community Med* Oct-Dec 2014; 39 (4): 203-207.
8. Yogeshgopal P. The assessment of indoor air pollution associated with household fuel use in Bagalkot district, Karnataka, India. *Global Journal of Medical and Public Health* Apr 2012; 1(2).
9. Osagbemi G. Awareness, attitude and practice towards indoor air pollution (IAP) amongst residents of Oke-oyi in Ilorin. *The Internet Journal of Epidemiology* 2009; 8(2).
10. Balakrishnan K, Parikh J, Sankar S et al. Daily average exposures to respirable particulates matter from combustion of biomass fuels in rural households of southern India. *Environ Health Perspect* 2002; 110: 1069-75.
11. Dasgupta S, Huq M, Khaliquzzaman M et al. Improving indoor air quality for poor families: A controlled experiment in Bangladesh. The World Bank Development Research Group Sustainable Rural and Urban Development Team, Dec 2007.
12. Dasgupta S, Huq M, Khaliquzzaman M et al. Improving indoor air in rural Bangladesh: Results of controlled experiments. ESMAP-Knowledge exchange series. Mar 2009.
13. Dutt D. Effect of indoor air pollution on the respiratory system of women using different fuels for cooking in an urban slum of Pondicherry. *The National Medical Journal of India* 1996; 9(3).
14. Behera D, Jindal SK. Respiratory symptoms in Indian women using domestic cooking fuels. *Chest* 1991; 100: 385-88.
15. Zhang X, Shu XO, Yang G et al. Association of passive smoking by husbands with prevalence of stroke among Chinese women nonsmokers. *American Journal of Epidemiology* Aug 2004; 161(3).