DOI: 10.7860/JCDR/2013/4326.2748

The Respiratory Health of Rural Indian Women: Does the Domestic Cooking Fuel Really Matter?

NEELAM D. SUKHSOHALE, UDAY W. NARLAWAR, SURESH N UGHADE

Dear Sir,

It is noteworthy that the air pollution in big cities creates headlines, but in many rural areas of the developing countries, the indoor air pollution is an even more serious health problem. The provision of air that is safe to breathe is just as important as safe water or food. Yet many millions of people, predominantly women, in the poor and developing countries, are obliged to breathe air that is heavily polluted with biomass emission products, which is a well-recognized source of acute as well as chronic morbidities that primarily affect the lungs [1, 2]. Poverty condemns half of the humanity to cook with solid fuels on inefficient stoves. As a cause of the ill health in the world, indoor air pollution ranks behind only malnutrition, AIDS, tobacco, and poor water or sanitation. The smoke in homes from these cooking stoves is the fourth greatest risk factor for death and disease in the world's poorest countries, and has been linked to 1.6 million deaths per year [3]. Yet the international community has largely neglected it. This report calls for global action to fight the killer in the kitchen – the smoke from the cooking stoves.

We conducted a community based, cross-sectional study in the Raipura village (with a total population of 7635 as per the census of 2001) of Hingna tehsil, Nagpur district in central India, with the objective of assessing the relationship between the type of cooking fuel and the airway reactivity in rural Indian women who were involved in household cooking with four different kinds of cooking fuels; 252 used biomass, 73 used kerosene stoves, 192 used Liquefied Petroleum Gas (LPG) and 243 used mixed fuels (a combination of two and more cooking fuels). The eligibility criteria for this study were 1) age ≥ 15 years 2) the principal cook of the family and 3) non-smokers. The Exposure Index (EI) i.e. the average time per day which is spent near the fireplace multiplied by the years of exposure, was calculated [4, 5]. The Peak Expiratory Flow Rate (PEFR) was measured in litres per minute according to the standards which were recommended by the American Thoracic Society [6]. The observed PEFR was calculated on the basis of the age in years and the height was measured in centimetres. Whereas, the predicted values for the PEFR in females were calculated as 3.310*height (cms) – 1.865*age (years) – 81.0 [7]. The airway reactivity was defined as a PEFR of less than 80% of the predicted value. The data was analyzed by using the Analysis of Variance (ANOVA) and multivariate logistic regression (MLR) models by using the statistical software, STATA version 10.1. The results showed that a high prevalence of airway reactivity was found in the biomass users [109 (43.3%)] as compared to that in the other groups. The mean observed PEFR showed a declining trend with an increase in the age, the duration of cooking and the exposure index in all the fuel users. The overall logistic regression model, when it was taken together, revealed that in the observations of a total of 760 study subjects; the age, the cooking fuel and the exposure index were significant predictors of the abnormal PEFR. Whereas no significant association was found between an abnormal PEFR and height [Table/Fig-1(a)]. However, a result of the subgroup analysis with the type of cooking fuel revealed that in the mixed fuel users; age [OR - 2.08, 95% Confidence Interval (CI) 1.32 - 3.28, P 0.00], height (OR -1.06, 95% CI 1.00 - 1.12, P 0.02) and the exposure index (OR -2.74, 95% CI 1.68 - 4.47, P 0.00)

Overall model (N= 760)	Outcome variable	Predictors	OR	95 % Confidence interval (CI)	P value
	Airway reactivity	Age	1.40	1.13-1.72	0.001
		Height	1.02	0.99-1.05	0.067
		Exposure index	2.39	1.85-3.08	0.000
		Cooking fuel	1.52	1.27-1.80	0.000

[Table/Fig-1(a)]: Results of logistic regression analysis showing association between airway reactivity and different predictors.

Overall model (N = 760)	Outcome variable - Airway reactivity											
	Number of study subjects											
Predictors	Biomass (Group I) (n = 252)			Kerosene (Group II) (n = 73)			LPG (Group III) (n =192)			Mixed (Group IV) (n = 243)		
	OR	95 % CI	P value	OR	95 % CI	P value	OR	95 % CI	P value	OR	95 % CI	P value
Age	1.23	0.90-1.67	0.18	1.02	0.45-2.31	0.94	1.44	0.90-2.28	0.11	2.08	1.32-3.28	0.00
Height	1.00	0.96-1.04	0.70	1.01	0.91-1.12	0.79	1.03	0.97-1.10	0.20	1.06	1.00-1.12	0.02
Exposure index	1.83	1.25-2.68	0.00	2.1	0.74-6.41	0.15	3.79	2.10-6.81	0.00	2.74	1.68-4.47	0.00

[Table/Fig-1(b)]: Results of subgroup analysis by type of cooking fuel.

were significant predictors of the airway reactivity. Whereas in the biomass and the LPG users, only the exposure index was found to be the significant predictor of the airway reactivity (P<0.05) and no significant association was found between the airway reactivity and the various predictors in the kerosene users (P>0.05) [Table/Fig-1(b)]. Thus, mixed fuel seems to be more deleterious in the impairment of the respiratory health of the rural Indian women, after robustly adjusting for the confounding variables, as was evident by a significant association of the airway reactivity with it. Similar findings as ours were reported in studies which were carried out in north India [4, 5]. While the precise mechanism of how the exposure causes an impairment in the lung function is still unclear, it is known that the small particles and several of the other pollutants which are contained in the indoor smoke cause inflammation of the airways and lungs and impair the immune response. Carbon monoxide also causes systemic effects by reducing the oxygen-carrying capacity of the blood. Oxidative stress may also be a component, as oxidizing radicals are present in the biomass smoke and are also released by the inflammatory cells [1].

REFERENCES

[1] World Health Organization. In :Bruce N, Perez-Padilla R, Albalak R, editors. The health effects of indoor air pollution exposure in developing countries. *Protection of the Human Environment Geneva.* 2002; 5-10.

[2] Perez-Padilla R, Schilmann A, Riojas-Rodriguez H, Respiratory health effects of indoor air pollution. *Int J Tuberc Lung Dis.* 2010;14:1079-86.

[3] Viegi G, Simoni M, Scognamiglio A, Baldacci S, Pistelli F, Carrozzi L, et al. Indoor air pollution and airway disease. *Int J Tuberc Lung Dis.* 2004;8:1401-15.

[4] Behera D, Jindal SK, Malhotra HS. Ventilatory function in non smoking rural Indian women using different cooking fuels. *Respiration.* 1994;61:89-92.

[5] Behera D. An analysis of effect of common domestic fuels on respiratory function. *Indian J Chest dis Allied Sci.* 1997;39:235-43.

[6] Bosse CG, Criner GJ. Using spirometry in the primary care office. A guide to technique and interpretation of results. *Postgrad Med.* 1993;93:122-24,129-30,133-36 passim.

[7] Ranga Rao TV, Sinha VN, Lanjewar P, Specialized training programme on occupational and environmental medicine. 2002, New Delhi: Ministry of Labour, Government of India.

AUTHOR(S):

1. Dr. Neelam D. Sukhsohale
2. Dr. Uday W. Narlawar
3. Dr. Suresh N. Ughade

PARTICULARS OF CONTRIBUTORS:

1. Assistant Professor, Department of Preventive and Social Medicine. IGGMC Nagpur, India.
2. Associate Professor, Department of Preventive and Social Medicine, Government Medical College, Nagpur, India.
3. Statistician, Department of Preventive and Social Medicine, Government Medical College, Nagpur, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Neelam Damodar Sukhsohale,
Assistant Professor, Department of Preventive and Social Medicine, Indira Gandhi Government Medical College,
Central Avenue Road, Nagpur-18, India
Phone: 09960390868
E-mail: bkdrneelam@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS:
None.

Date of Submission: Mar 22, 2012
Date of Peer Review: Aug 15, 2012
Date of Acceptance: Nov 24, 2012
Date of Publishing: Feb 01, 2013