RESEARCH ARTICLE

STUDY OF TRADITIONAL CHULHA, SMOKE EXPOSURE AND EFFECT ON HEALTH IN BELVAI VILLAGE (BANDA DISTRICT) - A CASE STUDY

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ARTICLE INFO	ABSTRACT
	Exposure to household wood smoke for longer duration and using traditional cook stoves and fuels is a risk factor for chronic lung diseases among women and young children in the kitchen premises with their mother's in developing countries. Now the social scientists have recently begun to pay closer attention to this issue and to test strategies for reducing indoor air pollution. In this paper the results of the survey of types of traditional cook stoves and fuel consumption effecting the people's health have been given. Also how long or how many hours the person responsible for cooking is exposed to the indoor air pollution / smoke produced by the biomass fuel. After the survey of 150 families in Belvai results clearly show the maximum number of families i.e. 80.66% families use traditional chulha's / cook stoves and LPG is used only by 3.33% families which is a clean and safe method of cooking whereas 0.66% families use both the methods of cooking. Dungcake, Wood, Coal, Kerosene, Agricultural waste were identified as types of fuel consumed. Maximum exposure duration is of 1 to 2 hours per day i.e. 52.66% families are exposed for 1 to 2 hours in front of the cook stoves while families who spend longer duration i.e. 3-4 hours are only 10% . Among the total diseased population of 150 families 62.74% were suffering from diseases like cold, headache, vomiting, viral etc and the percentage of people having lung and eye infection were 5.88% and 31.37% respectively. This paper will also reveal all the variables directly or indirectly related to the health effects of the fuel consumed by the villagers.

INTRODUCTION

Biomass fuels are extensively used for cooking and home heating in developing countries and have adverse health effects. On the global scale, the use of solid fuels in traditional chulhas is the most important source of indoor pollution. According to the studies conducted by Bruce *et al*. (2000) and Hong, WHO (1995) recent estimates 1.5 to 2 million deaths per year, most of them nearly 1 million occurring in children younger than 5 years due to acute respiratory infections (ARI), also in women due to chronic obstructive pulmonary disease (COPD) and lung cancer. Today, indoor air pollution, due to traditional chulha, ranks 10th among preventable risk factors contributing to global burden of disease. Half of the world's population uses traditional chulha / methods (solid fuels, coal and biomass) Desai *et al*. (2004) and Rehfuess *et al*. (2006). The persistent use of the cost of energy has prompted an increasing number of households to use wood or any other biomass product for heating. In addition there are worldwide transient exposures to the products of biomass combustion

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during forest fires. A wide range of factors including affordability and awareness of the household and availability of a particular fuel influence the household's choice of fuel. Vishwanathan and Kumar (2003) while analyzing trends in cooking fuel consumption by means of traditional cook stoves have identified significant spatial and rural urban differences and showed income as one of the main determinant of biofuel consumption. Chaudhuri and Pfaff (2002) studying emission from cooking fuels used by the households in Pakistan found evidence for the existence of Environmental Kuznet's curve (EKC), which shows the relationship with the pollution increase and decrease with economic growth. The prevalence of cataract is higher in females than in males in developed and developing countries. Epidemiological studies have established certain risk factors for cataract formation particularly age exposure to UV-B radiation (sunlight) Hiller *et al*. (1997), smoking Brilliant *et al*. (1983), diabetes Rowe *et al*. (2000) severe diarhoea and malnutrition Minassian *et al*. (1984), lower socioeconomic status and lower education and occupation Foster *et al*. (2003). Three epidemiological studies have provided some evidence of an association between cataract / blindness and exposure to indoor smoke from household use of traditional fuels such as animal dung, wood and crop residues. The first study to find an association

between cataract and indoor smoke exposure by Mohan *et al* (1989) was not specifically investigating this association and regarded it as an incidental finding. The second case and control study by Zodpey and Ughade (1999) found an association between cataract and cheaper cooking fuels (Coal, cow dung and wood). The third study found an association between biomass fuel use and partial and complete blindness (NFHS 1992 - 93). This article presents information about the exposure time per day to biomass fuels, distance covered to collect the fuel, types and sources of traditional fuels, ventilation status of the kitchen premises, the socioeconomic conditions and the occupation of the residents of village Belvai.

Background

Use of traditional methods of cooking is not only in a specific region, but its use is worldwide. Close to 50% of the world population, around 3 billion people, use biomass fuels as their primary source of domestic energy for cooking, home heating and light, ranging from near 0% in developed countries to more than 80% in China, Indian and sub - Saharan Africa Smith *et al*. (2004) Jaakkola,MS and Jaakkola JJ (2006). The current socioeconomic situation in many developing countries suggests that use of biomass fuels will continue in the coming decades. In these countries, nearly 2 billion kg of biomass are burned everyday Barnes DFOK *et al* (1994). In rural India, nearly 90 % of the primary energy is derived from biomass (wood 56%, crop residues 16%, dung cake 21%. The total annual average of wood production used for fuel in developing countries increased approximately 16.5% over the past decade to about 1.55 billion cubic meters.

Biomass materials are considered low efficiency fuels because there are many pollutant products and they are low warming. There is a wide variation in the emission of pollutants produced when biomass is burned depending on the characteristics of combustion and cooking practices. Unfortunately, the production and the end use of biomass fuels are done under suboptimal conditions, contributing enormously to Indoor air pollution and to greenhouse gas burden Bailis *et al*. (2007). Wood smoke is a complex mixture of numerous volatile and particulate substances constituted by different organic and inorganic compounds Zelikoff *et al*. (2002), Naeker *et al*. (2007) and its composition varies with the fuel and the condition of combustion. Several health related problems have been found to be associated with the toxic effects of smoke exposure. The global burden of disease due to use of the solid fuels has been estimated taking into account, acute lower respiratory infections, (COPD) and lung cancer for which there is a strong evidence of an association with the exposure Desai *et al* (2004) and Rehfuess *et al*. (2006). ALRI s in young children account for 59% of attributed premature deaths and 78% of DALYs. COPD accounts for almost all the remaining premature deaths due to indoor air pollution, with lung cancer as a relatively minor contributor which can be important for people exposed to coal.

MATERIALS AND METHODS

To study the types of traditional cook stoves, smoke exposure and its effect on health a survey was conducted in the village Belvai, of Banda Tehsil in Banda district. 150 families were

covered to collect the data by means of a questionnaire. The selection of the village was random including 2 villages from each tehsil of the Banda district. The questionnaire consisted of all the questions about what types of traditional cook stoves or fuels are used by the villagers, how much distance do they cover to collect the fuel, from where the fuel is purchased, how long do the women or the one who cooks food is exposed to smoke in a day. What all types of methods of cooking and fuels are they using and what are the health related problems these people are suffering with. One questionnaire was filled to collect the information of one family and most of these questions were asked to the women who are generally responsible for cooking food.

RESULTS

The main focus in the paper has been given on what all types of fuels are consumed by the villagers and what all cook stoves are used by the villagers. The time of exposure while cooking and the adverse effects of the indoor air pollution on health by burning traditional biomass fuels is also included. Weekly consumption of all types of fuel in Belvai is 3044 Kg. Among which major part of fuel is 2502 Kg consumed by the APL population i.e. 562 in number and only 542 Kg is consumed by BPL population who are 97 in number among the total population (659) of 150 families. Table 1 will show % of types of fuel used in different proportion by the villagers.

Table 1. Types of traditional / Biomass fuel consumed by villagers

S.No.	Types of Fuel	Percentage
1	Wood	67.98%
2	Dungcake	19.35%
3	Coal	00.54%
4	Kerosene	1.99%
5	Agricultural waste	10.10%
6	Other	NIL

Percentage
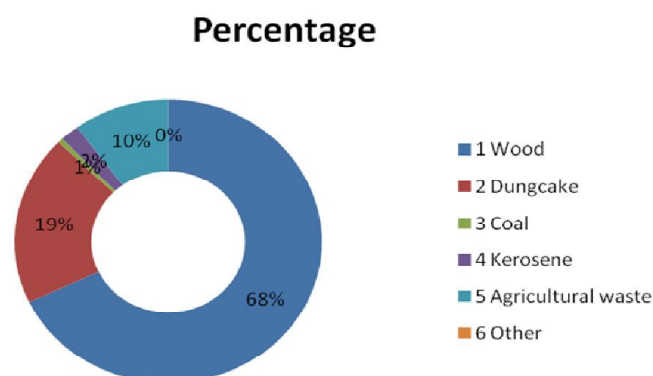
From the table / graph it is clear that wood is consumed the maximum and coal and kerosene comparatively less which are considered to be cleaner and safer methods of cooking.

People here also use LPG, heater, etc. which are the other clean and safe fuels and produce less pollution than the unclean fuels i.e. wood, dung cake, agricultural waste, etc. Some people use only clean and safe (LPG) while majority use both depending upon the availability of the fuel. Table 2 will show the different stoves used. Table 2 shows that people do not adhere to the use of only one type of cook stove, but depending on the other factors i.e. availability, cost and feasibility use one or more types of cook stoves along with the traditional chulha.

Table 2. Types of cook stoves used for cooking purpose

S.No.	Types of cook stoves	%
1	Traditional chulha	80.66%
2	LPG	3.33%
3	Chulha and LPG	0.66%
4	Chulha and Stove	11.33%
5	Chulha + Stove + LPG	NIL
6	Chulha and Sigri	2%
7	Chula + Sigri + Stove	NIL
8	Only stove	NIL
9	LPG and stove	0.66%
10	Heater and Chulha	1.33%
11	Improved Chulha	NIL

Table 3. Descriptive analysis of the characteristics related to the health problems and smoke exposure

1. AGE

S.NO.	Age Group	No. of males	No. of females	Total
1	0-5	24	23	47
2	6-14	82	54	136
3	15-25	92	70	162
4	26-60	144	122	266
5	Above 60	25	23	48
6	Total	367	292	659

2. Literacy

	No. of males	No. of females	Total
Literate	301	198	499
Illiterate	66	94	160

3. Occupation (Family Wise) Percentage

Agriculture	93.33%
Agriculture & Labour	NIL
Only Labourers	4 %
Service	NIL
Business	2 %
Agri + Business	0.66 %
Agri + Service	NIL

4. Caste Category

SC	15.02%
ST	NIL
OBC	60.24%
Other	24.73%

5. House type

Pucca house	14.66%
Kuchcha house	85.33%

6. Electricity connection

Regular connection	26.66%
Katiya Connection	16%
No connection	57.33%

7. Kitchen Location

Indoor Kitchen	68.66%
Outdoor Kitchen	30%
Both	1.33%

8. Kitchen ventilation

Ventilated	56.66%
Non Ventilated	43.33%

9. Food habits

Vegetarians	60.66%
Non vegetarians	39.33%

10. Source of fuel

Surrounding	38%
Market	54.66%
Govt Shops	3.33%
Surrounding and market	2.66%
Surrounding and Govt Shops	1.33%
Market and Govt Shops	NIL

11. Distance travelled for fuel collection

1 Km	51.33%
2 Km	8 %
3 Km	11.33%
4 Km	6 %
more than 4 Km	23.33%

12. Smoking status

Smokers (126 families)	84%
Non smokers (24 families)	16%

All these variables / factors (age, literacy. occupation etc are related to the health by one or the other way.

Depending upon the family, size, food type, the number of times meal is cooked at home and type of fuel used, exposure duration per day in hours is shown in the Table 4.

Table 4. Showing the exposure time in hours / day

S.No.	No. of hours	Family %
1	0-1 hr	10.66%
2	1-2 hr	49.33%
3	2-3 hr	33.33%
4	3-4 hr	6.66%
5	4-5 hr	NIL
6	5-6 hr	NIL

Table 5. Showing number of people infected with different types of diseases

S.No.	Types of infections/ diseases	No. of people	Percentage
1	Lung infection	3	5.88%
2	Eye diseases	16	31.37%
3	Both (eye and lung infection)	NIL	-
4	Other diseases	32	62.74%

Among 659 people belonging to 150 families 51 people i.e. 7.73% were found to be diseased and rest 608 i.e. 92.26% were healthy. The types of disease / infection is among all the age group i.e. infections are present in the children as well as adults and senior citizens. The health conditions have been found to be serious as well as normal. Among all diseased 86.27% people went to the doctor for checkup suffering from either of the problems. While rest of them 13.72% never

consulted to the doctor. This may be due to their unawareness about the seriousness of their disease or carelessness. Illiteracy in non consultancy with the doctor cannot be ruled out. Diseases like asthma, lung cancer, tuberculosis, acute respiratory diseases are lung infections which were observed whereas myopia, cataract, hypermetropia, itching of eyes, tear running eyes etc are the eye infections noticed. Other infections include headache, fits, joints / back pains, cold and cough, viral fever, vomiting by the infants sitting on mother's lap during cooking hours etc.

DISCUSSION

The results of this study confirm findings from previous studies that the risk factor of different types of diseases / infections is increased by the indoor exposure to smoke from solid cooking fuel combustion. Not only this the seriousness of disease becomes so severe in case of neglection, that it sometimes leads to death. Table 3 containing different variables in one or the other ways is associated with the health effects. Age group can be the reason to catch up any particular disease due to weakness or disability to fight with the type of infection. Besides this it is also observed that among all the categories of age group, population of females in comparison to males is less. It clearly shows that the mortality rate of females is more as they spend more time in the kitchen besides other reasons of death. Illiteracy is another factor, because still many people due to illiteracy are still unaware about the effects of types of cook stoves and fuels used. Occupation gives an idea of how much work load a person has besides the indoor pollution which can also be the reason of physical health condition.

Condition of the house ie kuccha /pucca, location of kitchen ie indoor / outdoor and ventilation also play a major role in health effects. If the ceiling of the house is made up of straw and bamboos etc (Kuchha houses) smoke goes out of it easily and also with the chimneys if present in the kitchen decreasing the indoor smoke pollution. Proper ventilation also decreases the possibility of exposure to smoke. Contrary to this if the kitchen is indoor and non ventilated, smoke will remain indoor for a longer duration increasing the risk of different infections. Electricity by means of using heater and for lighting purpose at night decreases the possibility of strain on eyes as well as lungs. Food habit is directly related to the amount of fuel consumed i.e. non veg food takes more time as well as fuel to be cooked in comparison to vegetarian food, wasting time and also the fuel. Simmilarly covering larger distances to collect the fuel effects health and time both. If the fuel is easily available people can easily give more time for other important tasks like earning and children going to school, instead of wasting time in fuel collection.

Besides indoor pollution, smoking is also a very big reason causing lung infection in the person who smokes as well as to the people around him. Use of cigarettes, bidis, hukka's and Gaanja''s are different means of smoking seriously effecting the people using them. The sex ratio of Belvai is 795 women per 1000 men which clearly indicates that besides other reasons of high mortality rates of females, long duration exposure to the biomass fuel is also the reason related to their death. As mostly females are responsible for cooking food at home regarding the other works they do.

Conclusion

In conclusion, our study confirms that the use of solid fuels in unimproved stoves accompanying the exposure of smoke and ventilation are associated with an increased risk of different infections and diseases. Biomass fuels in India according to National family health survey 2005 - 06 NFHS (IIP5 2007) is the dominant source of cooking. Currently dominant biomass energy technologies for cooking in household and institution are largely traditional chulhas i.e. mud, stove along with some metal, cement and pottery or brick stoves normally with no operating chimneys / hoods. They have low thermal efficiency i.e. poor extraction of energy contained in the fuel and significant emissions of pollutants. India's stove programme are now focusing in reducing wood consumption and smoke reduction in kitchens through chimneys. Bloom and Zaidi (2002) found that use of traditional cookstoves is significantly and positively associated with child and infant mortality, crude birth rate and total fertility population growth rate. 10% reduction in biomass fuel use would decrease the child immortality by 4.9 death / 10000 live births. The ideal data for the analysis would be the actual exposure level of individuals but very few studies have conducted personal monitoring of exposures (Schinding *et al.*, 2002). Hence more studies should be conducted in this field and more steps and suggestion should be given to avoid the use of solid biomass fuels, because this is not only affecting our health but also our environment and indirectly responsible for afforestation. If such a high demand of fuel wood will continue it will decreases the number of both fauna and floral species from the earth.

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