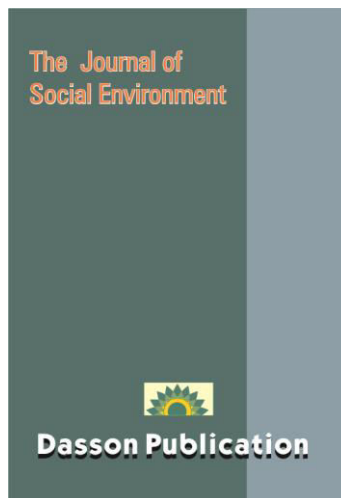


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Indoor air pollution from biomass combustion and acute respiratory infections in children under 5 year: a case study of rural household in Cooch Behar district.

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Abstract

The solid biomass is a common source of fuel, which is broadly used for cooking in rural households of developing countries of the world. The most of solid biomass fuels are wood, agricultural crops and dung cake etc which are the highly polluted fuel as well as the main source of indoor air pollution in rural areas. The present study was carried out for impact of solid biomass fuel combustion on children under 5 year. It is found that most of diseases are generated from indoor polluted air such as bronchitis, tuberculosis, asthma, eye irritation, adverse pregnancy outcomes, and skin infections, joint pain other respiratory diseases etc. The result depicts a clear correlation between acute respiratory infections in children under 5 years and solid biomass combustion in rural areas of Cooch Behar district, West Bengal. Ultimately the rural household of Cooch Behar District in West Bengal which is experiencing various types of respiratory infections in children below five year represent itself in the paper as a victim of such health degradation due to solid biomass combustion in rural cooking and seeks some remedial measures for declining the problems.

Key words: 1.Acute respiratory infections, 2.Rural cooking, 3.Rural household and 4.Solid biomass fuel combustion

Introduction:

The increasing trend of indoor air pollution coming from combustion of bio-fuel such as wood, agricultural crops and cow dung etc used by rural households in developing countries causes severe health problems especially to the children under five year nearer to his or her mother in rural kitchen. According to World Resource Institute (1999), approximately half of world population and up to 90 % rural households in developing countries are still rely on biomass fuel and about 75% Indian households are also use biomass fuel for cooking. In India about 68.84% population are from rural households where West Bengal the share of rural population is 89.75%.The most of rural households are use biomass combustion as a source of cooking for their daily life. The rural households are basically engaged in primary activities like agriculture, animal resource, dairy farming, labour wages etc and allied activities. Poverty is the dominant factor for use in bio-fuel combustion, but other important factors are traditional believes, poor literacy rate, awareness less. In sixteen countries in south and south East Asia over 2 billion people rely on bio-fuel for cooking, space heating and agro processing (United nation 2000). The use of bio-fuel combustion also released pollutants which cause acute health problems especially to women and below five year child, who are present during cooking. The most of diseases like acute respiratory infections, chronic obstructive lung diseases, lung cancer, tuberculosis etc. are the adverse effects of rural cooking in Cooch Behar district.

Literature review:

There are an enormous literature on the field of bio-fuel combustion as source of indoor air pollution and its wide-spread effects on women and below five year child. A related study in Gambia focuses that infants who were exposed to smoke by being carried on their mother backs during cooking were nearly three times more likely to develop significant cases of acute respiratory infection. Another similar study in Colombia expresses that women cooking over open fires had almost four times more chronic lung disease compared to those cooking in other manner (Partik, 1996). A study in Tanzania finds that children then five years who died at acute respiratory infections were almost three more likely to be sleeping in a room with an open clock stove than healthy children in same age group. Another study in India, Nepal and Papua New Guinea show that non-smoking women, who have cooked on biomass stoves for many years exhibit a higher prevalence of chronic lung disease. A study in Japan delves into high rates of cancer among women who had previously used wood as fuel. The risk of cancer is high in Chinese women exposed to coal smoke in homes. Likewise a study in Africa encompasses that cooking with wood greatly increased the risk of stillbirth. Considerable amount of carbon monoxide have been detected in the bloodstream of women cooking with biomass in India and Guatemala (World Bank, 2000).

It has been estimated that about half a million women and child die each year from air pollution in India. Compared to other countries India has among the largest burden of disease due to the use of dirty household fuels and 28 percent of all death due to indoor air pollution in developing countries occurring to India. (Smith 2000). Assessment of the burden of disease attributable to use of bio-fuels use in the Indian have put the figure in 3% -5 % of the national burden of disease (Smith 2000b, Smith and Mehta 2003)

Association between exposure to indoor air pollution and increased incidence of chronic bronchitis in women and acute respiratory infections in children have been documented (Armstrong and Campbell 1991, Bruces et al, 1998, Ezzati and Kammen 2001, robin et, al. 1996). Many recent studies have also been conducted in rural Indian villages (Awashthi et. al. 1991, Mishra and Rether ford 1997, smith 1993, Smith 1996)

A recent study has also characterised exposure response relationship between biomass smoke exposure and acute respiratory infections in children of rural Kenyan households (Estate et. al. 2000a)

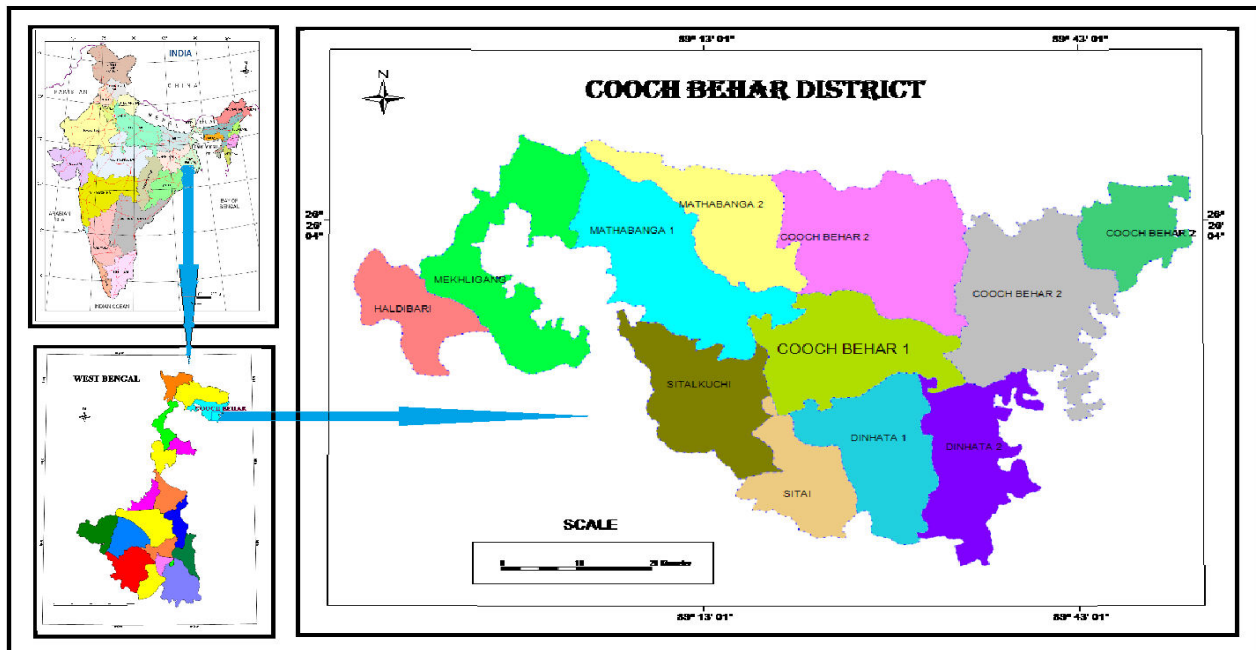
The incidence of chronic obstructive pulmonary disease in non-smoking using biomass for cooking has also been shown to be dependent on the number of years cooking with bio fuels and often to be comparable to that of men who usually have high smoking rates. Based on this evidence, it has been estimated that the indoor air pollution contribute to 3-5% other causes as well, it is difficult, lengthy, and of the national burden of disease in India (Smith 200b)

The epidemiological studies has provided some evidence of an association between cataract and blindness and exposure to indoor smoke from household use of solid bio fuels such as animal dung, wood crop residues (Mishra et. al. 1999, Zodpey and Ughad 1999) The study of Zodpey and Ughad (1999) found an association between cataract and cheaper fuels such as coal cow dung and wood presented limited data on potential confounding factors, others than age and socioeconomic status. The use of bio fuels cause a number of respiratory problems, which include acute respiratory infections in children, chronic obstructive lung disease in non smokers (Samet et. al. 1987). It has also been implicated as a risk for cancer in women (Gao 1996, and Du 1996). The present study is carried out to examine the health impacts pollutants coming from rural cooking in Cooch Behar district is a serious thinking issue, which are of special interest in the researchers, planners, and govt. and non-govt. agencies.

Study area:

Cooch Behar district is situated north eastern part of West Bengal. Cooch Behar district bounded by the district of Jalpaiguri in the north and north-west, state of Assam in the east and the international border in the form of Indo-Bangladesh boundary in the south and south-west. Geographical location of Cooch Behar district lies between $25^{\circ}57'47''$ to $26^{\circ}36'20''$ N latitude and between $88^{\circ}47'44''$ and $89^{\circ}54'35''$ E longitude. The total area of the district is 3387 sq km, which have 2530.63 sq km in agricultural area and 56.99 sq km in forest area. The district of Cooch Behar has a moderate type of climate characterised by heavy rainfall during the monsoon and slight rainfall in the month of October to mid-November. The summer season is from April to May with April being the hottest month with mean daily maximum of 32.5°C and mean daily minimum of 20.2°C . The winter season lasts from late November to February, with January being the coldest month with temperature ranging from 10.4°C to 24.1°C . The recorded temperature minimum is 3.9°C and respective recorded maximum is 39.9°C . The atmosphere is highly humid throughout the year, except the period from February to May, when the relative humidity is as low as 50 to 70%. The rainy season lasts from June to September. The district's average annual rainfall is 3201 mm.

Location map of the study area



Materials and method:

A self made questionnaire has been prepared and surveyed to evaluate the impacts of biomass combustion from rural cooking on children under five year. The survey was based on personal interviews of people located in 12 villages during March 2012 to August 2012. Total hundred respondents, both men and women and below five year child living in surrounding 12 villages among different blocks of Cooch Behar district were asked about their cooking fuel types, time span in kitchen, space in kitchen, and the problems faced by their kitchen and which types of diseases they faces in their areas. They were also responded that the various types of health effects like bronchitis, tuberculosis, asthma, eye irritation, adverse pregnancy outcomes, and skin infections, joint pain other respiratory diseases in villagers. The secondary data's like Location map and demographic data are collected from Cooch Behar District official Website and census of India

2001 and 2011. Acute respiratory infection data are collected from Survey Report of the CSSSC-UNICEF Social Inclusion Cell, October 2010 and questionnaire also.

Results and discussion:

Sample distribution of women and children under five year about the impact of rural cooking in Cooch Behar District.

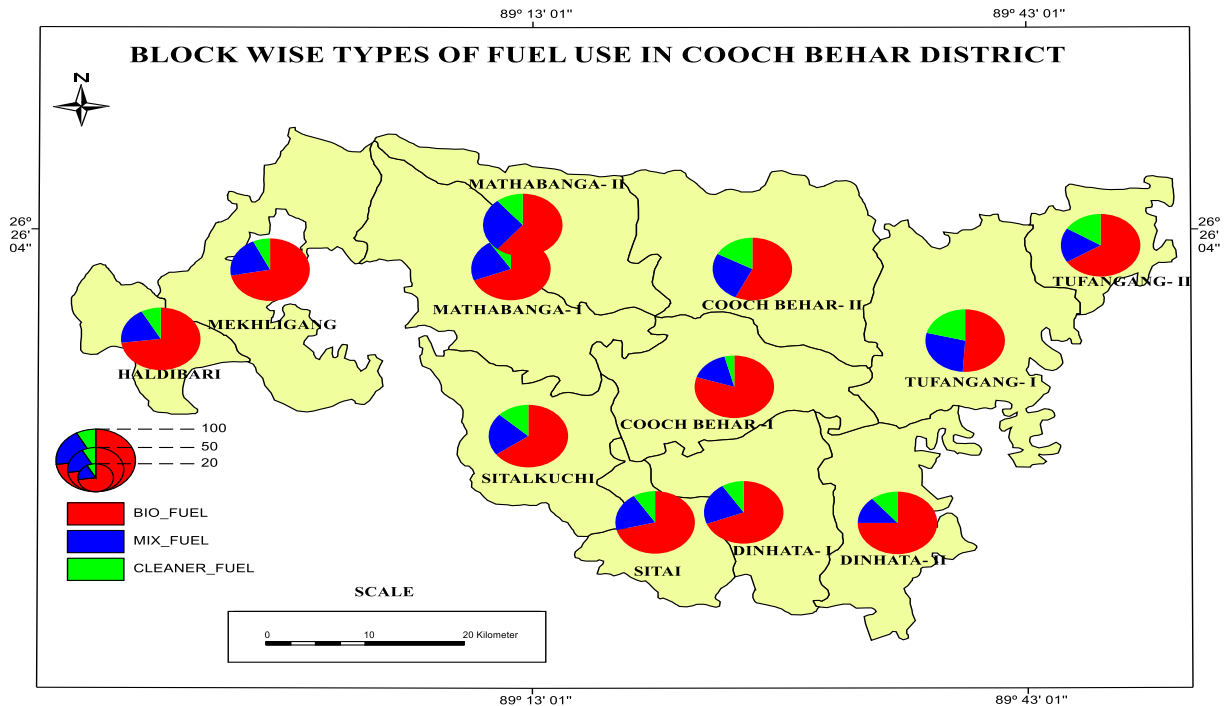
Characteristics	Parameters	No. Of Respondents in %
House Types	a) Pucca	13
	b) Semi Pucca	29
	c) Kachha	58
Separate kitchen in house	a) Yes	29
	b) No	71
Total no. of Chula	a) 1	37
	b) 2	56
	c) More than 3	7
Cooking fuel types	a) Bio fuel	68
	b) Fuel mix	33
	c) Cleaner fuel	9
Frequency of cooking	a) 2 times	14
	b) 3 times	59
	c) 4 times	27
Ventilation mechanism in house	a) Yes	9
	b) No	81
Total no. of women in a house	a) 1	49
	b) 2	34
	c) More than three	17
Total no. of children (below five year)	a) 1	5
	b) 2	19
	c) 3	41
	d) More than 3	33
Mothers age at children birth	a) 13- 24	43
	b) 25-34	39
	c) 35-49	18
Mothers education	a) Illiterate	30
	b) Literate, Middle, Complete	65
	c) Middle complete or higher	5
Total member in a house	a) Less than 3	2
	b) 3-5	24
	c) More than 6	74
Total earning member in a house	a) 1	61
	b) 2	34
	c) More than 2	5
Standard of living	a) Low	27
	b) Medium	64
	c) High	9
	a) Below 5 thousand	9
	b) 5- 10 thousand	37

Total income in Rs (monthly)	c) 10-15 thousand	41
	d) More than 15 thousand	13
Concept about indoor air pollution	a) No Idea	79
	b) Not Clear	18
	c) Clear Idea	3
Suffered from acute respiratory infections	❖ Yes	79
	❖ No	18
Reasons for not using cleaner fuel	a) Lack of availability	29.6
	b) Costly	50.31
	c) Not willing to use	12.60
	d) Anxiety of using	5.00
	e) Taste of food Change	3.49

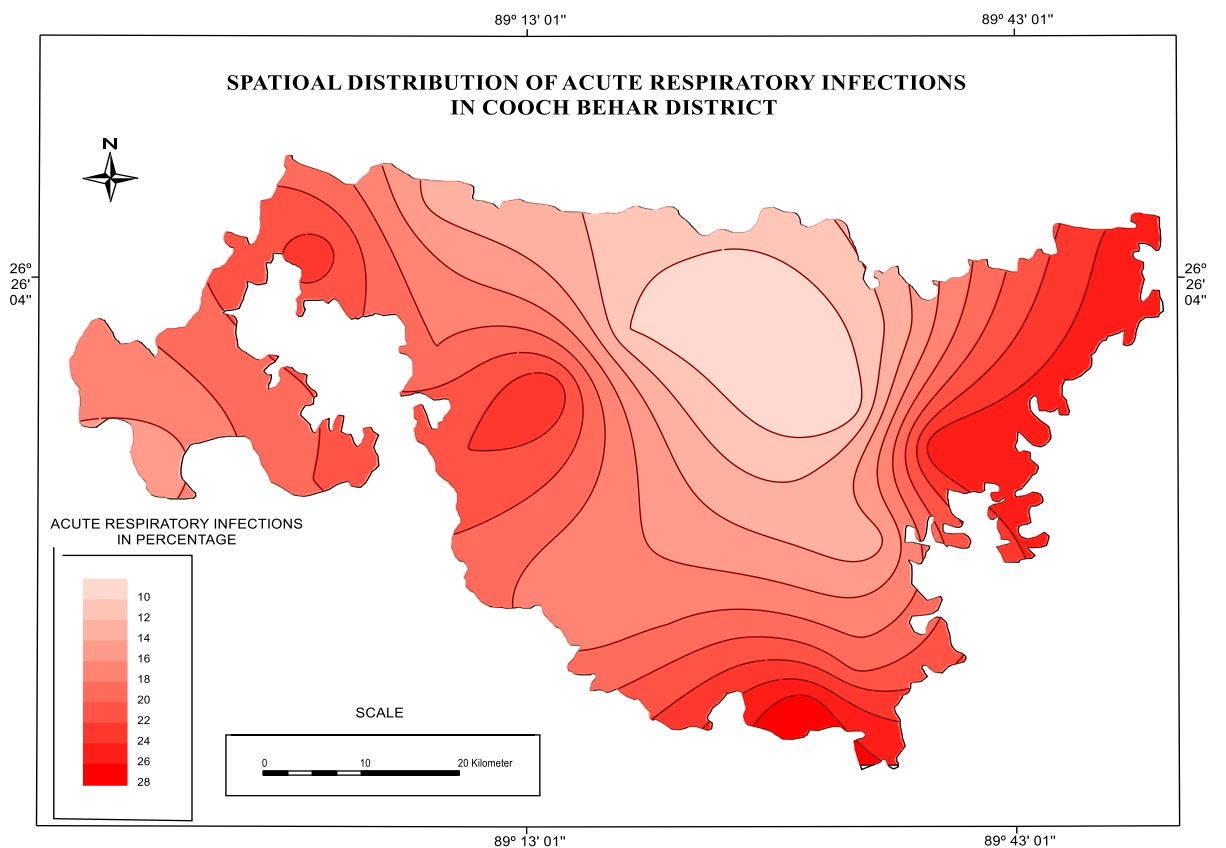
Pucca houses are found in 13% where as semi pucca and kachha types are 29% and 58% respectively. Most of cases there is only one room hut are found where 71% cases kitchen are not separated from bed room. The economic is mostly of primary types where maximum no of villagers are use 2 chula in their kitchen but comparatively 3 to 4 chula found very less in number. The study reveals that most of household are cook (59%) thrice meals a day, only 14% household are cook once. In general the rural households are one room based house and there was no nay ventilation system available. The total population of Cooch Behar District is 2,822,780 where as total 89.75% population are lives in rural areas of villages. According to total no. of female in a house only single women are found in 49% but double and more women are found in less percentage.

The result of the survey show that 50.31% of households are thinks that the cleaner fuels are so much costly in comparison to bio-fuels. Only 29.6 % are responded that there is a lack of availability of cleaner fuels. But 12.6% are not willing to switch over to accept the cleaner fuels where as other few house hold are thinks that the anxiety and taste of food.

Mother's age at children birth is an important characteristic where 43% are found 13-24 mothers age at children birth, and 39% and 18% are respectively from 25-34 and 35-49 mother age at children birth. The educations of mother are also another important criterion where most of mothers are found in literate but middle complete. The study reveals that the standard of living is moderate to low types where in 41% and 37% cases total monthly income is found 10-15 thousands and 5-10 thousands respectively.



The most of rural households are use in bio fuels where Sitai Block are contribute the highest position (80 %) and percentage of Cooch Behar I and II block are comparatively less in percentage. On the other hand Cooch Behar I & II block are quite familiar in cleaner fuel use like LPG gas, electric Oven. But Sitai, Mekhligang are not very much accepted for the use of cleaner fuels.



The villages of Bara Gitaldah I , Jamaladaha, Pachagarh, Rampur-I are found mostly respiratory affected villages in Cooch Behar district and Moamari, Chandamari Premerdanga are comparatively better condition are seen.

Recommendations:

Indoor air pollution comes out to be a major world's environmental and public health hazard for large numbers of the world's poorest and most disadvantaged people. The existing studies on impact of rural cooking as a source of indoor air pollution. There is also a strong case for carrying out a limited no. of intervention studies, particularly for the most common and serious health out comes from indoor air pollution due to biomass combustion. Greater emphasis should give to minimise problems of biomass fuel burning.

- ❖ Govt. should improve the health status especially to women and below five year child.
- ❖ Improve biomass stove and cleaner biomass based fuels will continue to be an option for reducing exposure for a larger majority in rural poor in developing countries.
- ❖ The govt. should give subsidy to the poor rural villagers for accept and use the cleaner fuel.
- ❖ Campaigning awareness programme to the use of cleaner fuel, their uses, facilities, misuses etc in rural village areas.
- ❖ Make another awareness programme to the worst effects biomass fuels combustion in rural cooking,
- ❖ Another most important element of a strategy to mitigate indoor air pollution is to bring about the behavioural change, including a greater demand for cleaner cooking.

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