

# Effects of different Biomass fuel type on breathing difficulties among the women of rural community in Bangladesh.

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## Abstract

### **Background**

In this paper, an attempt has been made to explore the relationship between different biomass fuel user and their health problems.

### **Methods**

For the purpose of analysis, “TUB Health and Socio-Economic Survey” 2013 data was used. Bivariate analysis along with a Chi-square test was performed to examine association.

### **Results**

Results highlighted that simpler form of biomass fuel such as leaf have higher prevalence of having breathing difficulties than complex form of biomass fuel such as cow dung. Fuel type Cow Dung user compared to leaf user, has 68.34% lower odds of having breathing difficulties, keeping all other independent variables at a constant level. Although 60+ ages’ female, primary and secondary educated female, heart disease, asthma and anxiety have significant effect of having Breathing Difficulties.

### **Conclusions**

Findings of this paper indicate that using complex form of biomass fuel is safer rather than using simpler form of biomass fuel. Completely avoiding biomass fuel is not possible in the Developing country like Bangladesh right now that’s why it is suggested to use complex form of biomass fuel for combustion.

### **Hypothesis:**

**Leaf users are more likely to develop breathing difficulties than other biomass users.**

### **Background**

Biomass (wood, charcoal, animal dung and agriculture residues) is the primary source of fuels used by poor households in developing countries who can hardly afford other fuel types (kerosene, liquefied petroleum gas, electricity)[1]. According to WHO(2006), countries like India, Bangladesh, Nepal, Pakistan and Sri Lanka used biomass as fuel (74%, 88%, 80%, 72% and 67% respectively) for daily household cooking. Nearly 3 billion people depend on solid fuels (biomass and coal) for cooking and heating and this number is expected to grow until at least 2030 [2].

In 2004, indoor air pollution from solid fuel use was responsible for almost 2 million annual deaths and 2.7% of the global burden of disease (in Disability-Adjusted Life Years or DALYs). This makes these risk factors the second biggest environmental contributor to ill health, behind unsafe water and sanitation. More than two billion people in developing countries still rely on the use of solid biomass fuels such as, cow dung, wood, crop residue and coal for cooking daily meals. This attributes a major source of indoor air pollution and is now regarded as major public health hazard in the developing world. Burning of biomass fuel in the kitchen releases smoke and particulate matters which may cause breathing difficulties [3].

Traditional biomass fuels (wood, agricultural wastes and animal dung) are the major source of energy in developing countries. Two billion people use biomass fuels as their main source of domestic energy. It is estimated that about 30% of urban households

and 90% of rural households in developing countries rely on traditional biomass fuels as the major, or only, source of domestic energy [4].

Exposure to pollution from biomass fuel combustion has been identified as an important health risk threat in developing countries. Cooking with biomass fuels and coal is estimated to cause 3% of all diseases worldwide [5]. It has been shown that exposure to biomass fuel smoke is responsible for a number of respiratory diseases such as Acute Respiratory Infections (ARI), Chronic Obstructive Pulmonary Disease (COPD), Tuberculosis and Asthma; Low Birth Weight; Cataract and Blindness. ARI are more common in children [5].

Wood, agricultural residues and dung cake continue to be one of the major energy sources in Bangladesh and many other developing countries. The agricultural wastes which have no particular use and lie in the field unutilized and cannot be composted easily end up as fuel. Hay, jute stick, paddy husk, wheat stalks, dried leaves of mango, jack-fruit, coconut, palm and sugarcane, bamboo leaves, branches and roots, cotton roots and stalks, root zone of millets, bajra, wheat husk, lops and tops of fruit trees which are annually pruned are used as fuel in rural areas.

Owing to population growth and economic development, Bangladesh energy consumption is increasing rapidly. Energy and energy technologies have a central role in social and economic development at all scales, from household and community to regional and national. Among its welfare effects, energy is closely linked with public health both positively and negatively, the latter through environmental pollution and degradation. The three main determinants in the transition from traditional to modern energy use are:

- Affordability
- Fuel availability, and
- Cultural preferences

People of the developing countries are typically exposed to very high levels of indoor air pollution for 3 to 7 hours a day [6]. Since it is always the women who cook daily household meals, their exposure is much higher than men's.

The most significant form of biomass burning in the developing country is the burning of leaves. This smoke is particularly hazardous since it is released at ground level in populated areas. Burning a ton of leaves will produce about 117 pounds of carbon monoxide, 41 pounds of particulates (most of them smaller than 10 microns and easily absorbed in the lungs), and at least seven highly carcinogenic polycyclic aromatic hydrocarbons (Battelle, Friedman). A number of studies have demonstrated adverse health effects from leaf burning [7].

#### **Objective:**

The study aims to examine the relationship between breathing difficulty and types of biomass fuel use among the rural women in Bangladesh.

#### **Method:**

This study uses data from the "IUB Health and Socio Economic Survey" 2013. The survey was performed under the authority of Independent University, Bangladesh IUB which was supervised by the School of Public Health (SPH) and the School of Liberal arts and Social Science (SLASS). "IUB Health and Socio Economic Survey" 2013 is covering 1310 households in four districts (Manikganj, Bagura, Natore, sylhet) of Bangladesh which were randomly selected. The unit of analysis is the adult (18 years and above) so total number of participants were 3843 adults. Data collection procedure was done by using IUB's own online based software.

The survey was conducted from 5<sup>th</sup> January -12<sup>th</sup> January, 2013. A pre-tested questionnaire was used to collect data from three villages of each district. 323 household from Manikganj, 299 from Bogra, 349 from Natore and 339 from Sylhet districts were randomly selected for the purpose of the survey. Two types of questionnaire were used to accomplish the survey. *Household*

*questionnaire* was used to collect information about the household member's social indicators, household characteristics, asset and economic hardship. *Adult questionnaire* was used to collect data for each adult member of the household which focused on education, employment status, marital history, general health, chronic morbidity, acute morbidity and medications.

For this study we have only considered the female (number) because in case of rural Bangladesh mostly females are responsible for the cooking. The study is about using different types of biomass fuel use for cooking and their effect on breathing difficulties that's why only females are considered for this study.

The dependent variable for this study is Breathing Difficulties and Different types of independent variables are use for this study which are described below,

Dependent Variable:

- Breathing Difficulties.

Breathing difficulty is a broad term that is used to describe discomfort when breathing, and the feeling that one cannot draw a breath. This can develop gradually, or the breathing may suddenly become more labored. Breathing difficulties make the person feel as though he/she cannot get enough air [8].

Independent variable:

- Type of fuel use.

Types of fuel used by the people affects their breathing. The rural women of Bangladesh use mainly solid biomass fuels such as Leaf, wood, cow dung, Agri. Waste etc for cooking their daily meals.

- Kitchen location

Indoor and outdoor both types of kitchens are seen in rural Community.

- Ventilation

Ventilation is the way fresh air moves into a room or building, and how old and polluted air moves out. If a house has poor ventilation, smoke and polluted air stays inside. Poor ventilation also traps moisture in the house, causing dampness and mold. The easiest way to reduce indoor air pollution is to improve ventilation. Burning any fuel without ventilation releases carbon monoxide (CO) and other harmful gases into the air, leading to serious illnesses[9].

- Age

Different age groups such as 18-29, 30-45, 46-60 and 60+ are Use to conduct this study.

- Education

Four level of education are considered for this study such as, no education, primary education, secondary education and higher education.

- Income

Income of that community are considered in four groups such as,  $\geq 15001$ , 10001-10000, 6001-10000,  $\leq 6000$  Tk.

- Smoking Cigarette

Smoking tobacco can cause many health problems for the smoker and for other people exposed to the smoke. Health problems from smoking include:

- Serious lung diseases, such as lung cancer, emphysema, and chronic bronchitis.
- Heart disease, heart attack, stroke, and high blood pressure.
- Cancer of the mouth, throat, neck and bladder.

Second-hand smoke is the mixture of smoke that comes from cigarettes, pipes, and cigars, plus the smoke breathed out by the smoker. Second-hand smoke makes smoking dangerous for everyone who lives with a smoker, especially children. It causes the same health problems as does smoking [10].

➤ Heart Disease

Heart disease can cause breathlessness if your heart is unable to pump enough blood to supply oxygen to your body. If your brain, muscles, or other body organs do not get enough oxygen, a sense of breathlessness may occur [11].

➤ Asthma

Asthma is an inflammatory disease of the lungs. It makes breathing difficult and brings on attacks of coughing, wheezing, tightness in the chest and shortness of breath [12].

➤ Anxiety

Anxiety is your body’s natural response to stress. It is a feeling of fear and apprehension about what’s to come. We all feel it at times; the first day of school, going to a job interview, or giving a speech cause most people to feel fearful and nervous. But if the feelings of anxiety are extreme, last for longer than six months, and are interfering the life, It is called anxiety disorder. During moments of extreme anxiety or during a panic attack, these symptoms may be accompanied by shortness of breath, rapid heartbeat, palpitations, chest pain, rapid breathing, hyperventilating etc [13].

This study is conducted by using SPSS, Descriptive statistics; Bivariate analysis and Logistic regression have been use for analysis.

**Result and Discussion:**

Descriptive statistics for selected variable are shown below in Table: 1,

**Table 1: Descriptive statistics for selected variable.**

Variable	Number (percentage)
<b>Breathing Difficulties.</b>	
Yes	88(5.8)
No	1423(94.2)
<b>Type of fuel use.</b>	
Wood	1024(58.6)
Agri. Waste	237(13.5)
Cow Dung	170(9.7)
Leaf	257(14.7)
<b>Kitchen location</b>	
Outside	943(53.8)
Inside	809(46.2)
<b>Ventilation</b>	
Exhaust/Chimney	818(42.8)
Window/Partly open	934(48.8)
<b>Age</b>	
18-29	645(33.7))
30-45	765(40.0)
46-60	245(12.8)
60+	258(13.5)
<b>Education</b>	
No education	968(50.6)
Primary (1-5)	398(20.8)
Secondary (6-10)	389(20.3)
Higher (>10)	158(8.3)
<b>Income</b>	
>=15001	523(27.3)

10001-10000	35(1.8)
6001-10000	78(4.1)
=<6000	1277(66.8)
<b>Smoking Cigarette</b>	
Yes	8(0.5)
No	1503(99.5)
<b>Heart Disease</b>	
Yes	46(3.0)
No	1465(97.0)
<b>Asthma</b>	
Yes	12(0.8)
No	1499(99.2)
<b>Anxiety</b>	
Not Depressed	1220(80.8)
Depressed	289(19.2)

**SD=Standard Deviation, Sample Size n=1913**

The descriptive analysis in Table: 1 says that 5.8% women have Breathing Difficulties and other 94.2% have not. In case of Fuel use, highest no of women use Wood for cooking which is 58.6% and respectively 14.7% Leaf user, 13.5% Agri. Waste user, 9.7% Cow Dung user, 1.4% Gas user, 1.1% Coal user, 0.6% Kerosene user, 0.3% Charcoal user. 53.8% Kitchen is lactated outside and other 46.2% kitchen is located inside house. In case of ventilation 42.8% kitchen has Exhaust/Chimney on the other hand 48.8% kitchen has Window. In case of age group, 30-40 age groups have highest 40% women and other 18-29, 46-60, 60+ age groups respectively contains 33.7%, 12.8%, 13.5%. Among all 50.6% women have no Education, 20.8% have Primary Education, 20.3% have Secondary Education and 8.3% have Higher Education. In case of income, 66.8% women have income of =<6000 TK, 4.1% women have income of 6001-10000 TK, 1.8% women have income of 10001-10000 TK and 27.3% women have income of >=15001 TK. 0.5 % women smoke Cigarette and other 99.5% are not. 3.0% women have Heart Disease and other 97.0% have not. 0.8% women have Asthma and other 99.2% have not. 9.2% women are depressed and 80.8% women are not depressed.

**Table 2: Bivariate analysis between Breathing Difficulties and selected variables.**

Variable	Breathing Difficulties		P value
	Yes (88)	No (1423)	
<b>Type of fuel use.</b>	Number(Percentage)	Number(Percentage)	
Wood	44	844	
Agri. Waste	17	182	0.021
Cow Dung	4	153	
Leaf	18	190	
<b>Kitchen location</b>	Number(Percentage)	Number(Percentage)	
Outside	46	758	0.829
Inside	42	660	
<b>Age</b>	Number(Percentage)	Number(Percentage)	
18-29	12	490	
30-45	36	608	0.000
46-60	18	198	
60+	22	127	
<b>Education</b>	Number(Percentage)	Number(Percentage)	
No education	71	742	
Primary (1-5)	10	318	0.000
Secondary (6-10)	6	302	

Higher (>10)	1	61	
<b>Income</b>	Number(Percentage)	Number(Percentage)	
>=15001	8	114	
10001-10000	2	33	0.979
6001-10000	4	74	
=<6000	74	1202	
<b>Smoking Cigarette</b>	Number(Percentage)	Number(Percentage)	
Yes	1	7	0.382
No	87	1415	
<b>Heart Disease</b>	Number(Percentage)	Number(Percentage)	
Yes	10	36	0.000
No	78	1387	
<b>Asthma</b>	Number(Percentage)	Number(Percentage)	
Yes	4	8	0.004
No	84	1415	
<b>Anxiety</b>	Number(Percentage)	Number(Percentage)	
Not Depressed	50	1170	0.000
Depressed	38	251	

SD: Standard deviation

Bivariate analysis in Table:2 between Breathing Difficulties and other selected 10 variables shows that among 10 independent variables Type of fuel use, Age, Education, Heart Disease, Asthma and Anxiety are associated with Breathing Difficulties as their level of significance is high and it is less than 0.05. So we can perform logistic regression analysis.

**Table 3: Logistic Regression coefficients of selected covariates for breathing Difficulties.**

Variable	Regression Coefficient	S.E	P-Value	OR
Constant	-2.906	0.401	0.000	
<b>Type of fuel use.</b>				
Wood	-0.614	0.283	0.030	0.541
Agri. Waste	-0.019	0.353	0.957	0.981
Cow Dung	-1.152	0.564	0.041	0.316
Leaf(ref.)				
<b>Age</b>				
18-29(ref.)				
30-45	0.461	0.359	0.199	1.586
46-60	0.653	0.416	0.117	1.921
60+	1.092	0.416	0.009	2.980
<b>Education</b>				
No education(ref.)				
Primary (1-5)	-0.831	0.361	0.021	0.436
Secondary (6-10)	-1.077	0.459	0.019	0.344
Higher (>10)	-1.154	1.041	0.268	0.315

<b>Heart Disease</b>				
Yes	1.172	0.413	0.005	3.230
No(ref.)				
<b>Asthma</b>				
Yes	1.947	0.654	0.003	7.009
No(ref)				
<b>Anxiety</b>				
Not Depressed(ref.)				
Depressed	0.932	0.242	0.000	2.540

OR: Odd ratio; S.E: Standard error

Logistic regression analysis shows that Type of fuel use (wood, cow dung), 60+ ages' female, primary and secondary educated female, heart disease, asthma and anxiety are statistically significant independent variables as the determinant factors for Breathing Difficulties.

Fuel type wood user compared to leaf user, has  $(1 - e^{-0.614}) \times 100\% = 45.88\%$  lower odds of having breathing difficulties, keeping all other independent variables at a constant level.

Or, Fuel type wood user compared to leaf user, is  $1 / e^{-0.614} = 1.85$  times as likely as to have breathing difficulties, keeping all other independent variables at a constant level.

Fuel type Cow Dung user compared to leaf user, has  $(1 - e^{-1.152}) \times 100\% = 68.34\%$  lower odds of having breathing difficulties, keeping all other independent variables at a constant level.

Or, Fuel type Cow Dung user compared to leaf user, is  $1 / e^{-1.152} = 3.16$  times as likely as to have breathing difficulties, keeping all other independent variables at a constant level.

Age 60+ years compared to 18-29 years female has  $(e^{1.092} - 1) \times 100\% = 198\%$  higher odds of having breathing difficulties, keeping all other independent variables at a constant level.

Or, Age 60+ years compared to 18-29 years female, is  $e^{1.092} = 2.98$  times as likely as to have breathing difficulties, keeping all other independent variables at a constant level.

Education level primary compared to no education has  $(1 - e^{-0.831}) \times 100\% = 56.44\%$  lower odds of having breathing difficulties, keeping all other independent variables at a constant level.

Or, Education level primary compared to no education, is  $1 / e^{-0.831} = 2.29$  times as likely as to have breathing difficulties, keeping all other independent variables at a constant level.

Education level secondary compared to no education has  $(1 - e^{-1.077}) \times 100\% = 65.94\%$  lower odds of having breathing difficulties, keeping all other independent variables at a constant level.

Or, Education level secondary compared to no education, is  $1 / e^{-1.077} = 2.94$  times as likely as to have breathing difficulties, keeping all other independent variables at a constant level.

Having heart disease compared to not having heart disease has  $(e^{1.172} - 1) \times 100\% = 223\%$  higher odds of having breathing difficulties, keeping all other independent variables at a constant level.

Or, having heart disease compared to not having heart disease, is  $e^{1.172} = 3.23$  times as likely as to have breathing difficulties, keeping all other independent variables at a constant level.

Having Asthma compared to not having Asthma has  $(e^{1.947} - 1) \times 100\% = 600\%$  higher odds of having breathing difficulties, keeping all other independent variables at a constant level.

Or, Having Asthma compared to not having Asthma, is  $e^{1.947} = 7$  times as likely as to have breathing difficulties, keeping all other independent variables at a constant level.

Having depression compared to not having depression has  $(e^{0.932} - 1) \times 100\% = 154\%$  higher odds of having breathing difficulties, keeping all other independent variables at a constant level.

Or, having depression compared to not having depression, is  $e^{0.932} = 2.54$  times as likely as to have breathing difficulties, keeping all other independent variables at a constant level.

Results highlighted that simpler form of biomass fuel such as leaf have higher prevalence of having breathing difficulties than complex form of biomass fuel such as cow dung. Fuel type Cow Dung user compared to leaf user, has 68.34% lower odds of having breathing difficulties, keeping all other independent variables at a constant level. Although 60+ ages' female, primary and secondary educated female, heart disease, asthma and anxiety have significant effect of having Breathing Difficulties.

## Conclusions

The aim of the study is to find out the Effects of different Biomass fuel type on breathing difficulties among the women of rural community in Bangladesh. Thus, we can see that most of the biomass fuel is responsible for breathing difficulties which mean they all have health hazards thus completely avoiding biomass fuel is not possible right now so the main findings of this paper indicate that using complex form of biomass fuel is safer rather than using simpler form of biomass fuel. Completely avoiding biomass fuel is not possible in the Developing country like Bangladesh right now that's why it is suggested to use complex form of biomass fuel for combustion to reduce potential health hazards.

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