

# Impact of biofuel on health and environment

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## Article Chronicle :

**Received :**  
25.09.2017;

**Revised :**  
13.11.2017;

**Accepted :**  
23.11.2017

## Key Words :

Biofuel,  
Consumption  
pattern, Health,  
Rural women

**ABSTRACT :** After 71 years of independence 69 per cent peoples are living in rural areas and for cooking they still depend on bio-fuels. The over-dependence on biofuels has led to several ecological and health problems. Keeping this in view a study was conducted to assess biofuel collection pattern, consumption pattern and its impact on health in rural areas. This study was conducted in two villages Achitpur and Chota Mirzapur Khurd of Jamalpur Block of Mirzapur district of Uttar Pradesh. A multi stage sampling design was followed. The target groups who were interviewed were women above 18 years of age. A total of 125 rural women (16 % of the total household) were selected randomly for data collection purpose. Desk review and analysis of secondary literature/data was also carried out to supplement the research. Survey method was adopted for quantitative data collection in the selected villages. The quantitative data collection tool was developed keeping in view the objectives, scope and focus of the study. The draft interview schedule was pre-tested in study villages of Mirzapur district in which around 50 respondents were interviewed. The data collection instruments were modified and finalized based on feedback of the pre-test exercise. Before the data analysis, a tabulation plan was developed. The quantitative data analysis was carried out by using latest version of statistical package for the social sciences (SPSS programme). The bi-variate analysis was carried out for the data analysis. Descriptive statistics including mean, standard deviation and percentage frequency were used for describing background characteristics of the respondents. This study points to a need for creating awareness on the environmental and health issues. At the same time, effective interventions on the popularization and use of fuel efficient and renewable energy cooking appliances should be carried out by the government and non-government organizations. Intersectoral co-ordination for the promotion of public health is also need of the hour.

HOW TO CITE THIS ARTICLE : Ahmed, Farida (2017). Impact of biofuel on health and environment. *Asian J. Environ. Sci.*, 12(2): 97-103, DOI: 10.15740/HAS/AJES/12.2/97-103.

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**B**iomass such as crop residues, charcoal, dung cake, etc., is the primary energy source to meet the domestic thermal energy requirement in developing nations. The biomass is available everywhere and can be burnt directly in the cook stove (Mehetre *et al.*, 2017). Around half of the world's population, mostly in low-income countries, relies on solid biomass fuels (such as dung, crop residues, firewood and charcoal) as their main means of cooking and heating fuel (WHO, 2013). These fuels are

typically burned in open, usually three stone, fires which burn inefficiently, releasing numerous toxic partial products of combustion (Bruce *et al.*, 2000; Ezzati and Kammen, 2002; Pant *et al.*, 2014 and Smith and Mehta, 2004). Among these bio-fuels; fuel wood with 180 million tons per annum has the highest share of energy consumption in rural areas, followed by animal dung and crop residues. The over-dependence on traditional fuels has led to several ecological and health problems. The consumption of fuel wood on large scale

is indeed associated with forest degradation (Jagdish, 2004). In view of above present study was done under taken with the following objectives:

#### Study objectives:

- To assess the demographic characteristics of the respondents.
- To examine the biofuel collection and domestic consumption pattern.
- To assess the problems faced while biofuel collection.
- To study effect of kitchen smoke on health.

### EXPERIMENTAL METHODOLOGY

This study was conducted in two villages Achitpur and Chota Mirzapur Khurd of Jamalpur Block of Mirzapur district of Uttar Pradesh. A multi stage sampling design was followed. The target groups who were interviewed were women above 18 years of age. A total of 125 rural women (16 % of the total household) were selected randomly for data collection purpose.

Desk review and analysis of secondary literature/data was also carried out to supplement the research. Survey method was adopted for quantitative data collection in the selected villages. The quantitative data collection tool was developed keeping in view the objectives, scope and focus of the study. The interview schedules had also close ended questions. Quantitative data was collected by using a semi-structured interview schedule. The draft interview schedule was pre-tested in study villages of Mirzapur district in which around 50 respondents were interviewed. Pre-test exercise was helped in finding respondents' difficulty in understanding language, inconsistency in placing and framing questions, providing right options, proper skipping of questions, use of local vocabulary for better understanding of questions and duplication of questions etc. The data collection instruments were modified and finalized based on feedback of the pre-test exercise.

Before the data analysis, a tabulation plan was developed. The quantitative data analysis was carried out by using latest version of statistical package for the social sciences (SPSS programme). The bi-variate analysis was carried out for data analysis. Descriptive statistics including mean, standard deviation and percentage frequency were used for describing background characteristics of the respondents.

### EXPERIMENTAL FINDINGS AND DISCUSSION

It is evident from Table 1 that 45.6 per cent of the respondents were of younger age group. The average age and standard deviation of the respondents was 38.90 years and 11.97 year, respectively.

Maximum respondents were belonged to Hindu religion (89.6 %). Maximum respondents (55.0%) were belonged to OBC (other backward caste) category. It can be interred from the above findings that in our social system OBC have been dominating.

The majorities of respondents (66.4 %) were illiterate. It may be concluded that the female literacy rate in the study area is very low. Similar comments also reported by Prasad *et al.* (2009).

More than half (57.6 %) of respondents head of the family were depend on daily wages as labour work followed by the respondents head of the family (18.4%) who were engaged in tiny business like beetle shop etc.

More than half (52.8%) of respondents had family annual income below Rs. 20,000 The trend shows that in study area, economic status of the people was very poor. Parikh and Laxmi (2000) have also stated poor economic condition of rural people in their study done at Tamil Naidu. Basic reason of poverty in the present study area was found large population growth and there were majority of respondents (89.0%) who had no membership of any type of organization.

Table 2 reveals that majority of the respondents (95.2%) cooking food on fuel wood. Regarding the fuel as dung cake, it was found that 5.6 per cent of respondents were not using it at any cost while 80.0 per cent of respondents purchasing dung cake from market. Only 14.4 per cent respondents who had their own cattle were getting by self made. Therefore, biofuels are still the main source of cooking fuel and use of fuel wood and dung cake was very common in the present study area.

The fuel kerosene were using mostly for lighting purpose by all the respondents in the present study out of which more than three-fourth (77.6 %) of respondents drawing kerosene oil for lighting and cooking (adding 2-3 drop for lightening fuel wood) from ration shop.

The utilization of LPG (Liquid petroleum gas) as a clean fuel in rural area was very less till now only 8 (6.4 %) respondents were buying it from agency and only 1 (0.8%) respondent from market place. It is also emphasize the fact that the bulk of rural people cannot

afford alternative fuels like kerosene, biogas and LPG for cooking purposes. The only option available to them is to use firewood. Jagdish (2004) was also reported in Karnataka study that using clean fuel for cooking was very expensive and unaffordable for rural people.

The Table 3 depicts that maximum respondents (40.8 %) were spent  $\leq 15$  minute time followed by 36.0 per cent respondents were spent 16-30 minutes time at every trip for fuel purchasing/collection. The average time consumption for every trip in purchasing/collection of fuels is found to be  $26.37 \pm 24.53$  minutes.

The Table 4 shows that majority of respondent and

their family members (64.0%) were covering  $\leq 200$  meter distance for various types of fuel purchasing/collection. The average distance covered either by respondents or by their family members was found to be  $(220.84 \pm 191.02)$  meter. Thus, in a month a distance of 6 kilometer and above was traveled for purchasing/collecting the required the quantity of fuel.

The Table 5 depicts that majority of respondents and their family members (52.0%) were taking (21-30) trips/month for fuel purchasing/collection. The average number of trips/month with standard deviation was  $(20.65 \pm 10.60)$ , respectively. It indicates that the people of the

<b>Table 1 : Distribution of the respondents according to their various characteristics</b>		<b>(n=125)</b>
Socio-economic characteristics	Frequency	Percentage (%)
<b>Age group (Years)</b>		
$\leq 35$	57	45.6
36-45	36	28.8
$> 45$	32	25.6
Average age $\pm$ SD = $38.90 \pm 11.97$		
<b>Religion</b>		
Hindu	112	89.6
Muslim	13	10.4
<b>Caste</b>		
SC/ST	46	37.0
OBC	69	55.0
Others	10	8.0
<b>Literacy</b>		
Illiterate	83	66.4
Literate	42	33.6
<b>Main occupation of head of the family</b>		
Daily wage labours	72	57.6
Caste occupation	12	9.6
Tiny business	23	18.4
Independent profession	12	9.6
Cultivation	5	4.0
Service	1	0.8
<b>Total family annual income (Rs.)</b>		
$\leq 20,000$	66	52.8
20,000-40,000	39	31.2
$> 40,000$	20	16.0
Average family annual income $\pm$ SD = $28,604.00 \pm 24,414.10$ (Rs. 9,600 to 1,10,000)		
<b>Social participation</b>		
No membership	112	89.0
Member of one organization	9	7.2
Member of more than one organization	4	3.2

selected area are consuming more time for collection of fuels as well as other materials for cooking food.

The Table 6 reveals that in more than one-third of the respondents (39.2%), male members visited to shops for purchasing fuels while in 31.2 per cent and 16.8 per cent, both male and female and male, female and their children were purchasing/collection the various fuels from

the suitable places. In least number of families only female, children as well as female with their children visited the shop in 4.0 per cent, 3.2 per cent and 5.6 per cent, respectively. Parikh and Laxmi (2000) also reported in their study that households mostly send one person for fuel collection. In some cases, however, two persons were engaged for collecting fuel wood.

**Table 2: Distribution of respondents according to the sources of domestic fuel purchasing/collection**

Sources	Domestic fuels							
	Fuel wood		Dung cake		Kerosene		LPG	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Not used	6	4.8	7	5.6	-	-	116	92.8
Market	116	92.8	100	80.0	2	1.6	1	0.8
Ration	-	-	-	-	97	77.6	-	-
Own cattle	-	-	18	14.4	-	-	-	-
Govt. forest	3	2.4	-	-	-	-	-	-
Ration+ market	-	-	-	-	26	20.8	-	-
Agency	-	-	-	-	-	-	8	6.4
Total	125	100	125	100	125	100	125	100

**Table 3 : Distributions of respondents according to the time spent by them per trip for fuel purchasing/collection**

Time (Minute)	Frequency	Percentage (%)
≤ 15	51	40.8
16-30	45	36.0
31-45	21	16.8
> 45	8	6.4
Total	125	100

Average time spent ± SD =26.37 ± 24.53

**Table 4 : Distribution of respondents according to the distance covered per trip by them and their family for kitchen fuel purchasing/ collection**

Distance (meters)	Frequency	Percentage (%)
≤ 200	80	64.0
201-400	24	19.2
401-600	16	12.8
601-800	5	4.0
Total	125	100

Average distance ± SD =220.84 ± 191.02

**Table 5: Distribution of respondents according to the number of trips/month for fuel purchasing/collection**

Trips/Month	Frequency	Percentage (%)
≤ 10	29	23.2
11-20	31	24.8
21-30	65	52.0
Total	125	100

Average trips/month ± SD =20.65 ±10.60

The Table 7 projects about per month expenditure incurred on various type of fuels which reveals that the maximum Rs. (521.85 ± 247.16) average expenditure incurred in fuel wood followed by Rs. (241.67 ± 104.58) on LPG while on dung cake, the average per month expenditure was Rs. (60.68 ± 39.59) and on kerosene

oil, it was Rs. (42.61 ± 40.03), respectively. The data clearly shows that in the study area, the fuel wood as well as dung cake were utilized by maximum respondents family may be due to easy availability and more cheaply than the other type of fuels.

The various type of fuels like wood dung cake and

**Table 6 : Distribution of respondents and their family members according to their involvement in domestic fuel purchasing/collection**

Family members	Frequency	Percentage (%)
Male	49	39.2
Female	5	4.0
Children	4	3.2
Both male and female	39	31.2
Both female and children	7	5.6
Male, female and children	21	16.8
Total	125	100

**Table 7: Descriptive statistics about per month expenditure on various types of fuels by the respondent's family**

Sr. No.	Fuel	Number	Minimum	Maximum	Mean	SD
1.	Fuel wood	119	-	1050	521.85	247.16
2.	Dung cake	118	-	240	60.68	39.59
3.	Kerosene	125	11	330	42.61	40.03
4.	LPG	9	100	350	241.67	104.58

**Table 8: Relationship of respondents according to their family annual income (Rs.) and utilization of various types of fuels**

Sr. No.	Type of fuel	Family annual income (Rs.)						Total	df=2			
		≤ 20000 (n=66)		20000-40000 (n=39)		>40000 (n=20)			No.	%	χ <sup>2</sup>	P
		No.	%	No.	%	No.	%					
1.	Fuel wood	63	95.5	37	94.9	19	95.0	119	95.2	0.02	>0.005	
2.	Dung cake	61	92.4	38	97.4	19	95.0	118	94.4	1.18	>0.005	
3.	Kerosene	66	100.0	39	100.0	20	100	125	100.0	-	-	
4.	LPG	-	-	1	2.6	8	40.0	9	7.2	38.58	>0.005	

**Table 9: Distribution of respondents according to the problems faced by them and their family members while purchasing/collection fuel for domestic use**

Sr. No.	Problems	Frequency	Percentage (%)
1.	Reducing infant and child care	7	5.6
2.	Bite from venomous reptiles and insects	1	0.8
3.	Allergic reactions	7	5.6
4.	Fungus infections	3	2.4
5.	Severe fatigue	12	9.6
6.	Muscular pain	21	16.8
7.	Back pain	10	8.0
8.	Arthritis	5	4.0
9.	No problem	59	47.2
	Total	125	100.0

kerosene were utilized by near about in equal proportion by the respondents of the entire economic group where as the use of clean fuel was maximum (40.0%) in higher income groups and only in one family of middle income group it was utilized which may be either due to non-availability of the LPG connection in rural areas or due to their financial crises (Table 8).

The Table 9 shows that in 16.8 per cent of household either respondents or their family members were suffering from muscular pain followed by 9.6 per cent by severe fatigue while 8.0 per cent respondents or their family members were suffering from back pain and 5.6 per cent respondents or their family members were not paying proper attention to infants and other children and problem of allergic reaction. The respondents or their family members who had any type of problem during fuel purchasing/gathering like as arthritis, fungus infections and bite from venomous reptiles and insects were accounted as 4.0 per cent, 2.4 per cent and 0.8 per cent, respectively. It is also noted that about half (47.2%) of respondents or their family members responded that they were not facing any problems while fuel purchasing/gathering.

The Table 10 depicts that out of the total respondents only 3.2 per cent did not have any type of problems due to kitchen smoke where as remaining 96.8 per cent were suffering from various type of diseases. The respondents who were facing any type of problems during survey period, majority of the respondents (26.4 %) suffering from wheezing problem followed by 24.0 per cent from breathlessness and 14.4 per cent from cough, respectively. Other type of problems like as phlegm, respiratory irritation, chest illness blood in sputum and eye irritations were accounted as 10.4 per cent, 8.8 per

cent, 5.6 per cent and 4.8 per cent of respondents, respectively due to kitchen smoke. It was also observed that only 2.4 per cent of respondents were facing the problem of cataract. It shows that the prevalence of disease caused by smoke are very high in the study area may because of improper kitchen facilities as well as cooking materials. Mostly female above 18 years were the chief cooks. Those who were chief cooks have a greater risk of respiratory ailments. The serious gender and health implications of rural energy consumption pattern have also been brought out in the study of Parikh and Laxmi (2000).

### Conclusion:

The use of biofuels in rural areas creates forest degradation, air pollution and health hazards. It was also found in the study that availability of clean fuel was not sufficient in the study area. The kerosene supplied through public distribution system (PDS) was mostly restricted to a quota of 3 litres per household. Rural families were facing many problems while fuel purchasing/gathering and the prevalence of disease caused by smoke was very high in the study area may be because of improper kitchen facilities as well as cooking materials. Those who were chief cooks had a greater risk of respiratory ailments. Therefore, this study points to a need for creating awareness on the environmental and health issues. At the same time, effective interventions on the popularization and use of fuel efficient and renewable energy cooking appliances should be carried out by the government and non-government organizations. Intersectoral co-ordination for the promotion of public health is also need of the hour.

**Table 10: Distribution of respondents according to the disease/symptoms faced by them and their family members due to kitchen smoke**

Sr. No.	Disease/symptoms	Frequency	Percentage (%)
1.	Cough	18	14.4
2.	Phlegm	13	10.4
3.	Breathlessness	30	24.0
4.	Chest illness blood in sputum	7	5.6
5.	Wheezing	33	26.4
6.	Eye irritation	6	4.8
7.	Respiratory irritation	11	8.8
8.	Cataract	3	2.4
9.	No problem	4	3.2
	Total	125	100.0

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