*International Journal of Applied Home Science* **RESEARCH PAPER**
*Volume 5 (4), April (2018) : 793-799* ISSN : 2394-1413
*Received : 18.02.2018; Revised : 28.02.2018; Accepted : 10.03.2018*

# Biomass fuels affecting health of the rural women

**ARPITA JAIN*[1] AND NEETA LODHA[2]**
[1]Ph.D. Research Scholar and [2]Professor & Head
Department of Family Resource Management, College of Home Science, Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan) India

## ABSTRACT

Emissions from incomplete combustion of biomass are a major source of indoor air pollution (IAP) worldwide (World Health Organization, 2011; Chakrobarty *et al.,* 2014). When burned in open and inefficient cook stove produces lots of smoke (Mondal *et al.,* 2013). Biomass smoke contains wide spectrum of potentially health damaging pollutants such as carbon dioxide ($CO_2$), carbon monoxide (CO), ozone ($O_3$) including temperature and humidity (Huboyo *et al.,* 2014). The present paper aims to scrutinize the health problems of rural women while using biomass fuels in the household for cooking purpose. Two hundred forty households were selected from four villages, 60 HHs from each village of Udaipur district having higher energy consumption. An interview schedule was used to gather the relevant information regarding respondents' health related problems which includes all the signs and symptoms faced by the rural women while using biomass fuels used for cooking in kitchen at household (HH) system. The findings of the study highlighted that majority of the women respondents were suffering from the immediate and acute symptoms like headache, phlegm and burning due to emission of CO from the incomplete combustion of the biomass used while cooking in their HH.

**Key Words :** Biomass, Indoor Air Pollution (IAP), Emissions, Household System (HH), Health

## INTRODUCTION

Biomass includes wood, charcoal, animal dung and agriculture residues which account for more than half of domestic energy in most developing countries and for as much as 95 per cent in low income countries (Smith *et al.,* 2004; Ndwiga *et al.,* 2014). It is the primary source of fuels used by poor households in developing countries who can hardly afford other fuel types such as kerosene, liquefied petroleum gas (LPG) and electricity (Chakrobarty *et al.,* 2014).

The combustion efficiency of biomass fuels (BMF) is very low, thus it yields relatively high levels of products of incomplete combustion such as the carbon monoxide, hydrocarbons, oxygenated organics, free radicals and chlorinated organic (WHO, 2004). This causes high level of indoor air pollution (IAP) and poses more damaging health impact of the user (Naeher *et al.,* 2007).

The IAP leads to increased risk of respiratory tract infections, exacerbations of inflammation lung conditions, cardiac events, stroke, eye disease, tuberculosis (TB) and cancer (Lin *et al.,* 2007; Ndwiga, 2014). The IAP (mainly particulate matter -10) caused by BMF is three times higher than those of clean fuels like kerosene, LPG and biogas (Wickramasinghe, 2001; Hoskins, 2011). Further, the adverse health effects of IAP are often exacerbated by lack of ventilation in homes using BMF

**Cite this Article:** Jain, Arpita and Lodha, Neeta (2018). Biomass fuels affecting health of the rural women. *Internat. J. Appl. Home Sci.,* **5** (4) : 793-799.

and by the poor design of stoves that do not have flues or hoods to take smoke out of the living areas.

Women bear the burnt of the disease burden associated with BMF, primarily because women often spend 3-7 hours per day near a traditional open fire cooking meals and in cold months may tends to stay near a fire for heat for a large part of the day. Rural women are more exposed to high levels of BMF smoke (Fullerton *et al.*, 2008). Since, they are the main protagonist of the biomass fuels chain as gatherers, processors, carriers or transporters and foremost as end-users or cooks (Dara, 2001). Focusing on the need of an hour the present paper aims –

1. To identify the health problems caused due to use of biomass fuels on the rural households.
2. To study the role of ventilation and windows in kitchen on the health problems of respondents regarding use of biomass on the users.

To assess the extent of exposure of the respondents towards various developmental programmes.

## METHODOLOGY

On the basis of higher number of cooking systems and sub system 240 household were selected purposively from the four villages of Udaipur district of Rajasthan. Data regarding ventilation, number of windows in the kitchen and health effects of using biomass fuels on the health of the respondents while cooking was collected personally by the researcher. A structured interview schedule was used to collect data. The unit of inquiry was rural households and females were the key informants. The knowledge regarding use of different biomass fuels while cooking was taken on dichotomous categories on the basis of 'yes or no' answers. Each correct and incorrect response was given one and zero score. The information gathered from respondents was tabulated and analyzed by using frequency and percentage.

## RESULTS AND DISCUSSION

The findings revealed the knowledge of the respondents regarding the ventilation of kitchens, number of the windows and the different signs and symptoms of using biomass fuels on the health of the respondents while cooking. Based on the availability of ventilation, windows and health problems respondents were given scores.

**Family background information :**

The respondents' households were studied in respect with their family background details. The respondents were studied for their religion, type and size of family, age, educational level, employment status and income. As these factors were found to influence their choices regarding type of kitchen, fuel selection and consumption and hence, their health impacts.

**Religion:**

Religion plays important role in adoption of CDM practices. The data in Table 1 disclosed that more than two-third of the respondents (70.00 %) were Hindu whereas near about one-fourth (22.92 %) were Jains. Only a meager percentage of respondents' were Muslims.

**Type of family:**

The type of family influences the choice of fuels. It affects the amount of fuel used and

related GHG emissions. Tabulated data revealed that majority of the respondents (81.67 %) belonged to nuclear families whereas less than one-fifth was from joint families (18.33 %).

**Size of family:**

Household size plays an important role in choices of fuels. It determines respondents' preferences regarding CDM fuels and technologies over traditional fuels and inefficient technologies. Ozcan *et al.* (2013) stated that larger households prefer dirty fuels over clean fuels due to higher cost of modern fuels. Table 1 portray that near about the three-fourth of the respondents (72.08 %) belonged to the medium family size whereas 16.25 per cent were from large size families. Only 11.67 per cent of the respondents belong to small family size.

**Table 1 : Distribution of respondents according to their religion, type and size of family, gender and age of head of the family (n=240)**

| Sr. No. | Demographic information | f | % |
|---|---|---|---|
| 1. | Religion | | |
| | Hindu | 168 | 70.00 |
| | Muslim | 17 | 7.08 |
| | Jain | 55 | 22.92 |
| | Total | 240 | 100 |
| 2. | Type of family | | |
| | Nuclear | 196 | 81.67 |
| | Joint | 44 | 18.33 |
| | Total | 240 | 100 |
| 3. | Family size | | |
| | Small family size (Up to 3 members) | 28 | 11.67 |
| | Medium family size (4-6 members) | 173 | 72.08 |
| | Large family size (Above 7 members) | 39 | 16.25 |
| | Total | 240 | 100 |
| 4. | Gender of head of the family | | |
| | Male | 208 | 86.67 |
| | Female | 32 | 13.33 |
| | Total | 240 | 100 |
| 5. | Age of head of the family (in years) | | |
| | 48-54 years | 112 | 46.67 |
| | 54-60 years | 44 | 18.33 |
| | 60-66 years | 84 | 35.00 |
| | Total | 240 | 100 |

**Gender of the head of the family:**

Gender of the head of the family greatly effects the selection and adoption of CDM fuels and technologies. Households with female heads tend to shift earlier than those with male households (Lee, 2013; Özcan *et al.*, 2013; Rahut *et al.*, 2014). This may be attributed to the fact that women are often responsible for household cooking and thus they are directly affected by the labour in fuel gathering and air pollution emitted from the burning of the traditional fuels. The data in Table 1 reflect that majority of the respondents households head of the family were males (86.67 %). However, it is interesting to note that few households were headed by females (13.33 %).

**Age of the head of the family:**

Age of the head of the family affects the preferences for particular fuels and its use. A household with older heads prefer traditional fuels and technologies than the CDM ones. Such preferences for traditional fuels support the notion that older people tend to perpetuate traditional habits related to fuels and technologies more than young people (Özcan *et al.*, 2013; Rahut *et al.*, 2014; Muller and Yan, 2016). Nearly 46.47 per cent of the respondents' household head of the family were falling in the age group of 48- 54 years whereas less than 18.33 per cent were in the age groups of 54-60 years. Though, 35.00 per cent of the respondents were in the 60-66 years of age group.

**Ventilation of kitchen:**

Indoor air pollution is related with the increased risk of health damage. Health danger varies with the solid fuel smoke exposure and ventilation of the kitchen as well as devices used for cooking. Table 2 reflects that three fourth of the respondents have ventilation in kitchen whereas one fifth were not having any ventilation.

**Table 2 : Distribution of the respondents according to the type of house and ventilation (n=240)**

| Sr. No. | Particulars | f | % |
|---|---|---|---|
| 1. | Ventilation of Kitchen | | |
| | Not ventilated | 58 | 24.17 |
| | Ventilated | 182 | 75.83 |
| | Total | 240 | 100 |
| 2. | Window in kitchen | | |
| | No window | 18 | 7.50 |
| | One window | 164 | 68.33 |
| | Two window | 58 | 24.17 |
| | Total | 240 | 100 |

**Windows in kitchen:**

In many households windows in the kitchen were used for ventilations. More than two-third of the respondents (68.33 %) were having only one small window whereas nearly one fifth of the respondents (24.17 %) were having two windows. However, a meager percentage of the respondents (7.50 %) were having no window. Due to improper ventilation in the kitchen lot of smoke collects in the kitchen which was found to be inhaled by the respondents till cooking is completed (Huboyo *et al.*, 2014).

**Biomass fuels affecting respondents' health:**

Incomplete combustion of biomass fuels is the main source of indoor air pollution worldwide (World Health Organization, 2011). When burned in open and inefficient cook stove produces lots of smoke (Mondal *et al.*, 2013). Biomass smoke contains wide spectrum of potentially health damaging pollutants such as $CO_2$, CO, $O_3$ including temperature and humidity (Huboyo *et al.*, 2014).

Respondents cook short duration food items on LPG stove whereas traditional foods of long duration which are time consuming were cooked on *chullha*. Thus, traditional food cooked on *chulha* requires biomass which releases higher GHGE. From economic point of view these biomass

fuels are freely available all the year round; accessible, affordable, socio-culturally acceptable and rural women were familiar with its use. Though, the use of these biomass fuels creates indoor air pollution affecting the health of the women and other family members.

**Table 3 : Distribution of respondents' according to health problems while using biomass fuels during cooking (n=240)**

| Sr. No. | Health problems* | f | % |
|---|---|---|---|
| 1. | Watery eyes | 179 | 74.58 |
| 2. | Burning eyes | 201 | 83.75 |
| 3. | Sore throat | 196 | 81.67 |
| 4. | Phlegm (cough) | 205 | 85.41 |
| 5. | Cold | 114 | 47.50 |
| 6. | Nasal congestion | 140 | 58.33 |
| 7. | Dizziness | 29 | 12.08 |
| 8. | Expectoration | 96 | 40.00 |
| 9. | Short of breath | 65 | 27.08 |
| 10. | Headache after awakening from sleep | 210 | 87.50 |
| 11. | Frequent infections | 30 | 12.50 |

* Multiple responses

Table 3 clearly disclosed that majority of the respondents using biomass suffered from problem of headache after awakening from short nap during noon (87.50 %), followed by cough (85.41 %), burning eyes (83.75 %) and sore throat (81.67 %).Three fourth of the respondents face problem of watery eyes while cooking. Less than sixty per cent of the respondents suffered from the nasal congestion (58.33 %), cold (47.50 %) and expectoration (40.00 %). Shortness of breath was revealed by few respondents (27.08 %) whereas a meagre percentage suffered from recurring infections

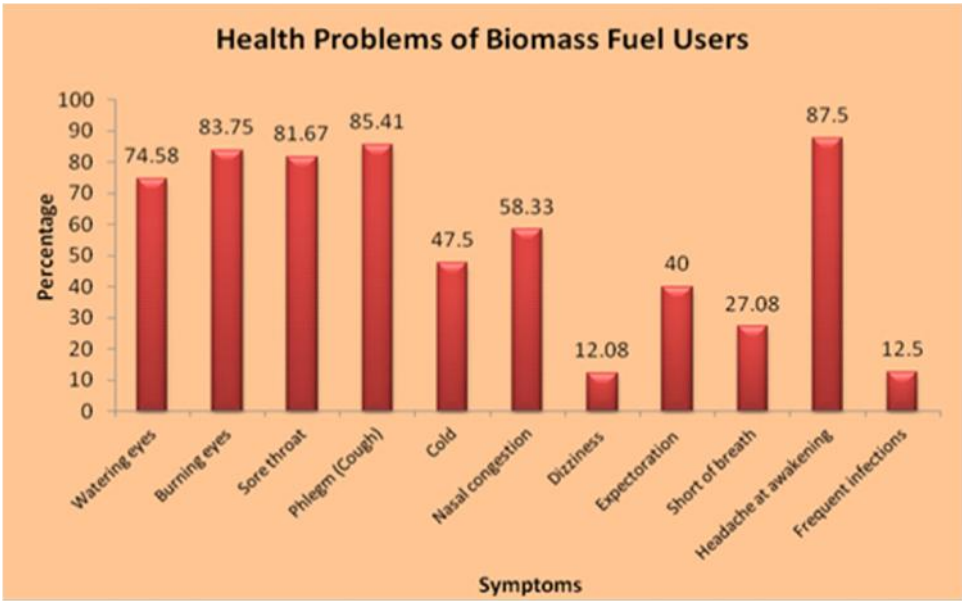


**Fig. 1 : Effect of use of biomass fuels on respondents' health**

(12.50 %) and dizziness (12.08 %) after cooking. Corroborated findings were reported by Mondal *et al.* (2011) and Chakraborty *et al.* (2014) related to indoor air pollution in rural kitchens. Immediate and the acute symptoms like headache and lack of breath among biomass using respondents was due to the emission of CO which is released by incomplete combustion of biomass fuels (Katiyar and Rastogi, 2014; Sharma, 2014). These pollutants alter the properties of the atmosphere which also affects climate change (Chakraborty, 2014).

**Conclusion:**

Thus, concisely it can be concluded that majority of the respondents suffered from the immediate signs and symptoms of the biomass smoke while cooking in kitchen. This may be attributed to the emission of CO which is released by incomplete combustion of biomass fuels.

**Recommendation:**

1. There is need to generate awareness about the role of ventilation in reducing indoor air pollution while cooking in the rural kitchens.
2. There is prerequisite to emphasize on the presence of windows in the rural kitchens.
3. Government should curtail the prices of LPG so that it can be afforded by everyone. Further, more emphasize should be given on building a family or community size biogas plants at subsidized rates to overcome the shortage of LPG. This will not only lower health issues but also combat the GHG leading to climate change.

## REFERENCES

Chakraborty, D., Kumar, N., Jayanta, M.and Datta, K. (2014). Indoor pollution from solid biomass fuel and rural health damage: A micro-environmental study in rural area of Burdwan, West Bengal. Internet link: http://www.sciencedirect.com/science/article/pii/S2212609014000521

http://file.scirp.org/Html/2-2430059_49534.htm

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2568866/

Huboyo, H.S., Tohno,S. and Lestari, P. (2014).Characteristics of Indoor Air Pollution in Rural Mountainous and Rural Coastal Communities in Indonesia. *Atmos. Environ.* **82**, pp: 343-350. Retrieved on 11th June, 2017

Katiyar, R. and Rastogi, S.K. (2014). Study of indoor air quality of kitchens of rural area's in Lucknow. *Current World Environment,* **9**(2) : 525-30. Retrieved on 27th June, 2017

Mondal, N.K., Bhaumik, R. and Das, C.R. (2013). Assessment of indoor air pollutants Generated from bio and syntheic fuels in selected villages of Burdwan, West Bengal. *J. Environ. Biol.* **34** : 963-966. Retrieved on 28th January, 2017

Muller, C and Yan, H. 2016. Household Fuel Use in Developing Countries: Review of Theory and Evidence. Internet link: https://halshs.archives-ouvertes.fr/halshs-01290714/document. Retrieved on 23rd January, 2017

Özcan, K.M., Gülay, E. and Üçdoðruk, Þ. (2013). Economic and demographic determinants of household energy use in Turkey. *Energy Policy,* **60** : 550–557. Internet link: http://www.academia.edu/29046477/Economic_ and_demographic_determinants_of_household_energy_use_in_Turkey. Retrieved on 23rd January, 2017

Rahuta, D.B., Das, S., Groote, H.D. and Behera, B. (2014). Determinants of household energy use in Bhutan.

*Energy,* **69** : 661-72. Internet link: http://www.sciencedirect.com/science/article/pii/S0360544214003260. Retrieved on 23rd January, 2017

Sharma, S. (2014). IAQ: Issues and concerns in India. Internet link: www.grihindia.org/events/tgs/2014/pdf/sumitsharma.pdf. Retrieved on 10th May, 2017

World Health Organization (2011). Population using solid fuels (percent), 2010. Internet link: http://gamapserver.who.int/mapLibrary/appsearch Results.aspx. Retrieved on 10th October, 2013

********