Improved biomass stoves in rural area -A boon

ABSTRACT

Inefficient combustion of solid fuels emits high concentrations of particulate matter (PM) and other harmful emissions. A strong association has been shown between household air pollution (HAP) and acute lower respiratory infections (ALRI) in children, and chronic obstructive lung disease (COPD) and lung cancer in adults. As a result of the magnitude of these adverse health impacts, household air pollution from burning solid fuels in primitive cook stoves is the primary environmental cause of death.

Study design: exploratory and experimental

Place and Duration of Study: Study was conducted during 2016-17 Dharwad and Vijayapur districts of Karnataka state.

Methodology: Keeping this in view a study was conducted in two villages namely Timmapur Village of Dharwad district and Bhaganager village of Vijayapur district. From each village 60 households were selected randomly. Interview schedule was used.

Results: About 80 per cent of the women were illiterate in Timmapur and 76.70 per cent of the women were illiterate in Bhaganagar. The quantity of ash, charcoal and smoke after food preparation was significantly varied in both the villages. The reduction in percentage of both carbon dioxide and carbon monoxide was found in biomass stove compared to traditional stove. The experimental research revealed that as 58 percent of the fuel wood was saved per year per100 families when compared to traditional stove. Whereas the traditional stove consumes 1200 kg /month/100 families. By using biomass stove on an average 384 trees/ year/100 families could be saved.

Key words Energy, Biomass, Carbon Emission, Indoor pollution, Improved Chula

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Introduction:

About 40 per cent of the global population (amounting to three billion people) relies on solid biomass fuels including fuel wood, crop residues, charcoal and dung for cooking. India leads the world in number of people using traditional biomass for cooking. Over two thirds of the national population (772 million) uses biomass as their main cooking fuel, accounting for 30 % of the global total of biomass users. (Legros *et al.,* 2009).

This resulted in tree cutting and loss of vegetation. In addition traditional stove creates problems of health such as eye nose throat irritation may cause impaired lung function and increased respiratory infections especially in women and children due to smoke (World bank and kumari *et al.,*). Improved biomass stove are best alternative to overcome the problem.

- A modified version of the traditional cooking stove is the Improved Biomass Stove (IBS).

Certain features have been modified to make more efficient with respect to fuel wood consumption, make convenient for cooking and much safer from a health point of view. It reduces exposure to harmful pollutants by improving combustion efficiency and introducing chimneys in some fixed biomass stove, reducing cooking times.

Hence, the present study aims to know the full time utilization of stove and know the impact of health on users with the following objectives:

Objectives of the study:

- To quantify the fuel wood consumption in traditional and biomass stove.
- To estimate the Co2 and Co while cooking with different fuel wood.

METHODOLOGY:

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The study was conducted in two villages namely Timmapur Village of Dharwad district and Bhaganager village of Vijayapur district. From each village 60 households were selected randomly in total 120 households were selected for the study. Personal interview schedule was used to elicit the required information. Frequency, Percentage and Students t-test were the statistical tools used for the study.

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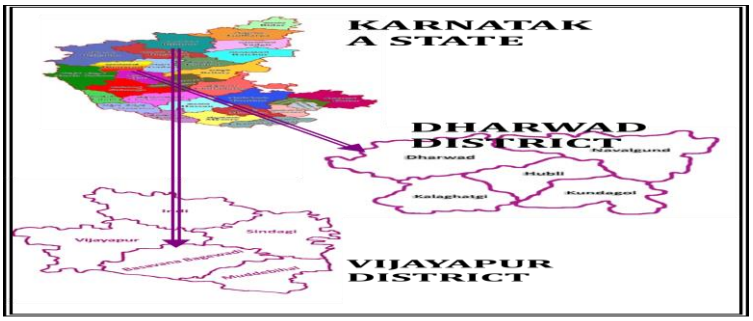

Fig. 1: Map showing study area

Traditional stove

Biomass stove

Plate 1 : Biomass stove in rural area

- Biomass stove was used for project intervention in the study.

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RESULTS AND DISCUSSION

The data in fig1 shows that Socio economic status of the rural women in the selected households. In Timmapur village majority (51.70 %) of the rural women were belonged to middle age group (< 30 years) followed by 33.3 per cent of them were belonged to old age group (> 51 year) and 15 per cent of the women were belonged to young age group (31 to 50 years). While in Bhaganagar village majority (56.70 %) of the women were belonged to middle age group (< 30 years) followed by (28.30 %) of them were belonged to young age group (31 to 50 years) and 15 per cent of the women were belonged to old age group (> 51 years).

Education

In Timmapur village majority of the women were illiterate (80.00 %) followed by 11.70 per cent of the women had an education up to primary level school (1-4) and 8.30 per cent of them had studied middle level school (5-7) .76.70 per cent of the women were illiterate in Bhaganagar village followed by 11.66 per cent of them had studied primary level school (1-4), 10 per cent of them had studied middle level school (5-7) and 1.70 per cent of them were

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studied high school (8-10). The results are similar to the results of study conducted by Komala *et al*., (2016).

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Occupation

In Timapur village majority of the women were belonged to agricultural labourer (98.30 %) and followed by a few per cent of them belonged to agriculture (1.70 %).

In Bhaganagar village, majority of the women occupation was agriculture (76.70 %) followed by agricultural labouers (23.30 %). With respect to the family type majority of the women in Timmapur village were belonged to nuclear family (61.70 %) where as about 38.30 per cent of them belonged to joint family. While in Bhaganagar majority of the women belonged to nuclear family (58.33 %) followed by joint family (41.66 %).

Family Size

The data on the family size in Timmapur village is presented in Table 1. majority of (56.60 %) the women had medium family size (4-6 members) followed by equal per cent (21.70 %) of the women had small family size (< 3) and large family size (6 and above).while in Bhaganagar village majority (46.60 %) of the women had medium family size (4-6 members) followed by 36.70 per cent of women had small family size (< 3) and 16.70 per cent of women had large family size (6 and above). The results are in line with Somnath *et al.,* (2014).

With respect to the annual family income, in Timmapur village that majority (50.00 %) of the women had low annual income (< 60,000) followed by 45 per cent of the women were in the medium annual income (Rs. 60,000 to 1,20,000), only 5 per cent of the women were in the high income group (> 1,20,000). While in Bhaganagar majority (66.66 %) of the women were in the medium income (Rs. 60,000 to 1, 20,000) followed by 26.70 per cent of the women were in the high income (> 1, 20,000) only 6.66 per cent of the women had low income (< 60,000). It can be observed that, majority (51.70 %) of the women belonged to landless category followed by 41.70 per cent of the women were small farmers (< 5 acres), and few 6.70 per cent of them were belonged medium farmers category (5-10 acres) in Timmapur village. While in Bhaganagar, majority (38.30 %) of the women respondents belonged to medium farmers (5-10 acres) categories, followed by 35 per cent of them belonged to small famers (< 5 acres) and 20 per cent of them belonged to landless categories.

The data in the Table 1 indicates that comparison of time, quantity of fuel wood required to prepared food per day and quantity of smoke perceived, in both the villages less time was

taken with a improved biomass stove as compared with traditional stove and significant difference was found between the quantity of fuel wood and time taken between improved biomass stove and traditional stove.

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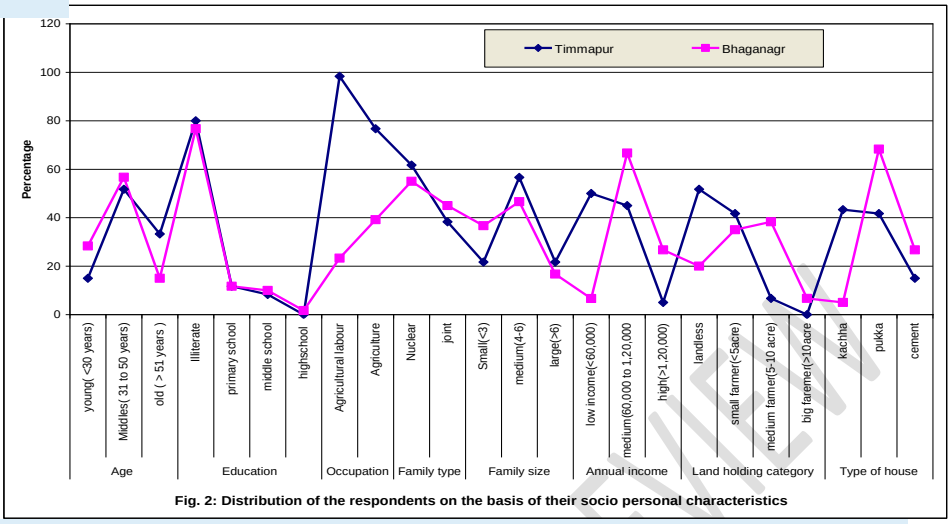

Fig. 2: Distribution of the respondents on the basis of their socio personal characteristics

Fig. 2 distribution of the respondents on the basis of their socio personal characteristics

With respect to quantity of fuel wood used in traditional and improved stove there was't' test shows that significant difference between traditional and improved biomass stove and also there was significance difference of perceived smoke between traditional and improved biomass stove.

Table 1. Comparison of time, quantity of fuel wood required to prepared food per day and quantity of smoke perceived **N=120**

Particulars	**Timmapur**		**(n_1=60)**	**Bhaganagar**		**(n_2=60)**
Time (Hours)	**Traditional stove**	**Improved stove**	**t-value**	**Traditional stove**	**Improved stove**	**t-value**
< 2 2-4 > 4	2.43	1.9	7.71*	2.41	1.73	11.28**
Fuel wood (kg)						
< 5 5-10 > 10	2.48	1.96	7.45*	2.43	1.93	7.96*
Smoke level						
Less Medium More	2.83	1.23	25.08**	2.75	1.33	22.07**

Note: * Significance at the 0.01 level ** Highly significance at the 0.01 level

Table 2 shows that the saving quantification of fuel wood used in the biomass stove. The experimental research revealed that about 58 percent of the fuel wood was saved per year per100 families when compared to traditional stove. About10-15 kg of wood is utilized per year while cooking with biomass stove from 100 families with the karijali fuel wood about 720 kg/ month/100 families. Whereas the traditional stove consumes 1200 kg /month/100 families. By using biomass stove on an average 384 trees/ year/100 families could be saved.

Table.2 Comparative Fuel wood Consumption

Traditional stove	**Biomass stove**
10x30=300 Kg/Week/100Families	6x30=180 Kg/Week/ 100Families
300Kg/ Week/ 100Families	180Kg / Week / 100Families
1200 Kg /Month/ 100 Families	720 Kg / Month / 100 Families
14400 Kg / Year/ 100 Families	8640 Kg/ Year/ 100 Families
14400-8640=5760 Kg Saving	
Therefore each tree = 10-15 Kg wood /Year	
5760/15=384 Trees /Year/100 Families	
5760/100=57.6%/Year/100 Families	

Experimental results

Table 3 Shows that the production of CO_2 was found to higher than the safe level while CO was lower than the safe level (Safe level CO2= 250-350 ppm CO= 9ppm).

The percentage reduction in carbon dioxide and carbon monoxide was found in biomass stove as compared to traditional stove. It could be due to the reduction in smoke and fuel wood consumption in the biomass stove.

Table 3: Estimation of co_2 and Co **N=10**

Parameters	Traditional			Biomass stove			Percentage reduction
	Max	Min	Average	Max	Min	Average	
co_2	754	519	637	510	401	468	26%
CO	21	01	7.50	12	01	5.50	26%

Fuel wood used= cotton stick and Nilagiri , Duration =30 min

CONCLUSION

Improved biomass stoves should be promoted to encourage the rural women for better use of stove. Rural women should be educated regarding usage and importance of improved biomass stoves on their quality of life. The government should enact the policy on subsidiary towards the improved biomass stove. Action oriented research should be taken up to create awareness on usage of improved biomass stove and safeguard the environment.

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