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Usage Pattern of Improved Biomass Stove in Rural Households of Dharwad and Vijayapur Districts, Karnataka, India

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ABSTRACT

A study on utilization pattern of improved biomass stoves in rural areas of Dharwad and Vijayapur districts is conducted during the year 2016-17. The objective to analyze the socio-economic status of the rural women, usage pattern of adopted improved biomass stoves and time, quantity of fuel wood required to prepare food per day, cooking time (morning and night) and smoke perceived on the improved biomass stove. The sample of the study comprises of 120 rural women. The personal interview method was used to collect the data. Appropriate statistical techniques like percentage, frequency and t-value are used to depict the results. The findings of the study revealed that in both the villages majority of the rural women were belonged to middle age group. Majority of the women were illiterate, Agricultural labourer was the main occupation in village and nuclear family was more than the joint family, income of the family was medium. Majority of the women belonged to Small farmer category and most of women had pucca house. In both the villages cent percent of the women were utilized the adopted improved biomass stove full time to cook the food during morning and night and less time, less quantity of fuel wood required to cook food on improved biomass stove as compared with traditional stove and also less smoke released on improved biomass stove as compared with traditional stove.

Key words: *Improved biomass stove, Traditional stove, Fuel wood, time and Smoke perceived.*

INTRODUCTION

Improved biomass stove is an 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. The continued use of improved stoves in the developing countries is of social, economic and environmental concern. In most developing countries, biomass-based energy accounts for more than 90% of all household energy consumption.

It is estimated that 2 million people die globally because of indoor air pollution in smoky kitchens according to the World Health report. One way to minimize pressure on forests, reduce household's wood fuel demand, improve indoor air conditions as well as mitigate against global warming and climate change is by adopting wood fuel conservation technologies. These technologies do not only assist in energy conservation but they also emit less pollutants thus reducing women and children exposure to indoor air pollution. There has been a disparity in their adoption and limited data are available relating to adoption of these technologies. It is believed that the use of improved biomass stoves would save on use of wood fuel yet the take up is low. Promotion of energy technologies such as improved biomass stoves has been going on in many countries yet the uptakes of the technology remains relatively low. Thus, the present study was undertaken to know the adoption and use of improved biomass stove in rural areas.

MATERIAL AND METHODS

The present study was conducted in Timmapur and Bhaganagar villages of Dharwad and Vijayapur districts. The total sample size was 120. Each 60 samples from Timmapur and Bhaganagar villages. Multistage random sampling technique procedure was adopted for selection of the sample. The data regarding usage pattern of improved biomass stove in rural households. The interview schedule was used for the collecting the data. Collected data was analysed with help of percentage, frequency and t-test.

RESULTS AND DISCUSSION

Socio economic profile of the respondents

The Table 1 showed that, in both Timmapur and Bhaganagar villages majority (54.16 %) of the women had belonged to middle age group (31 to 50 years) followed by old age group (> 51 years) and young age group (31 to 50 years).Majority of the women were illiterate (78.33 %) followed by 11.66 per cent of them had an education up to primary level school

(1-4), middle level school (5-7) and high school (8-10) and majority of the women occupation was agricultural labour (60.83 %), followed by agriculture (39.16 %). Majority of the women were belonged to nuclear family (58.33 %) where as about 41.66 percent of them belonged to joint family and majority (51.66 %) of the women had medium family size followed by Small family and large family size. Overall, majority of the women were in the medium income group (55.83 %) followed by low income group and less of the women were in the high income group. Overall, majority of the women were belonged to small farmer category (38.33 %) followed by landless, medium farmers category and big farmers category. Overall, majority of the women had pucca house (55.0 %) followed by Kachha house and RCC house.

Usage pattern of the improved biomass stove by selected families

Irrespective of both the villages majority of the women had used the combination of fuel wood, twigs and cow dung in both morning and night (50.00 and 50.83 %), followed by wood pieces, maize cobs and twigs. With respect to quantity of fuel wood majority of the women had used the 1 -2.5 kg of fuel wood during night and morning (83.33 and 55.83), followed by 3 to 4.5 kg and 5 to 6.5 kg. With respect to ash quantity was more in the morning and less in the night, charcoal quantity was medium in the morning and as well as night (54.16 and 53.33) and more women had spent the time 2 hours to 3 ½ hours for cooking in the morning time and ½ an hour to 1 ½ hour during night (85.83 and 60.83). The findings inline with Abhishekh *et al.*[2] found that most households in the Indian region, mixed fuel (MF) is more commonly used because of the cost and access constraints posed by hardwood.

Time and quantity of Fuel wood required to prepare food per day and the quantity of smoke perceived

The data in Table 3 depicts that time and quantity of fuel wood required to prepare food per day and the quantity of smoke perceived by women. Overall, majority (54.16 %) of the

women were spent more than 4 hours for cooking on traditional stove and while on improved biomass stove most of the women (80.00 %) had spent 2-4 hours for cooking. With respect to quantity of fuel wood, about 78.33 per cent of the women had used more than 10 kg of fuel wood on traditional stove and 95 per cent of the women had used 5 to 10 kg of fuel wood on improved biomass stove. Regarding quantity of smoke majority (79.16 %) of the women were expressed that more smoke released from the traditional stove as compared to the improved stove and 71.66 per cent of the women were expressed that less smoke released from the improved biomass stove. The results are inline with Abebe *et al.*[1] found that More than half of the respondents agree that improved stoves reduce fuel wood collection and cooking time. For example, about three-fourths of households report cooking time savings. The contradictory result of the study with Nepal *et al.*[5] found that 42-45 per cent of the women were reported that improved stove requires the less time as compared to traditional stove. Vivek *et al.*[7] found that use of improved biomass stove saved 25 % fuel 12 % time and indicates smokeless (63 %).

Comparison of time, quantity of fuel wood required to prepared food per day and quantity of smoke perceived

The data in the Table 4 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.

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: Socio economic profile of the rural women   N=120

Variables	Categaory	Timmapur (n₁=60)	Bhaganagar (n₂=60)	Total (N=120)
Age	Young (<30 years)	9 (15.00)	17 (28.30)	26 (21.66)
	Middle (31to50 years)	31 (51.70)	34 (56.70)	65 (54.16)
	Old (> 51years)	20 (33.30)	9 (15.00)	29 (24.16)
Education	Illiterate	48 (80)	46 (76.70)	94 (78.33)
	Primary school (1-4)	7 (11.70)	7 (11.70)	14 (11.66)
	Middle school (5-7)	5 (8.30)	6 (10.00)	11 (9.16)
	High school (8-10)	-	1 (1.70)	1 (0.83)
Occupation	Agriculture labour	59 (98.30)	14 (23.30)	73 (60.83)
	Agriculture	1 (1.70)	46 (76.70)	47 (39.16)
	Subsidiary	-	-	
	Salaried job	-	-	
Family Type	Nuclear	37 (61.70)	33 (55.00)	70 (58.33)
	Joint	23 (38.30)	27 (45.00)	50 (41.66)
Family size	Small (< 3)	13 (21.70)	22 (36.70)	35 (29.16)
	Medium (4-6)	34 (56.60)	28 (46.60)	62 (51.66)
	Large (> 6)	13 (21.70)	10 (16.70)	23 (19.16)
Annual income of the Family (Rs)	Low income (<60,000)	30 (50.00)	4 (6.66)	34 (28.33)
	Medium (60,000 to 1,20,000)	27 (45.00)	40 (66.66)	67 (55.83)
	High (> 1,20,000)	3 (5.00)	16 (26.70)	19 (15.83)
Land holding category	Land less	31 (51.70)	12 (20.00)	43 (35.83)
	Small farmer (<5acre)	25 (41.70)	21 (35.00)	46 (38.33)
	Medium farmer (5-10acre)	4 (6.70)	23 (38.30)	27 (22.50)
	Big farmer (>10acre)	-	4 (6.70)	4 (3.33)
Type of House	Kachha	26 (43.30)	3 (5.00)	29 (24.16)
	Pucca	25 (41.70)	41 (68.30)	66 (55.00)
	RCC	9 (15.00)	16 (26.70)	25 (20.83)

Note:-Numbers in the parenthesis indicate percentage

Table 2: Usage pattern of the improved biomass stove by selected families   N=120

Sl. No.	Particulars		Timmapur (n₁=60)		Bhaganagar (n₂=60)		Total N=120	
			Morning	Night	Morning	Night	Morning	Night
1.	**Type of wood**	Wood pieces	12 (20.00)	15 (25.00)	24 (40.00)	22 (36.70)	36 (30.00)	37 (30.83)
		Twigs	7 (11.70)	8 (13.30)	-	-	7 (5.83)	8 (6.66)
		Both wood pieces twigs and cow dung	41 (68.30)	37 (61.70)	19 (31.70)	24 (40.00)	60 (50.00)	61 (50.83)
		Wood pieces and maize cob and cow dung	-	-	17 (28.30)	14 (23.30)	17 (14.16)	14 (11.66)
2.	**Quantity of fuel wood**	1kg-2.5kg	21 (35.00)	47 (78.30)	45 (75.00)	53 (88.30)	67 (55.83)	100 (83.33)
		3kg-4.5kg	32 (53.30)	12 (20.00)	13 (21.70)	6 (10.00)	45 (37.5)	18 (15.00)
		5kg-6.5kg	6 (10.00)	1 (1.70)	1 (1.70)	1 (1.70)	7 (5.83)	2 (1.66)
		7 and above	1 (1.70)	-	1 (1.70)	-	2 (1.66)	-
4.	**Ash Quantity**	Less	-	21 (35.00)	7 (11.60)	32 (53.30)	7 (5.83)	53 (44.16)
		Medium	24 (40.00)	38 (63.30)	31 (51.70)	27 (45.00)	55 (45.83)	65 (54.16)
		More	36 (60.00)	1 (1.70)	22 (36.70)	1 (1.70)	58 (48.33)	2 (1.66)
5	**Charcoal Quantity**	Less	3 (5.00)	29 (48.30)	1 (1.70)	25 (41.70)	4 (3.33)	54 (45.00)
		Medium	35 (58.30)	31 (51.70)	30 (50.00)	33 (55.00)	65 (54.16)	64 (53.33)
		More	22 (36.70)	-	29 (48.30)	2 (3.30)	51 (42.5)	2 (1.66)
6.	**Time taken for cook (min)**	½ hour to 1 ½ hour	3 (5.00)	27 (45.00)	14 (23.30)	46 (76.70)	17 (14.16)	73 (60.83)
		2hour to 3 ½ hour	57 (95.00)	33 (550.0)	46 (76.70)	14 (23.30)	103 (85.83)	47 (39.16)

Note:-Numbers in the parenthesis indicate percentage

Table 3:Time and quantity of Fuel wood required to prepare food per day and the quantity of smoke perceived

Particulars	Timmapur (n₁=60)		Bhaganagar (n₂=60)		Total N=120	
Time	Traditional stove	Improved stove	Traditional stove	Improved stove	Traditional stove	Improved stove
< 2 hours	9 (15.00)	8 (13.33)	5 (8.33)	10 (16.66)	14 (11.60)	18 (15.00)
2-4 hours	16 (26.66)	50 (83.33)	25 (41.66)	46 (76.66)	41 (34.16)	96 (80.00)
> 4 hours	35 (58.33)	2 (3.33)	30 (50.00)	4 (6.66)	65 (54.16)	6 (5.00)
Fuel wood						
< 5 kg	3 (5.00)	2 (3.33)	3 (5.00)	4 (6.66)	6 (5.00)	6 (5.00)
5kg-10kg	6 (10.00)	58 (96.66)	4 (6.66)	56 (93.00)	10 (8.33)	114 (95.00)
>10kg	51 (85.00)	-	43 (71.66)	-	94 (78.33)	-
Smoke						
Less	-	46 (76.7)	-	40 (66.7)	-	86 (71.66)
Medium	10 (16.67)	14 (23.3)	15 (25.00)	20 (33.3)	25 (20.83)	34 (28.33)
More	50 (83.33)	-	45 (75.00)	-	95 (79.16)	-

Note:-Numbers in the parenthesis indicate percentage

Table 4: Comparison of time, quantity of fuel wood required to prepared food per day and quantity of smoke perceived

Particulars	Timmapur	(n₁=60)		Bhaganagar	(n₂=60)	
Time (Hours)	Traditional stove	Improved stove	t-value	Traditional stove	Improved stove	t-value
< 2						
2-4	2.43	1.9	7.71*	2.41	1.73	11.28**
> 4						
Fuel wood (kg)						
< 5						
5-10	2.48	1.96	7.45*	2.43	1.93	7.96*
> 10						
Smoke level						
Less						
Medium	2.83	1.23	25.08**	2.75	1.33	22.07**
More						

Note: * Significance at the 0.01 level

** Highly significance at the 0.01 level

CONCLUSION

The present study was concluded that the utilization of improved stoves in Timmapur and Bhaganagar villages in Dharwad and Vijayapur districts .The main advantages of the improved biomass stove, which facilitate its utilization, were that it saves households fuel and time. It also produces less smoke in kitchen and improved the quality life of rural women.

REFERENCES

1. Abebe, D. B., Randall, B., Sahan, D., Zenebe, G., Peter, M., Alemu, M. and Michael, T., Can improved biomass cook stoves contribute to REDD+ in low-income countries? Evidence from a controlled cooking test trial with randomized behavioral treatments. *WPS7394,www.http://econ.worldbank. org.*, pp. 1-47 (2015).
2. Abhishek, K., Ibrahim, H. R., Jennifer, B., Praveen, S. P., Ramasubramanyaiyer, S., Lokendra, S., Vivek, K. S., Tanveer, A., Nithya, R. and Veerabhadran, R., Real time assessment of black carbon pollution in Indian households due to traditional and improved biomass cookstoves. *Environ. Sci. Technol.*, **40:** 85-92 (2012).
3. Elisabeth, D., Bendevries Martin, H., Verchot, L. and Robert, M., Fuel wood savings and carbon emission reductions by the use of improved cooking stoves in an afromontanceforest, Ethiopia. *Land ISSN.* **3:** 1137-1157 (2014).
4. Moreshwar, H., Improved cookstoves for Rural Inia: Issues and recommendations. *TERRE (Policy center),* pp. 1-27 (2014).
5. Nepal, C. D., Mehrab, A., Anik, A., Tahmid, A., Mushfiq, M. and Grant, M., Pilot Intervention of Improved Cook Stoves in Rural Areas: Assessment of Effects on Fuel Use, Smoke Emission and Health. *Res. Evaluat. Division,* **53:** 1-26 (2012).
6. Somnath, H., Jessica, L., Ipsita, D., Ashok, S., Adoption and Use of Improved Stoves and Biogas Plants in Rural India. *South Asian Network for Development and Environmental Economics (SANDEE), ISSN 1893-1891,* WP 86– **14:** 1-34 (2014).
7. Vivek, S., Ravi Teja, P. L., Kumar, R., Sundaresan, Improved Biomass Solid Fuel Based Cooking Devices and Adoptability Issues. *Int. J. Sci. Res. Engg. Technol.,* **2(11):** 711-716 (2014).