Content list available at http://epubs.icar.org.in, www.kiran.nic.in; ISSN: 0970-6429

Indian Journal of Hill Farming

2018, Special Issue, Page 113-117

Contribution of Smokeless Chulha for Rural Cooking in Churachandpur District, Manipur

S. Roma Devi[1] • L Kanta Singh[2*]

[1]KVK Churachandpur, ICAR Research Complex for NEH Region, Manipur Centre, Imphal-795004, Manipur

[2]KVK Imphal West, ICAR Research Complex for NEH Region, Manipur Centre, Imphal-795004, Manipur

ARTICLE INFO

Article history:
Received 5 January 2017
Revision Received 18 July 2017
Accepted 25 September 2017

Key words:
Traditional Chulha, Smokeless Chulha, Fuel Wood Requirement, Cooking

ABSTRACT

The smokeless chulha is a cooking stove that can save the lives of hundred thousands of women and young girls in rural areas as well as urban areas who are burning wood as cooking fuel. Average time required to boil one litre of water was calculated 12.25 minutes using smokeless chulha and in case of traditional chulha it was 19.3 minutes. Average fuel require to boil one litre of water was estimated 237 gm of fuel wood for smokeless chulha and whereas 411 gm of fuel wood was required in case of was traditional chulha. Smokeless chulha on an average could save 42.46% of fuel over the traditional chulha. The smokeless chulha could save huge amount of natural resources by reducing the cutting of forest.

1. Introduction

About 2.7 billion people cook food over stone, clay stoves, brick and fuelled by wood, leaves, dung, etc. (International Energy Agency, 2015). Wood is the most common fuel used in rural homes of Manipur, because women get them from forest free of cost especially in hill areas of Manipur. Smokeless chulha is an improved version of traditional chulha and has many advantages over it. Its proper use and care relieves an individual from different problems like smoke free kitchen which is safe for many health problems. Traditional cooking air pollution caused by burning unprocessed biomass is a serious and urgent health concern. The traditional chulha cooking stove is one of the major causes of pollution in both in urban and as well as rural areas. The toxins and carcinogens released from these stoves cause nearly 500,000 deaths annually in India alone (Anonymous 2007; World Bank 2002). Due to this open design, the traditional chulha is not only inefficient, but also subjects the homemaker (predominantly women and young girls) to carcinogenic fumes. The smokeless chulha is a cooking stove that can save the lives of hundred thousands of women and young girls in rural areas as well as urban areas who are burning wood as cooking fuel subject to the deadly toxins released from the fuel wood. Improved chulha refers to a more clean, economical and environmentally safe option over a traditional local chulha. The traditional chulha has no system of smoke removal which leads to air pollution resulting health hazards especially to rural women and young children. On other hand improved chulha has better system of smoke removal and air circulation for better thermal efficiency. Smokeless chulha can be easily constructed using locally available materials. Approximately half the world's population burns unprocessed biomass fuels to meet their daily cooking energy needs (Anonymous, 2001). Solid fuel pollution is the largest energy-related health risk in the world and is the main causes of ill-health for Indian women and girls (Smith and Sagar, 2014). In most of the developing countries, wood and other biomass fuels are still the primary source of energy for majority of the people. The total energy used for domestic cooking is about 70 – 80% of the total energy available in the village and about 80 - 90% of domestic cooking energy is met from fuel wood. (Hazarika *et al.,* 2007). In Churachandpur district of Manipur most of the cooking is met through traditional chulha and about 100% energy for cooking is met from fuel wood. Across Manipur a family's economic status generally determines the form of energy used. The wealthy family tends to used of more electric power and LPG gas in domestic cooking to poorer family towards the used of more fuel wood.

*Corresponding author: kanta_lai@yahoo.co.in

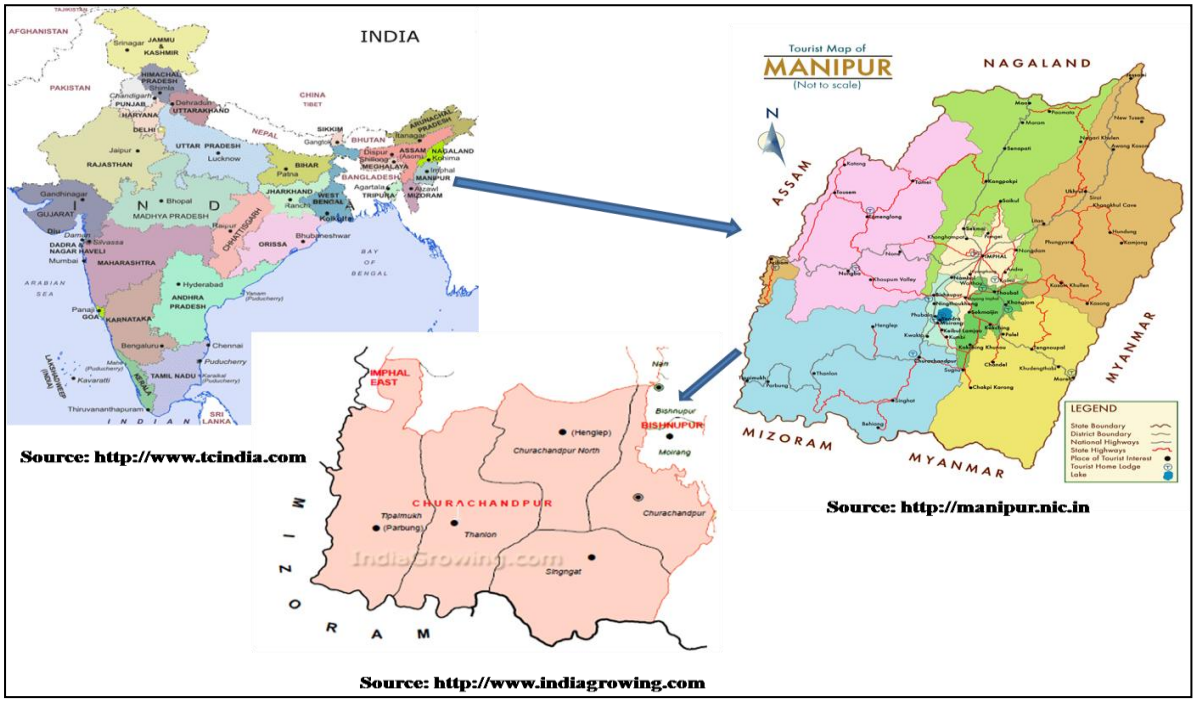

Figure 1. Location of study area

2. Materials and Methods

2.1 Overview of study area

According to the 2011 census, Churachandpur district has a population of 274143. The density of the district population is 60 km^2. The population growth with reference to last population census 2001 is 20.29%. Churachandpur district has a sex ratio of 969 females to 1000 males and district has a literacy rate of 82.78 %. Out of the total Churachandpur population for 2011 census, 6.7% lives in urban areas and remaining 93.3% lives in rural areas. The details of population data is given in Table 1. The location of the study area is given in Figurer 1. Household size was estimated by taking household survey. Similarly boiled water requirement including bathing and cooking per household were also calculated by household survey data (Table 2). Average size of the population was calculated at 6.5 per person per household. The average boiled water used per person per day including cooking and bathing was estimated at 13 litres. Number of households was calculated by dividing average household size to the total population.

Table 1. Population of Churachandpur district, Manipur as per 2011 census

Population Type	Male	Female	Total
Rural	129659	126127	255786
Urban	9161	9196	18357
Total	138820	135323	274143

2.2 Fuel wood used for the trial

Alder (*Alnus nepalensis*), a very common species of fuel wood used in the Churchandpur district was selected for the trial of fuel wood for both in traditional chulha and smokeless chulha. Traditional chulha used in case of rural household cooking was considered 80% whereas urban household cooking was considered 20%.

Table 2. The household size and boiled water requirement per person of Churachandpur district, Manipur

House Survey No	Persons per household	Boiled water used (including bathing and cooking)	Boiled water used (per person per day)
1	5	70	14
2	5	60	12
3	8	120	15
4	7	77	11
5	7	84	12
6	5	65	13
7	6	84	14
8	7	91	13
9	7	84	12
10	8	112	14
Average	**6.5**	**84.7**	**13**

2.3 Cooking methods in rural areas

The most of the rural areas cook their meals on wood burning chulhas that have been a part of Indian cooking system for thousands of years. The open flame cooking platform has a variety of forms and materials but the basic construction is similar. Fuel wood is burned under a pot or pan that is suspended over the open flame. Chulhas are often made from materials that are easily accessible in rural areas. The open design allows heat and smoke to dissipate from the sides without channelling it to productive use. A huge portion of the heat produced by the burning fuel wood is lost to the open air. Due to heat losses to the open air, traditional chulha requires more fuel and more cooking time. The traditional chulha posses hazardous smoke randomly. The individuals cooking mostly ladies or girls or even to the entire family members are exposed to carcinogenic flames that cause serious long term health problems. The chulha requires extended cooking time. Another disadvantage of traditional cooking chulha can only cook one item at a time, which expands more cooking time. Traditional chulha used in Churachandpur in given in Figure 2.

2.4 Smokeless chulha an alternative solution

Udairaj smokeless chulha developed by Renewable Energy Department., CTAE, MPUAT, Udaipur were introduced as alternative viable option to the traditional chulha. The smokeless chulha still burns wood like the traditional chulha. The smokeless chulha uses closed design of heat from the burning wood more efficiently and also diverts the carcinogenic smokes out through an overhead cement pipe away from the cooking chulha or cooking area. The chulha is designed with closed walls on all three sides and two top open holes for cooking. A cement pipe affixed to a corner edge is a key feature that diverts the smoke up and away from the cooking chulha. Construction of smokeless chulha is shown in Figure 3.

Table 3. Time and fuel required for boiling of one litre of water using traditional chulha

Trial No.	Time required for boiling one litre water using traditional Chulha (minutes)	Fuel required for boiling one litre water (gm)
1.	20.5	410
2.	18.5	385
3.	21.0	435
4.	17.5	380
5.	19.0	395
6.	22.0	440
7.	17.5	395
8.	18.5	415
9.	19.5	425
10.	19.0	430

Table 4. Time and fuel required for boiling of one litre of water using smokeless chulha

Trial No.	Time required for boiling one litre water using smokeless chulah (minutes)	Fuel required for boiling one litre water (gm)
1.	12.5	220
2.	13.5	255
3.	11.5	235
4.	12.0	240
5.	14.5	260
6.	12.0	230
7.	11.5	225
8.	10.5	210
9.	11.5	240
10.	13.0	250

Figure 2. Traditional chulha used in Churachandpur district, Manipur

3. Results and Discussion

3.1 Cooking time and fuel consumption

Ten numbers of trials were performed for both traditional chulha and smokeless chulha. One litre of water was taken for each trial. Time taken to boiled the water and fuel consumption was measured for each trial. Details of trial for both traditional chulha and smokeless chulha are given in Table 3 and Table 4. Average time required to boil one litre of water was calculated 12.25 minutes using smokeless chulha and in case of traditional chulha it was 19.3 minutes. Average fuel required to boil one litre of water was estimated 237 gm of fuel wood for smokeless chulha and whereas 411 gm of fuel wood was required in case of was traditional chulha (Table 5). By using smokeless chulha on an average 42.46% of fuel can be saved over the traditional chulha.

Table 5. Comparative studies of time and fuel requirement for boiling one litre water using smokeless chulha and traditional chulha

Particulars	**Smokeless Chulha**	**Traditional Chulha**
Average time required for boiling one litre water (minutes)	12.25	19.3
Average fuel required for boiling one litre water (gm)	237	411
Heating efficiency	High	Low

3.2 Potential fuel wood used

Annual potential fuel wood used in Churachandpur district was estimated using population data of rural as well as urban areas (Table 6). The annual potential fuel wood used for traditional chulha in rural areas was estimated at 399066 tonnes and 7159 tonnes in the urban areas (Table 7).

Standard deviation of fuel required for boiling one litre of water was calculated 15.82 and 21.45 for smokeless chulha and traditional chulha respectively. Three different scenarios of annual consumption of fuel wood using traditional chulha and smokeless chulha were calculated (Table 7). In the first scenario smokeless chulha could save 43.35% of fuel wood over traditional chulha. In the second and third scenario smokeless chulha could save 42.46% and 41.65% respectively.

Table 6. Total number of population cooking on traditional chulha

Inhabitant Area	**Population**
Rural	204629
Urban	3671
Total	208300

Table 7. Annual fuel wood requirement for traditional chulha in Churachandpur district

Inhabitant Area	**Annual fuel wood requirement for traditional chulha (tonnes)**
Rural	399066
Urban	7159
Total	406226

Conclusion

In the last few decades, Manipur have experienced a rapid depletion of natural forest resources that has resulted in hardship for the people living in rural areas, especially women and children who spend a considerable part of their time and energy in search of fuel wood and often have to cover long distances. Besides, deforestation has also led to many negative ecological consequences. The smokeless chulha is good technology and it's affordable for most people in rural areas. The smokeless chulha could save huge amount of natural resources by reducing the cutting of forest. It is a boon to the rural people of Manipur.

Figure 3. Construction of smokeless chulha in Churachandpur district, Manipur

References

Anonymous (2007) Environmental sanitation institute, smokeless chullas. http://www.esi.org.in/ technology_ smokeless.htm (assessed on October 14, 2015).

Anonymous (2001) Indoor air pollutants in India – a major environmental and public health concern. Indian Council of Medical Research Bulletin: 31(5). http://icmr.nic.in/bumay01.pdf (assessed on October 14, 2015).

Census (2011) Population of Churachandpur district. Census data, http://www.census2011.co. in/census /district/372-churachandpur.html (assessed on 05 January, 2015)

Hazarika S, Barooah MJ and P Rajkhowa (2007) Improved cookstoves in Assam- a performance study, Akshya Urja: 1(1)

International Energy Agency (2015). World energy outlook 2015-traditional use of solid biomass for cooking. London: OECD/IEA.

Map of Churachandpur district, Manipur. http://www. indiagrowing.com/article_img/churachandpur.png (assessed on 12 October, 2015).

Map of India. http://www.tcindia.com/images/map.gif (assessed on 12 October, 2015).

Map of Manipur. http://manipur.nic.in/images/Manipur-Map-copy.gif (assessed on 12 October, 2015).

Smith KR and A Sagar (2014) Making the clean available: Escaping India's Chulha Trap. Energy Policy, 75: 410-414.

World Bank (2002) Indoor air pollution: energy and health for the poor. Energy Sector Management Assistance Programme (ESMAP); no. 7 (July 2002). Washington, DC: World Bank, http:// documents.worldbank.org/curated/en/2002/07/3517 582/indoor-air-pollution-energy-health poor (assessed on October 14, 2015).