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HOUSEHOLD ENERGY CONSUMPTION PATTERN AND SOCIO-ECONOMIC FACTORS ASSOCIATED WITH IT: A CASE STUDY OF VILLAGE DANDESAR, DISTRICT RAJOURI (J&K, INDIA)

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ABSTRACT

A survey of household energy consumption pattern was carried out in village Dandesar of tehsil Nowshera, district Rajouri (J&K, India). The major fuel types fulfilling the energy demand of local people in study area were wood, LPG, crop residue and dung cake. Fuel wood constituted the major share of consumption which was 100.74×10^6 kcal/month, while dung cake utilization was found to be least. The total fuel consumption in the study area was 111.49×10^6 kcal/month. The study concluded that income was an important factor in making fuel preferences at household level.

INTRODUCTION

Energy is a vital component for the sustained economic growth and energy mix is an indicator of sustainable development of a region or country. Energy resources hold the key to the economic development of any region. Their availability increases growth and development whereas their non-availability retards development. To achieve development goals through energy, it requires the knowledge of how people make decisions about their energy use (Kowsari and Zerriffi, 2011). Throughout the developing world, biomass is the primary source of energy for domestic use (Bhatt and Sachan, 2004), which includes agricultural crops, trees, wood residue, grasses, municipal residue and plant derived matter with variety of applications, including bioenergy, biofuel production, residential heating, industrial heat and processing energy (Christopher *et al.,* 2009). Biomass is one such renewable source which accounts for nearly 33% of a developing country's energy needs. Fuel wood is the most widely used form of biomass. Crop residues and dung cakes are also used in place of fuel wood where there is a scarcity of wood (Madubansi and Shackeleton, 2006). More than 70% of Indian population lives in rural areas and satisfy 80% of its energy needs only from the fuel wood collected from forests and nearby sites (Bhattacharya, 2005).

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Cooking fuels in the rural areas of India are predominantly unprocessed biofuels, such as fuel wood, crop residues and animal dung. According to household expenditure survey conducted by NSSO in the year 2007-2008 in rural India, over 77% households were found to depend on fuel wood chips for cooking. About 7% households used dung cakes and only 9% made use of LPG. Fuel wood is the natural source of energy whose decentralized character is particularly suited to the scattered nature of rural habitation and usually makes it possible to obtain the fuel at very affordable cost. In Jammu and Kashmir (J&K) due to its temperate, dry and cold arid conditions, huge quantity of energy is required for cooking as well as keeping the houses warm during severe winter. To meet the demands of fuel wood, the households are usually dependent on the forests or other community lands whereas little is obtained from agriculture fields and markets.

In high altitude villages of Kashmir and Ladakh regions of J&K, it was reported that fuel wood and kerosene are the two main sources of energy in decreasing order, respectively (Hussein, 1987). Due to population growth and changing socio-economic condition of the people, resources like fuel, fodder, timber and other forest products are becoming scarce and their overuse results in deforestation, disturbed ecosystem, erratic rainfall, recurrent soil erosion, loss of biodiversity and habitat of wild animals. In order to get rid of such problems, there is need to formulate the strategies for adoption of eco-friendly and non-conventional sources of energy. In this

context, the present study was conducted in order to know the household energy consumption pattern and associated socio-economic factors in village Dandesar, district Rajouri (J&K, India).

MATERIALS AND METHODS

The study area was Village Dandesar of Tehsil Nowshera, District Rajouri, situated on the Jammu-Poonch Highway. The area was situated between 33ºN latitude and 74ºE longitude. Most of the area was undulating with moderately sloped hills. Only a small portion of Rajouri district in the northeast had high altitude mountainous tract, where the altitude was raised upto 4460m at its highest peak. The climate of the area was of sub-tropical type. The area was rain fed and dependent mainly on rainwater for irrigation. For the collection of data, a detailed questionnaire was prepared involving the various aspects such as socio-economic status, income groups, types of occupation, land use pattern, energy consumption patterns, quantity and types of fuel consumed along with other miscellaneous information.

The survey was conducted in thirty houses on random basis from centre of the village to the periphery to obtain the real pattern of information. The survey of demographic status of the study area involved the use of adult units i.e., one man =1 adult unit, one woman=0.8 adult unit and one child=0.5 adult unit so as to find out the average size of family (Sharma, 1993). For calculating landholding the units used were, one kanal =1/8 Acre, and one hectare=2.471 Acres. Energy units used for different fuel types were, one kilogram of firewood=4000 k.cal, one kilogram dung cake=2400 k.cal, one kilogram crop residue=3200 k.cal, one kilogram of LPG=10800 k.cal and one liter kerosene=7900 k.cal (Veena, 1988).

RESULTS AND DISCUSSION

The energy consumption pattern of an area depends upon availability of its sources and prevailing socio-economic status. In this regard, a comprehensive study was carried out at household level to find out the annual income, land holding, literacy status, and fuel consumption pattern with interrelating socio-economic factors in the study area.

Socio-economic and literacy status

The population of the study area was categorized into four income classes *viz*. very low, low, medium and high.

Table 1. Land use pattern in the study area among different land holding categories

S. No	Landholding category (LHC[1])	Representation of families (%)	Share of LHC's in total land holding (%)	Pattern of landholding among various LHC's (%)	
				Cultivable[2]	Non- Cultivable[3]
1.	Marginal	37	19.13	46.05	53.94
2.	Small	31	25.64	57.60	42.39
3.	Semi-medium	22	30.26	58.21	41.78
4.	Medium	7	11.95	61.22	38.70
5.	Large	3	12.98	42.42	57.57

[1]Marginal < 0.1 hectare, Small 0.1-2.0 hectare, Semi-medium 2.0-3.0 hectare, Medium 3.0-4.0 hectare, Large 4.0-5.0 hectare.
[2]Cultivable land : Irrigated, unirrigated, leased in.
[3]Non-cultivable : Pastures and other grazing land, tree and orchards, barren and cultivable land, cultivable waste land.

Table 2. Energy consumption pattern in the study area

		FUEL IN USE (K.CAL/MONTH)					
S. No	Categories of families	Wood	Kerosene oil	LPG	Dung cake	Crop/agro residue	Representation of families(%)
1.	Marginal	86.96×10^6 (95.85)	13.272×10^5 (1.46)	6.48×10^5 (0.71)	3.6×10^5 (0.39)	14.4×10^5 (1.58)	37
2.	Small	6.48×10^6 (68.85)	10.665×10^5 (11.35)	10.8x105 (11.47)	1.44×10^5 (1.53)	6.4×10^5 (6.80)	31
3.	Semi-medium	52.2×10^6 (71.85)	8.69×10^5 (11.96)	8.64×10^5 (11.89)	0.72×10^5 (0.99)	2.9×10^5 (3.30)	22
4.	Medium	1.12×10^6 (44.35)	6.32×10^5 (25.03)	6.48×10^5 (25.66)	0.288×10^5 (1.14)	0.96×10^5 (3.80)	7
5.	Large	0.965×10^6 (61.27)	1.105×10^5 (7.05)	4.6×10^5 (29.36)	0.072×10^5 (0.46)	0.228×10^5 (1.83)	4
	Total	100.74×10^6	4.0052×10^6	3.7×10^6	6.112×10^5	2.439×10^6	100

*Marginal < 0.1 hectare, Small 0.1-0.2 hectare, Semi-medium 0.2-0.3 hectare, Medium 0.3-0.4 hectare, Large 4.0-5.0 hectare
*Figure in parenthesis indicates percentage

Table 3. Percentage share of different fuel types in terms of their usage in the study area

S. No	Type of fuel	Total fuel used (Kcal/month)	Percentage
1.	Wood	100.74×10^6	90.35
2.	Kerosene oil	4.005×10^6	3.59
3.	LPG	3.7×10^6	3.31
4.	Dung cake	0.6112×10^6	0.45
5.	Crop/Agro residue	2.439×10^6	2.18
	Total	111.4952×10^6	100

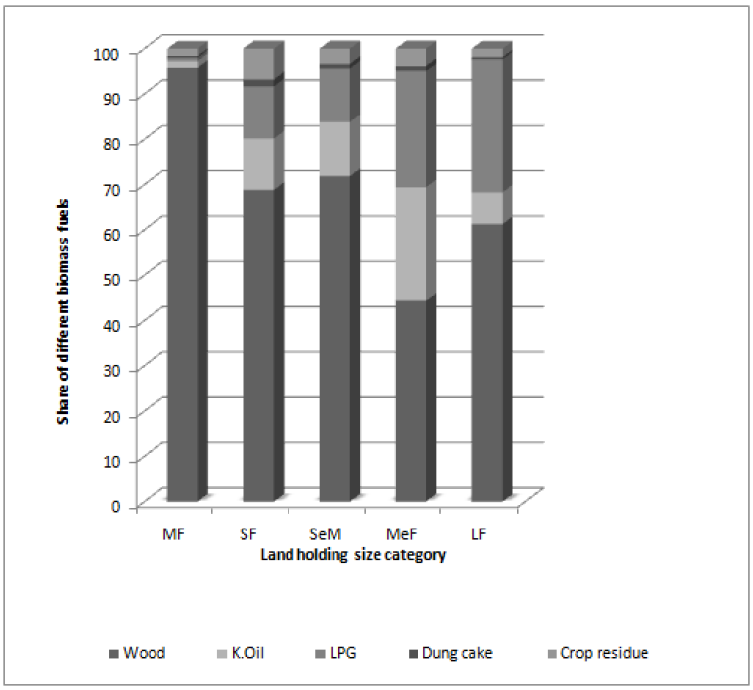
The representation of high-income class was found to be highest (43.75%), followed by very low (25.0%), low (12.5%) and medium class (18.75%). The less income of low-income group was due to less agricultural land holding and lack of employment. The main sources of income observed in the

study area were agriculture, apiculture, sericulture and farm forestry. The literacy status in the study area was also studied. In the present study, a literate was considered as one who knew three R's i.e. reading, writing and arithmetic. The literacy status of males and females in the area was 64% and 55%, respectively, which was comparable to the overall literacy rate of Jammu and Kashmir in which 54.66% females and 65.75% males were literate. The literacy status of males was more than that of females. The low literacy status among females can be attributed to the fact that people were not aware about the importance of women literacy and they did not even send female children to school to get primary education.

allocation of cultivable land in medium LHC was due to their dependency on agriculture as they have to maximally utilize the available land for cultivation and due to the same reason they had lesser non-cultivable land.

Fuel consumption pattern

The fuel consumption pattern in the study area was carried out among different landholding categories (LHCs). The major fuel types consumed in the area were wood, kerosene, liquid petroleum gas (LPG), dung cake and crop residue.



MF – Marginal farms, SF – Small farms, SeM – Semi-medium farms, MeF – Medium farms, LF – Large farms

Fig. 1. Impact of farm size on type of biomass fuel used in the study area

Land use pattern

The population of the study area was classified into different land holding categories *viz.* marginal, small, semi medium, medium and large. The percentage representation of families, their share in total land holding and pattern of land use are presented in the Table 1. The highest representation of families among various landholding categories was observed in marginal LHC (37%), followed by small LHC (31%), semi medium LHC (22%), medium LHC (7%), and large LHC (3%). Though the percentage representation of large LHC was low, the large LHC owned the biggest share of the total land. The total land under each land holding category was categorized into cultivable and non-cultivable land. Cultivable lands represented the irrigated, un-irrigated and leased-in lands while non-cultivable land represented the pastures and other grazing land, trees and orchards, barren and cultivable wastelands. The share of cultivable land was found highest among families covered under medium LHC (61.22%) and lowest among large LHC (42.42%), while largest share of non-cultivable land was observed in large LHC (57.57%) and smallest share in medium LHC (38.70%). The highest

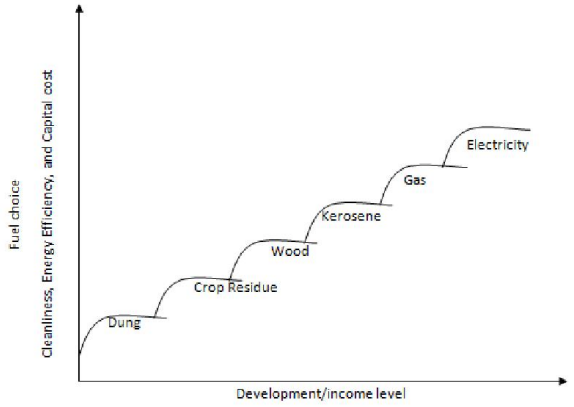


Fig. 2. Energy ladder indicating the shifts in choice on fuel with increasing income/development level

The percentage utilization of each fuel type among different LHCs is given in the Table 2. Fuel wood consumption accounted for the highest utilization (95.85%) in marginal LHC, followed by semi medium LHC (71.85%), small LHC (68.85%), large LHC (61.27%) and medium LHC (44.35%).

Kerosene utilization in the study area was highest in the medium LHC (25.03%), followed by semi medium LHC (11.96%), small LHC (11.35%), large LHC (7.05%) and marginal LHC (1.46%). The use of LPG as energy source for cooking purpose was found to be highest in large LHC (29.36%), followed by medium LHC (25.66%), semi medium LHC (11.89%), small LHC (11.47%) and marginal LHC (0.71%). The utilization of LPG as fuel was found to be highest among large and medium LHCs probably because of their good economic condition. Utilization of dung cake as fuel was found almost uniform in all the five LHCs (0.39-1.53%).

The utilization of crop residue as energy source was highest in small LHC (6.80%) followed by medium LHC (3.80%), semi-medium LHC (3.30%), large LHC (1.83%) and marginal LHC (1.58%). The total fuel consumption (in energy values) was calculated as 111.495×10^6 Kcal /month (Table 3). The highest consumption of the fuel in the study area was that of wood (90.35%), followed by kerosene (3.59%), LPG (3.31%), crop residue (2.18%) and dung cake (0.45%). However, the consumption of fuel wood (90.35%) was less as compared to the findings of Sharma (1993) in Rui watershed of Jammu region (95.79%), which was probably due to dominance of small land holdings and low income of the people. The kerosene consumption (3.59%) was also less as compared to the findings of Akhter and Malaviya (2014) in village chak chua of Jammu region (25.82%). The utilization of dung cake as fuel was low (0.45%) as compared to the findings of Qureshi *et al.* (2015) in village Shahdarah Sharief of district Rajouri (18.13%). This difference can be attributed to lower bovine population in the present study area and affluence of people to afford convenient and efficient sources of fuel energy.

The crop residue energy utilization in the present study area was found higher as compared to the findings of Sharma (1993) in Rui watershed of Jammu region (<1.0%). The tree species most preferred as fuel wood in the study area were Shisam (*Dalbergia sissoo*), Toot (*Morus alba*), Kidak (*Celtis australis*), Darank (*Melia azedarach*), Saintha (*Dodonea viscosa*), Garanda (*Carissa opaca*), Chir (*Pinus roxburghii*) and Phalai (*Acacia modesta*). The impact of farm size on the type of biomass used in the area revealed that use of fuel wood by marginal LHC was highest (95.83%), followed by semi-medium LHC (71.85%), small LHC (68.85%), large LHC (61.27%) and medium LHC (44.35%) (Fig.1).

The consumption of kerosene followed the pattern *viz.* medium LHC (25.03%), semi-medium LHC (11.96%), small LHC (4.33%), large LHC (7.05%) and marginal LHC (1.46%). The LPG consumption was more in case of large LHC (29.36%), followed by medium LHC (25.66%), semi-medium LHC (11.89%), small LHC (11.47%) and negligible in case of marginal LHC (0.71%). The dung cake use was nearly uniform for all LHCs ranging from 0.39-1.53%. The crop residue consumption pattern in case of marginal and large LHCs was 1.58 and 1.53% and for small LHC, semi-medium LHC and medium LHC, it was between 3.30-6.80%. The higher consumption of fuel wood by marginal LHC was directly related to their small land holding and low income while the higher consumption of LPG by large LHC was may be due to their higher purchasing power. The preference pattern for different kinds of fuel as energy source of the people of study area with increase in income/development level was constructed on the basis of energy ladder given by Smith *et al.* (1983). The observation regarding their preferences is given in Figure 2. The trend signifies that the choice of a fuel depends on its suitability, the access to fuel, the cost of the fuel and high calorific values per unit of given fuel (Mathur, 2012).

Conclusion

The main source of income in the study area was agriculture, non–farm occupations such as bee keeping, sericulture, flourmill, and government services. The representation of high-income class was highest, followed by very low, low, and medium income group. The major fuel types used were wood, kerosene, L.P.G, dung cake, and crop residues. Fuel wood (90.35%) consumption was found to be highest while dung cake (0.45%) was least consumed. Proper education, awareness and switching to cleaner fuels in the study area can reduce the pressure on natural forests for fuel wood species and help the households to act in a sustainable manner.

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