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Fuel consumption and expenditure among rural population of Cuddalore district, Tamil Nadu: a cross sectional study

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ABSTRACT

Background: There are two kinds living in the world. They are human beings and animals. The human begins of the pre-historic age lived like animals with little knowledge of a system of social advancement. The households in the rural and urban area are facing the difficult situation act spending of fuel consumption. A moderately large amount of the revenue of the households has to be set separately aside for the expenditure on fuel.

Methods: This study was a community based cross-sectional study to assess the fuel consumption, 150 households were included in the study.

Results: In the study population 75.33% (113) were male and 24.67% (37) were female. Among the study participants 39.33% of the households are using LPG followed by 24% are using firewood were in 20.67% are using electricity and 16% of households are using kerosene. The multiple linear regression analysis were carried out and the results for the coefficient of multiple determination R squared value is 0.420 which implies 42% of the variation in monthly expenditure of fuel due to the variations in the concerned predictor variables.

Conclusions: The study could be conducted in a large a scale over a wider area with a more accurate sampling procedure. This would give more information on the relation between the fuel consumption, the need for conservation as related to the different income groups and different educational level of the respondents.

Keywords: Cross sectional study, Fuel consumption, Fuel expenditure

INTRODUCTION

There are two kinds living in the world. They are human beings and animals. The human begins of the pre-historic age lived like animals with little knowledge of a system of social advancement. In all respects they were almost like animals and survived on the food like fruits, roots and raw animals flesh and fish. They also never had the concept of a house and their shelter was only the holes under the rocks. The use of fire was not known to them. With the course of time they invented fire by using stones. Later

they found fire is useful in many respects. With the advancement of a system of social advancement the use of fire for cooking, lighting was realized.

Even though rural households often have an easy access to traditional forms of energy-firewood, charcoal and agricultural residues-to fulfil their basic energy needs, these fuels carry adverse effects, such as emissions of particulate matter that are harmful to health, deforestation and environmental degradation. Electricity is an important form of fuel. The use of different forms of fuel is unlimited.

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Right from cooking the food, different forms of fuel are used. The rapid growth of urban areas in developing countries has been accompanied by a huge surge in the demand for household fuels and electricity.² Electricity is an important origin of energy and fuel. The use of electricity is for numerous purposes, such as lighting, running of electric trains and for running industrial units in the beginning electricity was generated by using the reservoirs and it is called hydro-electricity.

Now a day with the increasing demand for electricity, the production has been increased, moderately large by the use thermal stations. The oil is used to run the thermal stations and also the fuel like coal lignite. With the advancement of society and increase of population, the demand for different forms of fuel is also in the increase. With increasing demand for different forms of fuel, the supply could not be proportionately increased and so the cost of different forms of fuel is also increasing day by day.

The households in the rural and urban area are facing the difficult situation act spending of fuel consumption. A moderately large amount of the revenue of the households has to be set separately aside for the expenditure on fuel. While income of the household is considered as a main determinant of fuel choice in the literature on energy transition, a range of other factors such as power relations within the household, seasonal variation in income, and uncertainty about fuel availability have also been attributed for the fuel choice.³ The different form of the fuel used by the households in the rural and urban areas and to find the various factors that influences the expenditure on fuel and to know how far the members of the households realize the important of fuel and fuel economy. In this study is planned to explore the expenditure on fuel consumption has any relationship between income and education level among people of rural area of Cuddalore district.

METHODS

This study was a community based cross-sectional study to assess the fuel consumption households in rural population of Cuddalore district. The study was done between July 2019 to December 2019 (6 months). In this study it has been decided to have the area of survey as rural population of Chidambaram taluk. We have a mixture of households such as households with different levels of income, with different levels of education and people engaged in different professional. Many households consisting of labourers and people with low income can also be seen in this town. So it has been decided to take up this town for the purpose of the present study. Five villages from Chidambaram taluk was selected by simple random sampling method after line listing all the villages in the taluk. From each village a total of 30 houses were selected. The house numbers were enumerated separately for the each village. From each village a random sample of 30 households were selected by using the table of random numbers. Data was collected from 150 houses. The sampling procedure adopted above may be treated as a two stage sampling procedure with simple random sampling at each stage.

The sample size was calculated on the basis of assuming 50% as proportion, using the formula n=4pq/l², the sample size comes to 124. Assuming 10% non-responsiveness, the sample size is taken as 150. The study was done by using a pre-tested, semi structured questionnaire to collect data from the participants. The study questionnaire was divided into two parts as follows: part I-socio demographic details-basic details such as age, gender, education, occupation, type of house, number of members in a family and monthly income; part II-types of fuel used, monthly expenditure on fuel and need for conservation of fuel.

Data collected was entered into Microsoft (MS) excel and then analyzed using Statistical Package for the Social Sciences (SPSS) 23.0 software. Using descriptive statistics, multiple linear regression, to test the association for Chi square test was used for categorical variables, one way analysis of variance (ANOVA) were used for monthly savings from expenditure, monthly savings from electricity and monthly expenditure between three different income groups, P value <0.05 was taken as statistically significant. Those houses that are using at least any one of the fuel (liquefied petroleum gas, kerosene, firewood, electricity) and willing to participate were included in the study and those who are not willing to participate in the study were excluded.

RESULTS

The study included 150 households were selected in Chidambaram town. Among them 75.33% (113) were male and 24.67% (37) were female in the study. Among the study participants 48% (72) were in the age group 30-50, 29.33% (44) were of above 50 years 22.67% (34) were below 30 years. Among the study participants 25.33% (38) were secondary education, 22% (33) have done in primary education, 20% (30) have illiterates, 18% (27) have done some graduation and remaining 14.67% (22) have studied till post-graduation. Among them the head of the households 22.67% (34) were in skilled workers, 18.67% (28) were in semi-skilled workers, 15.32% (23) their own in clerical/ shop/ farm, 14% (21) were in semiprofessional, 12% (18) were in unskilled workers, 10.67% (16) were in professional workers and remaining 6.67% (10) are unemployed. Among them 52.67% (79) were in semi-pucca house and 28.67% (43) were in pucca house and remaining 18.67% (28) are Kuchha house. Among the study participants 39.33% of the households are using liquefied petroleum gas (LPG) followed by 24% are using firewood were in 20.67% are using electricity and 16% of households are using kerosene. Among the study participants for family income as per modified Prasad classification 36% (54) were in class II income group, 18.67% (28) were in class III income group, 17.33% (26) were in class I income group, 16% (24) were in class V income group and remaining 12% (18) were in class IV income group (Table 1).

In the present study monthly expenditure on fuel is influenced by number of factors. The chief among them is the monthly income. There may be a number of the other variables which influence the monthly expenditure on fuel. But for the present study in addition to the monthly income the other two variables taken are number of members in the family and the educational level of the head of the household. It is expected that if the head of the household is literate then there is a possibility that the head of the household to know about the need for conservation of fuel and also prevailing upon the other members of the family to economize the use of fuel. For the purpose of the study the respondents are classified as educated and uneducated. So this variable can be represented by a dummy variable. On the basis of data collected, the multiple linear

regression analysis were carried out and the results for the coefficient of multiple determination R squared value is 0.420 which implies 42% of the variation in monthly expenditure oh fuel due to the variations in the concerned predictor variables. Considering the significance of the regression coefficients of the predictor variable it is seen that the income of the household, the number of member in the family, monthly savings from implementation of economic measure and electricity appliance used in your house have significant regression coefficients because the corresponding P value are less than 0.05. The educational level of the head of the households has an insignificant regression coefficient. It implies that the educational level of the head of the household dose not influence the fuel consumption (Table 2).

Table 1: Distribution of frequency for socio demographic variables.

Variable	Frequency (n=150)	Percentage (%)		
Gender				
Male	113	75.33		
Female	37	24.67		
Age (in years)				
<30	34	22.67		
30-50	72	48.00		
>50	44	29.33		
Education				
Illiterate	30	20.00		
Primary	33	22.00		
Secondary	38	25.33		
Undergraduate	27	18.00		
Postgraduate	22	14.67		
Occupation				
Professional	16	10.67		
Semi professional	21	14.00		
Clerical/shop/farm	23	15.32		
Skilled worker	34	22.67		
Semiskilled worker	28	18.67		
Unskilled worker	18	12.00		
Unemployed	10	06.67		
Type of house				
Kuchha	28	18.67		
Semi pucca	79	52.67		
Pucca	43	28.67		
Type of Fuel used				
LPG	59	39.33		
Kerosene	24	16.00		
Firewood	36	24.00		
Electricity	31	20.67		
Family Income				
Class I	26	17.33		
Class II	54	36.00		
Class III	28	18.67		
Class IV	18	12.00		
Class V	24	16.00		

Table 2: Formulation of multiple regression equation for calculating the monthly expenditure on fuel and to the predictor variables.

Multiple regression statistics	Predictor variables					
	Constant	\mathbf{X}_1	\mathbf{X}_2	X 3	X_4	X_5
Co-efficient	87.52	0.01	15.51	0.06	43.88	6.11
Adjusted R ²	0.400			•		
\mathbb{R}^2	0.420					
Standard error	52.162	0.002	6.604	0.029	8.668	6.436
P-value	0.096	0.001	0.020	0.039	0.000	0.344

Note: X_1 -monthly income; X_2 -no. of member in a family; X_3 -monthly savings from implements of economic measures; X_4 -electricity appliance used in your house; X_5 - educational level

From Table 3, it was observed that it is proposed to test the average amount of monthly savings from expenditure on three different income groups for low income 167.65±53.76, middle income 273.91±87.43 and high income group is 583.91±196.68 with the P value is 0.000 which is statistically significant, it may be conclude that the average monthly saving due to fuel economy measures differ significantly between three income groups.

Average amount of monthly savings from electricity for low income 13.82±4.21, middle income 15.65±4.98 and high income group is 26.17±8.24 with the p value is 0.002 which implies that that there exists a significant difference

between the mean values of the three income groups. And the average monthly expenditure of the households belonging to the three different income group for low income 356.94 ± 117.89 ,middle income 421.45 ± 141.67 and high income group is 507.58 ± 168.54 with the P value is 0.000, which implies that there as a significant different in the average monthly expenditure on fuel consumption for the three different income groups. In Table 4 it was observed that education ($\chi^2=7.336$; p=0.835) and type of house ($\chi^2=2.269$; p=0.893) were not significantly associated with need for conservation of the type of fuel used. Were in family income ($\chi^2=21.550$; p=0.043), are significantly associated with need for conservation of the type of fuel used.

Table 3: ANOVA for different income group.

Test variable		Mean	Standard deviation	P value	
	Low income	167.65	53.76		
Monthly savings from expenditure	Middle income	273.91	87.43	0.000	
	High income	583.91	196.68		
	Low income	13.82	4.21		
Monthly savings from electricity	Middle income	15.65	4.98	0.002	
	High income	26.17	8.24		
	Low income	356.94	117.89		
Expenditure on income	Middle income	421.45	141.67	0.000	
	High income	507.58	168.54		

Table 4: Chi square test to association with socio demographic variables.

	Type of fu	el used (n=150)			
Variable	LPG N (%)	Kerosene N (%)	Firewood N (%)	Electricity N (%)	Chi square (P value)
Education					
Illiterate	09	06	08	07	
Primary	13	05	07	08	7.226
Secondary	15	06	10	07	7.336 (0.835)
Undergraduate	09	04	09	05	(0.833)
Postgraduate	13	03	02	04	
Family income					
Class I	12	06	02	06	
Class II	29	12	08	05	21.550
Class III	10	07	05	06	(0.043)
Class IV	03	05	07	03	

Class V	05	07	09	03	
Type of house					
Kuchha	07	10	06	05	2.260
Semi pucca	27	23	17	12	2.269 (0.893)
Pucca	17	14	07	05	(0.093)

DISCUSSION

In the present study males (75.33%) were predominantly the head of the family compared to female (24.67%) but in a study done by Miah et al both male (51.27) and female (48.73) were almost equally distributed as head of the family. In the present study it was found that 52.67% of the households were in semi pucca followed by 28.67% pucca house and 18.67% in kuchha house. As compared to Joon et al Semi pucca house is 16% and Pucca house (84%). It was found in the present study 39.33% of the households are using LPG followed by 24% are using firewood were in 20.67% are using electricity and 16% of households are using kerosene. Likewise a study done by Miah et al 20.3% of households are using LPG, 18.8% are using firewood, 27.5% are using electricity and 17.4% of households are using kerosene.

In our study participants of 48% of the head of the households belongs to the age group of 30 to 50 followed by 29.33% belonging to the age group of >50 and 22.67% are <30 years of age. Among the study participants 25.33% were educated up to higher secondary, 22% were educated up to primary education and 20% were illiterates. In our study population 22.67% were skilled workers, 18.67% were semi-skilled workers and 15.32% were involved in clerical/shop/farm. As per modified Prasad classification 36% of the study population were in class II, 18.67% were in class III, 17.33% were in class I, 16% were in class V and the rest 12% were in class IV income group.

On the basis of data collected, the multiple linear regression analysis were carried out and the results for the coefficient of multiple determination R squared value is 0.420 which implies 42% of the variation in monthly expenditure of fuel due to the variations in the concerned predictor variables. Considering the significance of the regression coefficients of the predictor variable it is seen that the income of the household, the number of member in the family, monthly savings from implementation of economic measure and electricity appliance used in your house have significant regression coefficients because the corresponding P value are less than 0.05. The educational level of the head of the households has an insignificant regression coefficient. It implies that the educational level of the head of the household dose not influence the fuel consumption.

Sample size is one of the limitations of the study and we did not study about the fuel consumption of automobile at household's level which would have added more information and value to the study.

CONCLUSION

Regressing the monthly expenditure on fuel consumption upon the monthly income, number of member in the family monthly savings, number of electric appliance use and the educational level of the head of the households, it is observed that the independent variable like income of the households, the number of member in the family, monthly savings from implements of economic measure, number electric appliance used in your house are influence expenditure on fuel consumption.

The analysis of variance applied to test the equality of average monthly expenditure on fuel consumption for the three different income levels shows that there is a significant difference between the mean. The study of the seriousness towards the fuel economy as evidenced by the respondents show that an average the expected monthly saving by adoption of fuel conservation significantly differs between the three different income groups. The amount of average monthly savings on the use of electricity due to economy measures is found to be same on the average for the three income groups.

The use of chi square test to test the independence of the intensity with concern of the respondents with that of the educational level, and type of house of the respondent shows that are independent were in family income are shows that dependent. Hence it may be concluded that educational level and type of house does not influences the extent of the concern of the respondents towards the type of fuel used. The level of importance attached to a type of fuel used concept of association with the income level of the respondents. Finally the extent of seriousness about the economic use of fuel is found to be associated with the different income level of the respondents. The study could be conducted in a large a scale over a wider area with a more accurate sampling procedure. This would give more information on the relation between the fuel consumption, the need for conservation as related to the different income groups and different educational level of the respondents.

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