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Determinants of Household Choice of Cooking Energy in Ondo State, Nigeria

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ABSTACT
The choice of domestic cooking energy in Nigeria is an issue for addressing deforestation, and health hazards resulting from indoor air pollution, as result of fuel wood consumption. This study analysed the factors determining the choice of cooking energy in ondo state, Nigeria. Random sampling technique was used to sample 409 households in the study area. The data used for the study were obtained with the use of well-structured questionnaires. Descriptive statistics and multinomial logit were employed for the analysis. Descriptive analyses show that the energy sources available for the use in the study area are kerosene (45%), firewood (43%) and cooking gas (12%). The analysis shows further that 63.7% of the rural populace and 22.9% of people in urban areas utilize fuel wood for cooking in the study area. The results of the multinomial logit show the household income, level of education, household size, occupation of the respondent, nature of the dwelling house and ownership of the dwelling house are the significant factors influencing fuel choice. In order to encourage households to make fuel substitution that will result in more efficient energy use and less adverse environmental, social, and health impacts, a promotion of higher level of education and a promotion of general economic development could be effective instruments.
Keywords: Cooking Energy, households' characteristics, multinomial logit and the use of descriptive survey type.

1. INTRODUCTION

Household energy consumption is a necessity considering its importance on household welfare, public investments, and environments. The pattern of household energy consumption indicates the state of welfare and economic development of an individual and of a particular country (Arowosoge & Faleyimu, 2011). Access to affordable and modern energy services is a pre-requisite for sustainable development and poverty alleviation, and more specifically, for achieving each of the Millennium Development Goals (MDGs). Lack of access to reliable, safe and mostly environmentally friendly energy is a strong constraint on human development. The use of cleaner and least polluting energy for cooking can play a variety of direct and indirect roles to help achieve MDGs. Access to cleaner energy reduces diseases and reduces child mortality. It facilitates the achievement of Universal Primary Education for children and empowerment of women by reducing the time spent by women and children on gathering firewood from the forest (UN-Energy 2005).

In developing countries, most of the rural as well as urban communities have less access to modern and clean energy sources and mostly depend on biomass fuels (woods, leaves, twigs, animal dung, charcoal and crop waste) for virtually all their energy needs (Bello, 2010). While rural households rely more on biomass fuels than those in urban areas, well over half of all urban households in sub-Saharan Africa rely on fuel wood, charcoal, or wood waste to meet their cooking needs (IEA, 2006). With increasing population and urbanization over time, urban household energy is an important issue for developing countries. The heavy reliance of urban households in sub-Saharan Africa on biomass fuels contributes to deforestation, forest degradation, and land degradation. This is partly because the use of these fuels is an important source of income for people in both rural and urban areas (Bello, 2010). Similarly, Mekonnes & Kohlin (2008) argue that while the use of woody biomass as fuel and as construction materials contributes to deforestation and forest degradation, the use of dung as fuel implies that it might not be available for use as fertilizer – thus contributing to land degradation and consequent reduction in agricultural productivity. This view was supported by Sambo (2009), who argues that sourcing of fuel wood for domestic and commercial uses is a major cause of desertification in the arid-zone states and erosion in the southern part of Nigeria. The consumption of firewood is worsened by the widespread use of inefficient cooking methods that are hazardous to human health, especially to women and children who mostly do the cooking in homes. The use of firewood for cooking contributes to the causes of some major health problems in the developing countries due to indoor air pollution (Bruce et al, 2000). The World Health Organization (WHO) estimates that about 1.5 million people per year die prematurely from indoor pollution due to the use of solid fuels. This is equivalent to 4,000 deaths per day. In addition, it has been estimated that there are 40, 000 new cases of chronic bronchitis yearly due to exposure to soot and smoke from biomass fuels. Other health effects include: acute respiratory infection, low birth weight and eye problems in Africa (World Bank, 2006).

Recognizing the adverse effects of the use of biomass fuels, the United Nation Millennium Project recommends halving the number of households that depend on biomass fuels for cooking by 2015, which involves about 1.3 billion people switching to other fuel (IEA, 2006). One set of factors necessary for switching to other fuels particularly in developing countries (like Nigeria) is better availability of alternative fuels other than biomass fuels. Such alternative fuels are generally available in major cities of developing countries. Household fuel choice also depends on other factors, which make knowledge of the determinants of households' choice of fuel important. In Nigeria, the problems relating to fuel wood as energy source has been an issue of concern for more than three decades. Efforts at encouraging households to make substitution that will result in more efficient energy use and less adverse environmental, social, and health impacts are advocated. Many policies have been implemented by public authorities to decrease household wood-energy consumption and to substitute it by alternative conventional fuels. But despite all the policies, the rate of consumption of wood-energy (and other biomass fuels) and its attendant negative environmental and health impacts are still alarming. The consumption of fuel wood which is a rural practice seems to have now gained acceptance in urban areas in a manner to which its demand is leading to the harvest of both dry and wet wood. The real effect of this problem is that the government understanding of fuel sector and the ability to predict and plan household fuel agenda is woefully inadequate. There exists a knowledge gap regarding how households' characteristics influence fuel choice. This study is therefore, motivated by the need to encourage households to make fuel substitution that will result in more efficient energy use and less adverse environmental, social, and health impacts, but this requires a research and analysis of the factors that affect or determine household choice of cooking energy

The broad adjective of this study is to investigate the different factors that affect a household's probability of choosing one cooking fuel option over another while the specific objectives of this study are to identify the different cooking fuel options available to the households and investigate the distribution of household by cooking energy types and by zone of residence. The rest of the paper is organized as follows: section two is on literature review. This is followed by the research methods and discussion of results in section three and four respectively. Section five concludes the paper.

2. **LITERATURE REVIEW**.

This section deals with conceptual clarification and empirical literature. It discusses the concepts of energy, review of Energy Sources and their Impacts. Energy in the layman's language is often synonymous with strength or force or better still fuels. In technical terms energy is that thing that can be used to produce work. Yergin (1989) defines energy as anything that makes it possible to accomplish physical work, anything capable of bringing about movement against resistance. Energy is the capacity to perform or carry out work. Abott (2001) define energy as something that appears in many different forms which are related to each other by the fact that conversion can be made from one form of energy to another. According to Dave (2004), energy is a property or characteristic (or trait or aspect) of matter that makes things happen, or, in the case of stored or potential energy has 'the potential' to make things happen. Gordon (1996) defines energy as a measure of the ability of a body or system to do work or produce a change, expressed usually in joules or kilowatt hours. No activity is possible without energy and its total amount in the universe is fixed. In other words, it cannot be created or destroyed but can only be changed from one form to another. Energy source can be classified as renewable and non-renewable forms. Renewable energy sources are those which cannot be exhausted. It includes geothermal, solar energy, water, wind energy, and crop residues while the non-renewable forms are mainly those which can be exhausted after some years. It includes petroleum products such as kerosene, petro, liquefied natural gas and coal. The household energy sector is divided into three sub-sectors: biomass fuels (wood, dung, and crop waste), hydrocarbon fuels (gas and kerosene), and electricity. In many communities, people use a combination of biomass fuels and hydrocarbon fuels in order to save electrical cost (IEA, 2006). These energy sources and their related impacts are discussed below:

Biomass fuels use in Nigeria

Biomass energy refers to the energy of biological system such as wood and waste. The biomass resources of Nigeria can be identified as wood, forage grass and shrubs, residues and waste (forestry, agricultural and industrial) as well as aquatic biomass (Gumau, 2007). Biomass fuels play a key role in household cooking fuels. According to the World Bank (2003), many urban households use biomass fuels for cooking in Nigeria. Biomass fuel is largely free and relatively available to most communities.

Kerosene use in Nigeria

Kerosene is one of the main fractional distillates of petroleum. It is a mixture of hydrocarbon that contains 12-18 carbon atoms per molecule and it boils between 190-250oC. It is a fairly volatile liquid widely used by many

household as the main source of energy for cooking, lighting lamps, burning bush, fuel for automobiles. It is also used as insects repellant because of its odour. Kerosene causes many casualities resulting from exposure to fumes from burning kerosene and poisoning of children who accidentally ingest kerosene drink bottles (Amakiri & Owen, 2009).

Liquid petroleum gas

It is a well- established fact that Nigeria petroleum resources kept in cold are richer in gas than in crude oil (Aston-Jone, 1998). These gases are grossly underutilized and constitute a waste to the economy and are known to damage atmosphere on which all life depend (Anija-Obi, 2001). Liquid petroleum gas is conventionally available through the petroleum and gas industry. Its distribution, according to Egbuna (1987) is mainly concentrated in urban area. Liquid petroleum gas if compared to kerosene or fuel wood, has clear heath, environmental and productivity benefit of course, choice of gas may be constrain by cost and not only fuel cost but also the start-up cost of connections, equipment and stoves. Despite its convenience, there is a great feeling of insecurity in relation to safety issues and the cylinder being stolen act as a barrier to the use of gas fuel. A fear about explosion is a concern raised by many people in relation to hazard and indoor air pollution effects.

Electricity in Nigeria

Electricity is a secondary fuel dependent on the transformation of other sources of energy and required a high-tech environment. The infrastructure involved in the generation and distribution of electricity is enormous and costly. Electricity is used for a number of purposes that include industrial, commercial and household purposes (Babatunde & shuaibu, 2010). Electricity generation in Nigeria began in 1896, fifteen years after its introduction in England. The Nigeria electricity supply company (NESCO) commenced operation as an electric utility company in Nigeria in 1929 with the construction of a hydroelectric power station at Kurra near Jos. The electricity corporation in Nigeria (ECN) was established in 1951, while the first 132kv lines was constructed in 1962, linking Ijora power station to Ibadan power station. The Niger dam authority was established in 1962 with a mandate to develop the hydropower potential of the country. However ECN and NDA were merged in 1972 to form the National Electric Power Authority (NEPA). The law which established the National Electric Power Authority (NEPA) in 1972 stipulated that it should develop and maintain an efficient, co-ordinated and economical system of electricity supply for all parts of Nigeria. At the inception of NEPA in 1973, only five of the nineteen state capitals were connected to the national transmission grid system. Today, all state capitals are being served from the national grid, though haphazardly.

Empirical Literature

Pundo & Fraser (2006) in a study on the analysis of household cooking fuel choice in rural Kenya: The case of Kisumu District uses multinomial logit model to investigate the factors that determine household cooking fuel choice between firewood, charcoal, and kerosene. Variables captured are: age of respondent, household sizes, occupation of the household head and category of food cooked by household, level of education of husband and wife, whether or not the household own the dwelling unit and the nature of the dwelling unit. Empirical results indicate that level of education of husband and wife, type of food mostly cooked, whether or not the household owns the dwelling unit, and whether or not the dwelling unit is traditional or modern type are important factors that determine household cooking fuel choice.

Another empirical work reviewed in this study is the work of Njong & Johannes (2011) titled “An Analysis of Domestic Cooking Energy Choices in Cameroon”. The study attempts to cast light on the distribution of households by cooking energy types and by region or zone of residence and investigate the main determinants of cooking energy choices in Cameroon. The study employs a multinomial logit model to test the statistical significance of the social and demographic factors that determine household cooking fuel choice in the country. Variables captured are: household size, occupation status, nature of the dwelling houses (proxy by wall materials), education, ownership of the dwelling house, and the distance of household from urban centre. Empirical results indicate that the level of education, distance of the household from urban centres, whether or not the household owns the dwelling unit and whether or not the dwelling unit is traditional or modern type are important factors that determine household cooking energy choice. The study also reveals that fuel wood is the principal cooking fuel for the majority of households in Cameroon.

Boukary (2006) examines household energy preferences for cooking in urban Ouagadougou, Burkina Faso. Descriptive statistics and multinomial logit model were employed for the analysis. The descriptive analysis shows that the domestic demand for wood energy is strongly related to household income. The firewood utilization rate decrease with increasing household income. In other words, this fuel appears as a “transition good” for the households which aim for other sources of energy for cooking that are more adapted for urban

consumption. The multinomial model analyses the sociological and economic variables of household energy preferences for cooking in Ouagadougou. The analysis shows that household energy preferences for cooking are determined by household size, income and high frequency of cooking certain meals. Mekonnen & Kohlin (2008) is another empirical work titled "Determinants of Household Fuel Choice in major Cities in Ethiopia". The study looks at the fuel choice of urban household in major Ethiopian cities, using panel data collected in 2004 and 2006. It examines use of multiple fuels by households in some details. The determinants of household choice of energy consumption were investigated using multinomial logit model. Variables captured are: household total expenditure on energy, family size, level of education, age of household head and household location. The results suggest that as households' total expenditures rise, they increase the number of fuels used, even in urban areas and they also spend more on the fuels they consume. This study shows the relevance of fuels stacking (multiple fuel use) in urban areas in sub-Saharan Africa. While income is an important variable, the results of this study find other variables such as family size, household location and level of education as important determinants of household fuel choice in Ethiopia. Farsi Mehdi et al (2007) examine fuel choice in urban Indian households. The study applies an ordered logit model to fuel choices and patterns of cooking fuels in urban Indian households using a large database consisting of 46, 918 observations. The analysis was used to determine the responsiveness of fuel choices to own price, income, price of alternate fuels and variables relating to demographic and geographic characteristics of households. Bello (2010) is one of the empirical works in Nigeria titled "Impact of Wealth Distribution on Energy Consumption in Nigeria: A case of selected households in Gombe State". The study uses multinomial logit model to analyse the determinants of household choice of energy used for cooking. Income, size of household, price of stove or cooker, head of household level of education and house wife level of education are variables captured. Empirical results reveal that the choice of cooking energy is mainly determined by income, size of household, and level of education. Arowosoge & Faleyimu (2011) is another empirical work that investigated household energy utilized for cooking and its determinants in Ado-Ekiti metropolitan area of Ekiti State. Simple descriptive statistics and chi-square test were employed for the analysis. The chi-square results established a significant relationship between income of household and the type of energy used for cooking. Onyekuru & Eboh (2011) investigated the determinants of cooking energy demand in the rural households of Enugu State. Bivariate probit model was employed for the analysis. Fuel wood and kerosene were the two different cooking fuel options available to the households. Occupation, family size, level of education and income are the variables captured. Empirical results show that occupation and income were the statistically significant factors affecting the choice of cooking energy demand.
Adetunji *et al* (2007) examined household energy consumption patterns in Osogbo Local Government Area of Osun State. Ordinary least square regression was employed to analyse the data obtained. Age, level of education, occupation, income and household size are variables captured. The regression results indicated that income and household sizes are the significant factors determining household choice of energy consumption while age, level of education and occupation of household are insignificant. Okunade (2010) is another empirical work titled "charcoal as an alternative energy source among urban households in Ogbomoso Metropolis of Oyo State, Nigeria". The study examined the type of energy sources available and the factors that determine their use. Ninety women were randomly selected from the household chosen. Simple descriptive statistics and ordinary least square regression were employed for the analysis. Variables captured are; age, level of education, occupation, income and household size. The regression result reveals that age, occupation, level of education and household size are the significant factors affecting household choice of energy used for cooking while income is insignificant. Shittu et al (2004) examined the demand for energy among households in Ijebu Division, Ogun State, Nigeria. Primary data were obtained in a cross-section survey of ninety households selected across six communities in Ijebu-Division of Ogun State. Variables captured are; age, level of education, income and household size. Linear logit model was employed for the analyses. Empirical results indicated that the influence of education and household size on household energy used were insignificant, while income and age of household heads revealed significant influence. The study concluded that improvement in income would cause increase in demand for firewood alternatives. In synopsis, there is diverse results that characterized the above empirical works and none of these studies have quantified empirically the influence of the following household characteristics on household choice of energy consumption: kitchen setting, ownership of the dwelling house, nature of the dwelling house, and the type of food commonly cooked. This distinguished this study and makes it unique.

3. **RESEARCH METHODS OF ANALYSIS**

This section highlights the research design, population, sample and sampling techniques, validity of the instrument, reliability of the instrument, administration of the instrument, model specification, identification of variables, and the analytical techniques. For the descriptive survey type, the population for the study consists all the households in Ondo State, Nigeria. The state is located in the Western part of Nigeria and falls on longitude $4^{0}45^{1}$ and $6^{0}00$ east of the Greenwich meridian and latitude $4^{0}45^{1}$ north of the equator. It is one of the nation's

least densely populated regions of the country. It has a total of eighteen local government areas, with an estimated population of 3,441,024 out of which 1,679,761 are female (Population census 2006).The target population consists of all female household heads and bachelors who mostly do the cooking in homes since social norms discourage married men from participating in fuel procurement and cooking. While the sample for the study consisted of 420 households that were selected from the Local Government areas in Ondo State based on multistage sampling technique. The first stage was the selection of two Local Government Areas randomly from each of the three senatorial districts, giving a total of six Local Government Areas in all. The second stage was the selection of one rural area and one urban area from each of the six Local Government Areas. The last stage was the random selection of thirty five households from each of the selected rural and urban areas giving a total of 420 respondents. As result of questionnaire not properly filled and returned to the researcher, only 409 households were used for the analysis. The research instrument was subjected to face and content validity which also ascertained by experts in economics and management studies. After the validity of the instrument, test-retest method was used for the reliability of the instrument, the reliability coefficient of 0.818 was obtained using Pearson Product Moment Correlation analysis and this was considered significantly adequate for the study. The data were analyzed using descriptive analysis. Frequency count and percentage were used to analysis general questions.

Model Specification

The model specification to be used in this study follows the model of Pundo & Fraser (2006), which took its root from utility maximization. . Pundo & Fraser expressed the choice of a given source of energy as a function of social characteristics of each household. The social factors considered are: age in years of a wife, the level of education of wife, the occupation of wife, household size, whether or not the household owns the main dwelling unit, whether or not the dwelling unit is traditional or modern type house and the type of food regularly cooked. Pundo & Fraser hinges the exclusion of income on the fact that a large portion of rural households' incomes is nonmonetary. However, the joint UNDP and World Bank Energy Sector Management Assistance Programme (2003) emphasized income, kitchen setting as some of the important variables in households' choice of energy consumption. This has called for the inclusion of these variables to modify the Pundo & Fraser (2006) model. Therefore, the model for this study is specified thus:

$$Y=\beta_0+\beta_1 AGE+\beta_2 HWE+\beta_3 HHS+\beta_4 INC+\beta_5 HWO+\beta_6 OWN+\beta_7 NDW+\beta_8 SPE+ \beta_9 SPO+\beta_{10} KIT+\beta_{11} TFC+\varepsilon$$

Description of Variables

Y = the cooking fuel choice (fuel wood, kerosene, cooking gas) with fuel wood as reference choice
AGE = age in years of respondents
HWE = housewife level of education (1 if postsecondary; 0 otherwise)

HHS = household size

INC = household income

HWO = housewife occupation (1 if white-collar; 0 otherwise)

OWN = ownership of dwelling house (1 if owner; 0 otherwise)

NDW = nature of the dwelling house (1 if modern; 0 otherwise)

SPE = spouse level of education (1 if postsecondary; 0 otherwise)

SPO = spouse occupation (1 if white-collar; 0 otherwise)

KITC = kitchen setting (1 if internal; 0 otherwise)

TFC = type of food commonly cooked (1 if longer hour; 0 otherwise)

ε = Error term

Analytical Technique

The data collected were analysed using appropriate descriptive statistics and multinomial logit model. Multinomial logit was employed to estimate the significance of the factors believed to influence a household's choice of cooking fuel.

4. RESULT AND DISCUSSION

This section deals with the analysis of data, interpretation and discussion of results. The analysis was in three stages: stage one involved the analysis of the bio-data, stage two involved the analysis of general questions while stage three involved the presentation and analysis of the significance of factors influencing fuel choice using the multinomial logit model. The discussion of the findings was made at the end of the analysis.

Descriptive Analysis

The bio-data analysis included gender distribution, age distribution, marital status and education qualification. To analyse the data, frequency and percentage were used in analysing the variables for the questions.

TABLE 4.2.1: Gender Distribution of the Respondents

Category	Respondent	Percentage (%)
Male	48	12
Female	361	88
Total	409	100

Source: *Field Survey* (2016)

The table 4.2.1 shows that 48 (12%) of the respondent households are males while 361 (88%) of the respondents are females. This probably reflects that females are more involved in fuel procurement and cooking in a household.

TABLE 4.2.2: Age Distribution of the Respondents

Category	Respondent	Percentage (%)
18 – 30	82	20
31 – 43	153	37
44 – 56	139	34
57 – 69	35	09
70 and above	Nil	Nil
Total	409	100

Source: Field Survey (2016)

Table 4.2.2 shows that most of the respondents are between the age of 31-56 years. Out of the 409 respondents, 153 (37%) of the respondents are in age bracket of 31 – 43 years. 139 (34%) of the respondent households are within the age bracket of 44 – 56 years. 82 (20%) of the respondents are between the ages of 18–30 years while 35 (9%) of the respondents are in the age bracket of 57 – 69 years. This indicates that the decisions over which fuel to use for cooking in a household are taken by adults.

Table 4.2.3: Education Status of the Respondents

Category	Respondent	Percentage (%)
No education	25	06
Primary education	81	20
Secondary education	169	41
Tertiary education	134	33
Total	409	100

Source: *Field survey* (2016)

Table 4.2.3 shows that majority of the respondents went to secondary school. 41 percent of the respondents have secondary education, 33 percent of the respondents have higher education, and 20 percent of the respondents have primary education while 6 percent of the respondents have no education. This indicates that over 94 percent of the respondents have average education and thus may have knowledge of the use of various household cooking fuels appliances

Table 4.2.4: Marital status of the respondents

Category	Respondent	Percentage (%)
Single	53	13
Married	353	86
Widowed	3	1
Divorce	Nil	Nil
Separated	Nil	Nil
Total	409	100

Source: Field Survey (2016)

Table 4.2.4 reveals that 353 (86%) of the respondents are married with spouse. 53 (13%) of the respondents are single while 3 (1%) of the respondents are widows. This shows that majority of the respondents are matured and married women

According to table 4.3, the family size of 178(44%) of the respondents fall within the range of 5 and 6. 101(25%) of the respondents family size fall within the range of 3 and 4. 59(14%) of the respondents had family size that fall within the range of 7 and 8, while 8(2%) of the respondents had family size that fall within the range of 9 and 10. This shows that majority of the respondent households have large family size. This implies that there is the likelihood of increased pressure on fuel wood due to the relatively large size of the family couple with low income. The table 4.3 also reveals that 103 (25.2%) of the respondents fall within the income category of 11,000 and 30,000. 148 (36.2%) of the respondents fall within the income category of 31,000 and 50,000. This shows that majority of the respondent households are relatively poor people with large family size who may not afford to buy expensive energy source for cooking. The table shows that the respondents are mostly petty traders, artisans, farmers and civil servants. 124 (30%) of the respondents are traders, 99 (24%) are artisans, 105 (26%) are farmers while 81 (20%) of the respondents are civil servants. From the table, 268 (66%) of the respondents are tenants while 141 (34%) own their dwelling house. Table 4.3 also shows that 158 (39%) of the respondents live in a traditional structure while 251 (61%) of the respondents live in a modern house. On questions about the education level of the spouse to the respondents, table 4.3 shows that 141(40%) have tertiary education, 124 (35%) have secondary education, 71 (20%) have primary education while 17 (5%) have no formal education. The table also shows that 112 (32%) of the spouse to the respondents are farmers, 81 (20%) are artisans, 56 (16%) are traders while 104 (29%) of the spouse to the respondents are civil servant. In the study area, there were three major types of energy sources available for domestic use as shown in table 4.3. 185(45%) of the respondents use kerosene, 177(43%) of the respondents use firewood while 47(12%) of the respondents use cooking gas. 229 (56%) of the respondents used any one of the energy sources available while 180 (44%) of the respondents used two different types of the energy sources available (one as a main cooking fuel while the other as a backup).

Table 4.4 present the distribution of households by energy type and by zone of residence. In Table 4.4, the proportion of households using firewood in Owo, Ondo town, and Akungba-Akoko is low compared to other communities, Igbado, in Ondo West Local Government Area, has the highest proportion of its households (77.1%) that use firewood as the main cooking fuel. This is closely followed by Oloruntele community in the Ile-Oluji/Okeigbo Local Government Area, Loda in Irele Local Government Area each having 74% and above of their households using firewood as main cooking fuel. The table also reveals that 22.9% of households in the urban area and 63.7% in the rural area use firewood as cooking fuel.

Table 4.3: Analysis of General Questions

Category	Respondent	Percentage (%)
Regular members of the household		
1-2	63	15
3-4	101	25
5-6	178	44
7-8	59	14
9-10	8	2
Total	409	100
Respondents level of income		
10,000 and below	82	20.1
11,000 – 30,000	103	25.2
31,000 – 50,000	148	36.2
51,000 – 100,000	75	18.3
101,000 – 200,000	1	0.2
200,000 and above	Nil	Nil
Total	409	100
Respondents category of occupation		
Farming	105	26
Civil servant	81	20
Trading	124	30
Artisan	99	24
Total	409	100
Ownership of the dwelling house		
Owner	141	34
Tenant	268	66
Total	409	100
Nature of the dwelling house		
Traditional type structure	158	39
Modern type structure	251	61
Total	409	100
Spouse to the respondent level of education		
No education	17	5
Primary education	71	20
Secondary education	124	35
Tertiary education	141	40
Total	353	100
Spouse to the respondent category of occupation		
Farming	112	32
Civil servant	104	29
Trading	56	16
Artisan	81	23
Total	353	100
Household main cooking fuel		
Kerosene	185	45
Firewood	177	43
Cooking gas	47	12
Total	409	100
Number of energy sources used		
One	229	56
Two	180	44
Three	Nil	Nil
Total	409	100

Source: Field Survey, 2016

Table 4.4: Distribution of households by cooking energy types and by zone of residence

	FIREWOOD		KEROSENE		COOKING GAS		TOTAL
	FREQUENCY	%	FREQUENCY	%	FREQUENCY	%	
OWO	5	15.2	16	48.5	12	36.3	33
USO	13	38.2	18	52.9	3	8.9	34
ONDO TOWN	3	8.6	19	54.3	13	37.1	35
IGBADO	27	77.1	8	22.9	0	0	35
ODE-IRELE	19	54.3	14	40	2	5.7	35
LODA	26	74.3	9	25.7	0	0	35
OKE-IGBO	9	25.7	25	71.4	1	2.9	35
OLORUNTELE	26	76.5	8	23.5	0	0	34
OBA-ILE	8	22.9	16	45.7	11	31.4	35
OWODE	19	59.4	13	40.6	0	0	32
AKUNGBA	3	9.4	24	75	5	15.6	32
OBA-AKOKO	19	55.9	15	44.1	0	0	34
TOTAL	177	43	185	45	47	12	409
Urban	47	22.9	114	55.6	44	21.5	205
Rural	130	63.7	71	34.8	3	1.5	204
Total	177	43	185	45	47	12	409

Source: Field survey, 2016

Table 4.5: Multinomial Logit Analysis for Kerosene and Cooking gas as Compared to Firewood

Variable Name	Kerosene			Cooking Gas		
	Estimated Coefficient	P-Value	Odds Ratio	Estimated Coefficient	P-Value	Odds Ratio
Constant	-6.410 (2.086)	0.002	_	-5.878 (1.916)	0.012	_
AGE(Age in years of the respondent)	-0.016 (0.028)	0.570	0.984	0.020 (0.025)	0.425	1.020
INC(Income level of the respondent)	0.417 (0.184)	0.042	1.517	0.506 (0.205)	0.006	1.658
HHS(The number of regular members of the household)	-0.336 (0.114)	0.003	0.715	-0.384 (0.106)	0.000	0.681
LEV-EDU(Category of education of the respondent)	0.540 (0.204)	0.004	1.716	0.535 (0.176)	0.002	1.707
SPOU-EDU(Category of education of the spouse to the respondent)	0.800 (0.246)	0.001	2.226	0.425 (0.196)	0.003	1.530
OWN-HOUSE(whether or not the household own the dwelling unit)	-0.989 (0.372)	0.021	0.372	-1.991 (0.580)	0.001	0.136
HOUNATUR(type of the main dwelling unit: traditional or modern)	-6.533 (0.802)	0.000	1.455	-3.298 (0.657)	0.000	0.037
RES-OCCP(category of occupation of the respondent	0.443 (0.207)	0.000	1.557	-0.305 (0.125)	0.513	0.737
SPOU-OCCP(category of occupation of the spouse to the correspondent)	0.243 (0.317)	0.363	1.275	0.887 (0.591)	0.463	2.428
FOOD TYP(category of food cooked by the correspondent)	-0.660 (0.577)	0.252	0.517	0.318 0.503	0.528	1.374
KITCH-TYP(kitchen setting: external or internal)	0.178 (3.213)	0.405	1.194	0.078 (2.153)	0.612	1.081
Mc Fadden pseudo - R^2 = 0.370 Model Fitting information (chi square) = 329.701, with p-value=0.00						

Source: Result from the multinomial logit regression
Note: Reference category is FIREWOOD. Standard errors are in parentheses

Table 4.5 presents the results of the multinomial logit analysis for kerosene and cooking gas as compared to firewood. In table 4.5, age was expected to be a significant factor in determining household fuel choice. An increase in age of respondent household was expected to be less likely to make a household switch from firewood. The result showed that age has negative estimated coefficient for kerosene and positive estimated coefficient for cooking gas. However, it was not significant at 5% confidence level. The effect of age may become clearer only at older age since most of the respondents are young people (see table 4.2.2). The estimated coefficients of the independent variable, 'income' of the respondent households is however significant and positive for kerosene and cooking gas implying that with everything else held constant, the respondent having higher income is more likely to switch over to modern fuel. This concurs with the theoretical expectation that as household income increases; household demand for these fuel wood alternatives will increase. Household size has negative and statistically significant coefficients for both kerosene and cooking gas, implying a decrease in the likelihood that these fuel types would be used by household with more members. For a unit increase in family size, the odds of households adoption probability of kerosene decrease by 28.5% (0.715-1.0= -0.285), while the odds of cooking gas adoption probability drops by 31.9% (0.681-1.0= -0.319), other things being equal. This conforms well to the a priori expectation that larger household would prefer to use firewood since it is comparatively cheaper to use firewood to cook for many people.

The positive estimated coefficients of the variable 'occupation status of the spouse to the respondent household' agrees with the theoretical expectation that respondent household whose spouse is employed in white collar job are more likely to use fuel wood alternatives. However, the probability of this relationship is not significant for both kerosene and cooking gas at 5% confidence level. This may be explained by the fact that it is the respondent households (women and bachelors) that are more involved with cooking fuel choice decision in their households. The "ownership of dwelling" has negative and statistically significant coefficients for both kerosene and cooking gas indicating a decrease in the likelihood that these fuel wood alternatives would be used by household who owns his dwelling unit. A change from being a tenant to become an owner decrease the odds of kerosene adoption probability by 62.8% (0.372-1.0 = -0.628) while the odds of cooking gas adoption probability decrease by 86.4% (0.136-1.0 = -0.864). This concurs with the theoretical expectation that household head who is owner of his house would prefer to use firewood since the household often share the dwelling with a large family members and is in charge of the management of space of his dwelling (mainly for storing wood-energy). As previously noted, the large size of the household sets the firewood utilization rate, all other things being equal. The positive and statistically significant coefficients of the education status of both the respondent and the spouse to the respondent for kerosene and cooking gas in the regression indicates that, with everything else held constant, the respondent having more education is more likely to switch over to these fuel wood alternatives. This conforms with the theoretical expectation that as household gained more education, household demanded more for firewood alternatives. This is because education improves knowledge of fuel attributes, taste, and preference for better fuels. The negative and statistically significant coefficients of the "nature of dwelling house" in the regression for kerosene and cooking gas indicate a decrease in the likelihood of using these fuel wood alternatives. A passage from a traditional type house to a modern type house decrease the odds of kerosene and cooking gas adoption probability by 46.1% and 94.2% respectively, all other things being equal. This is contrary to the theoretical expectation that if a household dwells in a modern type house, the household is most likely to use these fuel wood alternatives. One possible explanation is that a household may have kept to certain societal lifestyle of using firewood and have an outdoor cooking place built to accommodate the requirement of firewood use so that smoke does not pollute the main dwelling house.

The coefficient of "respondent occupation" is significant and positive for kerosene implying that this fuel type will be used by respondent households who are employed in white-collar job. However, it is negative and insignificant for cooking gas implying a decrease in the likelihood of using cooking gas as respondent households are employed in white-collar job. This is contrary to the theoretical expectation that respondent households that are employed would use this firewood alternative. One possible explanation is that if a respondent household exercises a great feeling of insecurity that may arise from the cooking gas cylinder being exploded; the household is less likely to use cooking gas. The positive estimated coefficients of the variable 'kitchen setting' for kerosene and cooking gas concurs with the theoretical expectation that a passage from a household without internal cooking facilities to a dwelling with this feature is more likely to increase kerosene and cooking gas adoption probability. However, the p-values of this relationship are not significant at 5% confidence level. If a household cooks mainly the food that requires long cooking time, the household is expected to be less likely to use kerosene or cooking gas. The regression result of this variable is negative for kerosene and thus concurs with the theoretical expectation but positive for cooking gas. However, their p-values are insignificant.

5. CONCLUSION AND POLICY RECOMMENDATIONS

The findings of the study revealed that most of the respondents were matured married people with average education, large family size and low level of income. 63.7 percent of the respondents in the rural areas used firewood as their main cooking fuel while 22.9 percent of the respondents in the urban areas used firewood as their main cooking fuel. This is not healthy for our rural and urban dwellers, especially for a country like Nigeria that is very wealthy with crude oil. This is because of what the consequence portends for their health as a result of air pollution in the use of firewood, the dangers and inconveniences involved in the search for firewood, its dirty nature, and forest depletion as a result of the fact that the people resort to the felling of life trees and wait for them to dry in the time of serious scarcity. The factors emerging out of the analysis is that higher education level of the respondent household and spouse to the respondent household could help trigger fuel switching and abandonment of firewood use. The study further revealed that higher level of income and the nature of occupation of the respondent households have great influence in the switch over to modern cooking fuel. The study also showed that having a large number of family members within a household, all things being equal, increase the adoption probability of firewood use as the variable "household size" exhibited negative and significant estimated coefficients for both kerosene and cooking gas. The finding of the study revealed that being an owner of a dwelling or living in a modern type house does not make a household adopt modern cooking fuels which inferred that these variables might not be good indicator of fuel choice. Based on the findings from this study, the following recommendations are suggested. The households should be encouraged to make fuel substitution that will result in more efficient energy use and less adverse environmental, social, and health impacts, a promotion of higher level of education and a promotion of good living standard by the government could be effective instruments. This will help reduce the consumption of wood energy, implying a reduction in the pressure on wood resources and contributing towards mitigating deforestation. Furthermore, measure should be taken by stakeholders in energy sector to develop and promote renewable, clean technologies to lessen the burden of adverse economic activities on the ecosystem, reduce pollution and meet the demand of households. Such measure should promote the use of energy carriers other than firewood as well as the use of wood energy in modern ways.

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