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ASSESSMENT OF FACTORS INFLUENCING THE CONSUMPTION OF FUEL WOOD IN ZARIA LOCAL GOVERNMENT AREA, KADUNA STATE, NIGERIA

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Abstract

The importance of fuel wood as a source of energy in developing countries including Zaria LGA cannot be overemphasized. This study assessed the factors that influence fuel wood consumption in Zaria LGA of Kaduna State. The study used questionnaire and in-depth interview to acquire data from 400 respondents as suggested by Yamane (1976). Systematic sampling was used in the administration of the questionnaire and 384 questionnaires returned for analysis. The results revealed about 54% of the respondents were male reflecting the tradition of African household and Islamic teachings where male dominate things and events. The results also revealed that 54% of the respondents were from extended family which increases the pressure on families to find a cheap source of energy which fuel wood is one. The results also revealed that 61% of the respondents attended secondary schools indicating the high literacy level of the people in the study area. The results further revealed that only 22% of the respondents earn N56, 000 and above among the respondents indicating a high poverty level which necessitate the use of fuel wood as it is the cheapest source of energy. The results finally revealed convenience (29%), availability (25%) and cost effectiveness (23%) as the leading factors influencing the consumption of fuel wood in Zaria LGA. It is recommended that government should initiate poverty alleviation programmes and awareness campaigns should be made on the dangers of deforestation and tree harvesting for energy. This will help reduce the poverty level and more people will use cleaner energy sources.

Key Words: Assessment, Consumption, Determinant, Fuel, Influence, Wood

1. Introduction

One of the necessities of life is energy. It is required for any social and economic development of all societies of the world. It is not only used for cooking, but also lighting, charging communication gadgets, cooling, and other applications. The demand for energy in each country is determined by the population size, technological advancement, industrialization and urbanization (Sule, et al, 2014). Fuelwood is one of the leading energy sources in the world especially in developing countries. In fact, it is not only the first mankind's source of energy, but also the largest energy source ever known to man (Food and Agriculture Organisation [FAO], 2016).

For clarity, fuel wood is a wood made from tree which is burnable. It can be in logs, charcoal, papers, sawdust or sheets (Hamilton, 2009; Ismai'l, et al, 2014. Available statistics reveals that fuel wood

contributes one third of the world replaceable energy use (Irena, 2018). Many factors such as: origin, size/number, quality, availability, accessibility and many more determine its choice and use (David, et al, 2013). Additionally, the use of this energy source is also determined by the educational level of the user, sex, household size among others (Ibrahim, et al, 2013).

Africa is reported to have the highest rate of urbanisation. Countries like Burundi (5.7%), Uganda (5.4%) and Niger (5.1%) are good example. In relation to Nigeria with 4.7% projected average rate of urbanisation and estimated population of 45 - 142.6 million between 1960 and 2006. According to World Bank estimate in 2022, 53% of the 213 million Nigerians live in urban areas and it is projected to reach 70% by 2050. (Adedini, 2023). The challenges posed by the rapid population growth in Nigeria have being felt on every sector of the economy, including energy sector which is of interest to this study. For instance, the National Population Commission [NPC] (2009) revealed that, more fuel wood is being used for cooking than any other type of energy in Nigeria. The implication is that vegetal surface is expected to deplete at an alarming rate especially if this trend is left unchecked.

On the other hand, Naibbi and Healey (2015) submitted that the excessive use of fuel wood for cooking in Nigeria, clearly demonstrates the insufficiency of other energy alternatives which as a result, have promoted the commercialization of fuel wood in many parts of the country, especially in the northern region where the consumption is high. Also attributable to the high dependence on fuel wood is the fact that it seems to be a common cultural practice among the people and it is economical, readily available and accessible (Edmund & John, 2014). In the same vein, Ojonigu et al., (2010) noted that the rise in the use of fuel wood to meet domestic and commercial needs has culminated in deforestation leading to loss of biodiversity, loss of soil fertility through loss of nutrients, drainage of previously moist forest soil, dramatic increase in temperature extremes, more desertification, more carbon dioxide, resulting in increase in global warming and climate change in Nigeria.

The aim of this study is to assess the factors influencing the consumption of fuel wood in Zaria Local Government Area, Kaduna State, Nigeria and the objectives of the study is to identify the bio-data of the respondents

In Zaria Local Government Area (LGA), like many northern parts in Nigeria, the situation is not different as the use of fuel wood is quite prominent. This is so as out of 1,610,433 households in Kaduna State using fuel wood as their major source of cooking energy, Zaria LGA accounted for 86,002 of the total households that depend on fuel wood, representing over 16.2% of the entire state (Kaduna State Bureau of Statistics, 2017). This makes the LGA, the third highest user of fuel wood in the state. Given the rapid expansion of urban development and population increase in many parts of the area, in addition to the current economic hardship, as well as the high costs and unreliability of other sources of household energy such as electricity, cooking gas and kerosene, the demand for fuel wood is on the increase.

as factors like gender, marital status, educational level and income and others have direct relationship with fuel wood consumption and other factors like accessibility, availability, price among

others which are also important factors considered. The spatial scope covers all the thirteen (13) wards of the local government area and the temporal scope was 2023. The content scope covers income of the respondents, energy and fuel wood sources, educational level, gender, economic activity, accessibility of fuel wood, availability of energy among others.

2. Study Area

Zaria LGA is located between Latitudes 11°6'N to 11°45'N of the Equator and Longitudes 7°29'E to 7°47'E of the Greenwich Meridian. Zaria LGA consists of six districts, namely: Birni Da Kewaye, Dutsen Abba, Gyellesu, Tudun Wada, Tukur Tukur, and Wucicciri. The study area covers a total land area of 563Km^2 with an altitude of about 662 meters above sea level (Ogunleye, 2006). Zaria is 170km from Kano, and 70km to Kaduna. The study area is bounded to the South by Igabi LGA, to the North by Sabon Gari LGA, to the West by Giwa LGA and to the East by Soba LGA (Figure 1).

Owing to its interior location of about 670km north of Atlantic Ocean, Zaria LGA experiences a Tropical Continental Climate characterized by distinct wet and dry seasons subject to the movement of the Inter Tropical Discontinuity (ITD) associated with Tropical Continental and Tropical Maritime air masses. The former air mass originates from the Sahara desert and therefore dry, bringing dusty and hazy conditions known as 'harmattan' to the region in the dry season while the latter air mass originates from the Atlantic Ocean and hence moist and rain-bearing (Abbas, 2018). The humidity also drops to less than 15% in December/January (dry season). After that, the South Westerly Monsoon winds (Tropical Maritime Air mass) laden with moisture bring the rain accompanied by thunderstorms and squalls with heavy fall of high intensities.

The study area is located within the northern Guinea Savannah Vegetation zone in Kaduna State, Nigeria. A designation which implies a woodland vegetation type characterized by the presence of *Isoberlinia doka, Isoberlinia tomentosa* and *Upaca togonensis*, with well-developed grass layer of tufted and low ground cover of *Andropogoneae*. There are also specific tree species which are mainly found in the northern part of the country such as Tamarind (*tamarindus indica)*, shea butter, mango *(mangifera indica)*, cashew, baobabs, locust bean, neem and eucalyptus to mention a few which are plenty in the study area (Abubakar, 2012).

Most of the trees grow long deep tap roots and develop thick barks which enable them to survive the long dry season and bush fires. The grasses have durable roots, which remain underground after the tops have been burnt off. After the dry season, the grasses sprout again with the beginning of the rainy season (Oyatayo, 2000).

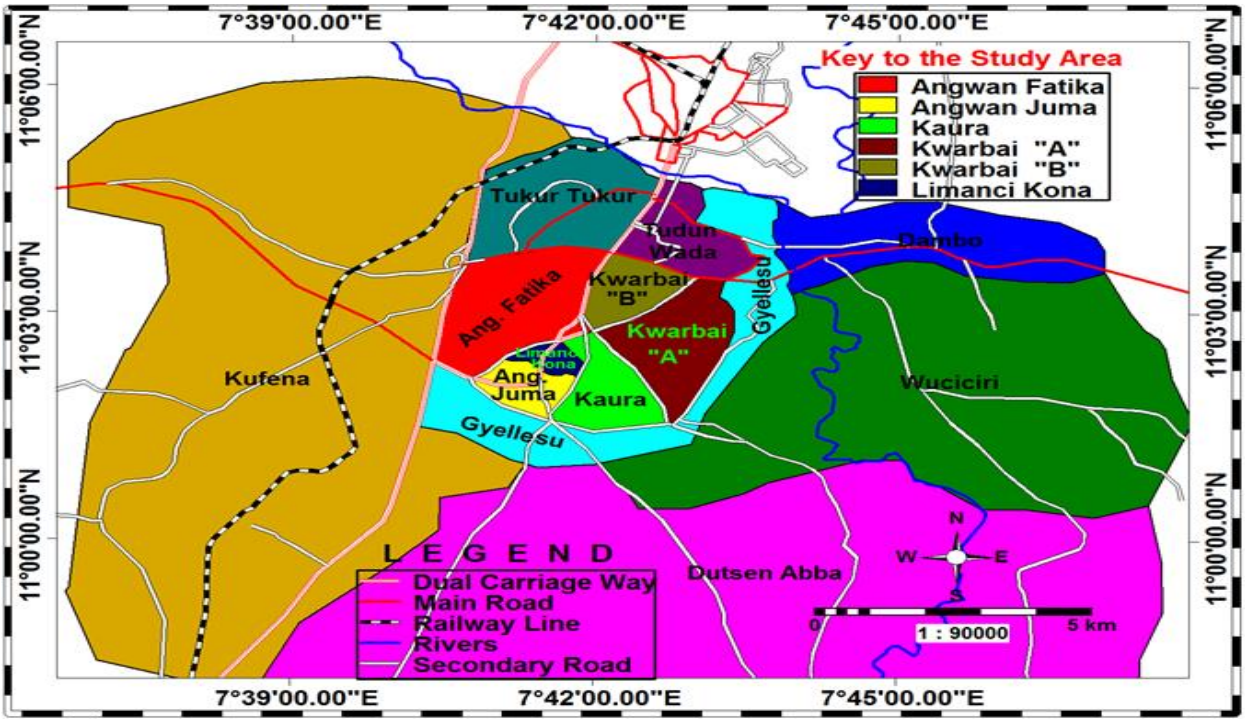

Figure 1: Zaria LGA Political Wards
Source: Modified from Administrative Map of Kaduna State from KADGIS.

3. Methodology

3.1 Types and sources of data used for the study

Table 1: Types and Sources of Data Used

S/N	Data	Source	Use
i.	Administrative map (1: 50,000)	Ministry of Land and Physical Survey Kaduna State	Extraction of administrative boundary of Zaria
ii.	Factors that influence fuel wood consumption	Questionnaire survey and in-depth interview to sampled respondents	Gather data on factors determining fuel wood consumption

Source: Authors' Compilation, 2023

3.2 Sample size and sampling technique

Given the availability of 1991 estimated population figure of the study area (see Table 2), which provides data at both LGA and ward level, the sample size of the study is drawn from the population of Zaria LGA. The NPC (2006) population projection formula (Equation 1) was adopted to project both the population data to the year 2023 (Table 3.2). This put the population figure of the LGA at 662,912. Table 3.2 is also used to show the wards and their population figures. Yamane (1967) provides a simplified formula to calculate sample size with 95% confidence level and 5% sampling error assumption (Equation 2). The study

used it to obtain a total of 399.9 approximately 400 sample size. Therefore, a total of 400 copies of questionnaire were administered to the respondents in the study area. The questionnaire was administered proportionate to the population figure (projected) of each of the 13 wards (Equation 3).

$[Po=P1\ (1+r)^{n}]$……Equation 1

Where Po= projected population,
P1= Initial population,
r= Growth rate (at 3%)
n= Number of years projected

$$n = \frac{N}{1 + N(e)\ 2}$$ ……Equation 2

Where: n= sample size
N= NPC Estimated population figure = 662,912
e=level of significance (set at 0.05 for this study)

$$q = \frac{n\ x\ 400}{N}$$ ……Equation 3

Where n= sample size (copies of questionnaire)
n=Population of each ward
N=Projected population figure of the study area.

Table 2: Population Distribution of Study Area by Wards and Number of Samples

S/N	Wards	`1991 Population	Projected Population (2023)	Number of Samples	Percentage (%)
1	AnguwanFatika	17,871	45, 275	27	6.75
2	AnguwanJuma	15,065	38,167	23	5.75
3	Kaura	15,065	38,167	23	5.75
4	Kwarbai A	14,697	37,236	22	5.50
5	Kwarbai B	34,663	87,823	53	13.25
6	Limancin Kona	35,834	90,788	54	13.50
7	Dambo	13,119	33,238	20	5.00
8	Dutsen Abba	26,350	66,761	41	10.25
9	Gyellesu	17,805	45,110	27	6.75
10	Kufena	13,361	33,091	21	5.25
11	Tudun Wada	12,998	32,932	20	5.00
12	TukurTukur	30,059	76,157	46	11.5
13	Wucicciri	15,065	38,167	23	5.75
	Total	261,952	662,912	400	100

Source: NPC (1991) (Authors' Projection, 2023)

3.3 Questionnaire survey

A structured questionnaire was designed and administered to the respondents residing in the study area. In order to select respondents from each of the thirteen (13) wards, a systematic random sampling technique was used which involved sampling the 1st, 5th, 10th 15th 20th etc. (an interval of 5) houses in each streets of the wards. This was done to ensure an unbiased and proportional spatial coverage of responses across the study area. Some of the data collected include: factors that influence fuel wood consumption, main source of household heating energy and form of fuel wood; the method(s) of fuel wood sourcing and frequency as well as means of conveyance to consumers etc. Out of the 400 copies of questionnaire administered only 384 were completed and returned.

3.4 In-depth interview

In-depth interview is an important tool for qualitative data collection. Fuel wood vendors and residents living close to the previously natural forested areas at various wards within the study area were interviewed. This was done to obtain data on factors that influence fuel wood consumption, to complement what was obtained from the questionnaire. For this reason, a semi-structured in-depth interview guide was designed and used.

4. Results and Discussion

Table 3: Gender, Age Nature of Household and Household Size

Age Groups	Frequency (F)	Percentage (%)
21-30	193	50.2
31-40	109	28.4
41-50	47	12.2
51-60	25	6.5
61 – Above	10	2.6
Total	384	100.0
Gender		
Male	207	53.91
Female	177	46.09
Total	384	100.0
Nature of Household		
Nuclear	179	46.6
Extended	205	53.4
Total	384	100.0
Household Size		
1-4	74	19.3

5-9	166	43.2
10 and above	144	37.5
Total	384	100.0

Source: Field Survey, 2020

Gender, age, nature of household and household size of respondents as shown in Table 4.1 reveal that, out of the 384 reached, there were 53.91% males (which constitutes the majority) and 46.09% females. The age range was 21-61 and above, with the highest number within 21-30 (50.2%) and the least between 61 and above (2.6%). While the representation of both male and female among the sampled respondents might have helped to accommodate the possible variation of opinion on issues explored in the study, the dominance of male respondents is attributed to the function of questionnaire administration in which more males were found and reached. According to Karakara (2018) majority of household heads in most African homes are male. This is because of the gender roles defined by most African cultures. This could also help explain the dominance of male gender in the survey. Another factor could be religion because Islam is the dominant religion in the study area and according to the teachings of Islam; communication between opposite sex which are not husband and wife or blood relative is limited. Gender plays a major role in determining fuel wood consumption; women often deal with domestic work especially in Northern Nigeria and are more likely to be properly aware of household energy usage in terms of forms (energy mix) and quantity. It can also be deduced that, being in their middle and active age brackets, majority of the respondents might not only be in better position to provide reliable responses to the issues addressed, but also might have positive effects on the general attitude towards adopting more heating energy mix, which could help to avert household energy crisis that usually emanates from over dependent on single energy source. The result of this study on the age distribution of respondents corroborates the findings of Karakara (2018) who revealed that in the Cape coast of Ghana; more young people were contacted and available for a study of such kind than the older folks with 65% dominance.

Table 3 further reveals that, 53.4% of the respondents had extended type of household while 46.6% were from nuclear households. Also, respondents from household size of 5-9 members accounted for the highest (43.2%), and this was closely followed by 10 and above members (37.5%). Least household size was 1-4 which accounted for 1.9%. This shows that most respondents are from relatively large households, which could be attributed to the practice of polygamous system of marriage. This result is similar to the findings of Okafor et al. (2021) where it was found that large household size of more than five children are common in Northern Nigeria due to the common practice of polygamy as supported by religious practices.

However, the implication of this large household size is that there is always high demand for forest wood products (fuel wood). The study of Mangi (2011) agrees to that, that large families in some rural districts of Tanzania are found to have high demand for forest resources. This could alter

the pattern of the forest resource use, and accelerate deforestation. According to Maji (2019) large household size requires large amount of energy in all ramifications. This means that the energy consumption level between large and smaller household size varies.

Table 4: Educational Attainment, Occupation and Income Level

Educational Attainment	**F**	**%**
No Formal education	24	6.2
Quranic education	92	24.0
Primary	24	6.2
Secondary	235	61.2
Tertiary education	2	0.5
Vocational training	7	1.8
Total	384	100.0
Occupation		
Trading	105	27.3
Farming	173	45.1
Civil Service	68	17.7
Artisan	38	
Total	384	100.0
Income Level (₦)		
< 18,000	78	20.3
18,100-37,000	134	34.9
37,100-56,000	86	22.4
56,100 and above	86	22.4
Total	**384**	**100.0**

Source: Field Survey, 2023

The educational attainment of respondents as shown in Table 4 reveals that, secondary education accounted for the highest proportion (61.2%). While respondents with tertiary education constituted the least (0.5%). This implies that majority of the respondents have attended one form of education or the other. Educational programmes such as environmental protection and importance of other energy alternatives both through public education and enforcement laws may easily be comprehended. Based on this therefore, Falcone (2017) is of the opinion that establishing laws and policies for environmental education and protection is paramount for the protection of vegetation cover from energy source vendors because most of the respondents are educated and can easily appreciate the policy. According to Johnson, et al., (2020) an educated society is a protected society.

Table 4 also shows that, farming constituted the highest proportion (45.1%) among the respondents' occupation, this was followed by trading (27.3%), while the least was artisan with 9.9%. This is in no doubt as majority of the dwellers in the study area are secondary school graduates (as seen in Table 4). This might influence their perception and attitudes towards the consumption of fuel wood. The result of this study is similar to the findings of Abdul-hadi (2016) who also revealed that in Zaria, the most dominant

occupation among household heads was farming. This was tied to the fact that majority of the households had been farmers for decades and as such have been passed on from generation to generation although many may have other sources of income because of the increased educational level in the area.

Moreover, differentials in economic position between households usually reflect in different energy consumption patterns. Table 4 further shows that, 55.2% earn between ₦18,100- ₦37,000 and below, only about 22.4% earn above ₦56,100 which shows that poverty level is high. According to Argawal (2019) income determines the type of energy used in a household. He further revealed that the low income earners use more dirty energy source than high income earners. This therefore could explain the dominant use of fuel wood in the present study area considering their low income level. Also, Abdul-Hadi (2016) supported Argawal revelation where he established that there exists a relationship between energy type used in a household and income level of that household. This implies that, the nature of household size and low income might influence high fuel wood intake, being that fuel wood is relatively cheaper as opposed to other sources of energy such as cooking gas or electricity. Similarities to the findings of the present study can be traced in the study of Edmund and John (2014), where income in Benin City was found to be relatively low among households who were dominantly fuel users.

Table 5: Factors Influencing Fuel Wood Consumption

Factors	Frequency	Percentage
Availability	96	25.0
Convenience	110	28.6
Cost effective	88	22.9
Relatively faster in cooking	54	14.1
High/unstable price for other energy sources	24	6.2
Large household size	12	3.1
Total	384	100.0

Source: Field Survey, 2020

The results from Table 5 reveal that convenience of sourcing accounted for the most common determining factor to the use of fuel wood with 28.6%, followed by availability of fuel wood and cost effectiveness as voted by 25.0% and 22.9% of the respondents respectively. This finding is similar to that of Abdul-Hadi, (2016), where the study revealed that cheap price, availability and affordability of fuel wood were found as factors responsible for fuel wood consumption in Zaria. Likewise, Audu (2013) in a study on fuel wood consumption and desertification in Bauchi area of Nigeria revealed that among the determinant factors of fuel wood consumption in Nigeria are partly due to its availability, accessibility and convenience. More so, the convenience of sourcing fuel wood over other forms of cooking and heating energy will result to increased consumption which makes the vital resource vulnerable to be over exploited by the consumers who may not care about the consequences of indiscriminate tree harvesting, provided their energy needs are met. The implication

is overexploitation of the available woodland and forestry resources. If this continues, attainment of the Sustainable Development Goal 7 (access to affordable, reliable, sustainable and modern energy) will be a mirage.

"We used more gas for cooking but gas price was increased, we have to revert to fuel wood and mix different sources of energy". A civil servant respondent, from Gyallesu ward.

"I used to leave the stem of my corn after harvest, but I have been using them for cooking from the last eight years because of economic hardship". A farmer respondent, from Kufena ward.

"My husband rarely bought fuel wood in the past because he believed it has a negative effect to our health and the environment, but we have been using it from the last six years because of the economic hardship". A housewife respondent, from Kwarbai ward.

5. Conclusion

This study has established that fuel wood is the major source of energy in the study area and the use of fuel wood is being influenced by its relative cost effectiveness, availability and accessibility. Likewise the use of fuel wood as a source of energy is influenced by the low income earning nature of the respondents in the study area. Thus, higher income earners use cleaner energy sources than fuel wood, while low income earners settle for fuel wood. In addition, level of education is another factor influencing energy as demonstrated by the interview conducted. Those with high education level resort to using firewood only when they can no longer afford the cleaner energy like gas. Although energy use is dominated by female, but male were the higher respondents given the religious and cultural orientation of people in the study area.

6.Recommendations

The study recommended that poverty reduction programmes should be initiated so that more people can leave fuel wood for better alternatives. Government should also enlighten the people since the vast majority are educated and can easily appreciate the dangers associated with deforestation and wood harvesting for energy in the environment and this would help government and non-governmental organisation to achieve the climate action which is goal thirteen (13) of the sustainable development goals.

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