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SURVEY OF PREFERRED HOUSEHOLD ENERGY UTILIZATION IN OTUKPO TOWN BENUE STATE, NIGERIA

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ABSTRACT

The study conducted in Otukpo town, Benue State, Nigeria was aimed to assess the preferred household energy utilization and the factors influencing these preferences. Multi-stage sampling technique was adopted to randomly select 10 households from 10 communities in Oturkpo town. One hundred adults purposely selected and interviewed with Google Forms semi-structured questionnaire for data collection. Results showed a majority of respondents were females (91.2%). Monthly, most of the respondents (43.1% and 35.3%) earned between ₦ 21,000 to ₦ 50,000 and spent ₦5,000 to ₦10,000 on household energy. Majority (38.2%) preferred firewood as single-use energy and firewood and charcoal (68.6%) as double-use while charcoal was the most (65.7%) easy and convenient accessible energy. Income (42.2%) was the major factor influencing energy preference while convenience (35.3%) and ease of accessibility (35.3%) were the major reasons for preference. Preference for gas increased progressively from 2% for no-salary earners to 78.4% for those earning above ₦ 200,000. Preference for charcoal and firewood decreased from 34.7% and 72.3% to 10.8% and 8.8% respectively for respondents with no-salary and income above ₦ 200,000, respectively. The choice for firewood decreased from 60.8% for the unemployed to 6.9% for the Civil Servants. Also, respondents with no formal education utilized charcoal and firewood (53.9 % and 50.0%) compared to those with tertiary education (11.8% and 8.8%), respectively. Preference for cooking gas was lowest with respondents with no formal education in contrast to those with tertiary education (86.3%). In conclusion, low income and education encouraged the use of firewood and charcoal.

Keywords: Energy, household, preference, Otukpo, Nigeria

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INTRODUCTION

Household energy utilization is very crucial to every home in Nigeria. The types vary from biomass sources which include fuelwood and charcoal to electricity, petroleum products like kerosene, and liquefied natural gas (Ogwumike *et al.*, 2014). The choice differs from one household to another depending on a lot of factors. Some of the factors may include poverty, income, level of education, availability, and cost (Laska and Ige 2023). Although Nigeria is one of the largest deposit and exploration of petroleum in the world yet, many communities face the acute challenge of accessing kerosene for households (Ogwumike *et al.*, 2014). People living in Nigerian villages, responsible for safeguarding the forest's resources, depend mainly on firewood and charcoal to sustain their lives, making them the most commonly utilized energy source in the country (Rotowa *et al.*, 2019). Therefore, dependence on firewood and charcoal as sources of household energy leads to massive

deforestation and degradation of the natural environment.

The extensive adoption of inefficient cooking techniques in Nigeria exacerbates the demand for firewood, posing risks to human health, particularly among women and children who typically handle household cooking. The reliance on firewood as a cooking fuel significantly contributes to severe health issues in developing nations due to indoor air pollution. The World Health Organization (WHO) approximates that approximately 1.5 million individuals annually suffer premature deaths due to indoor pollution stemming from solid fuel usage. This staggering toll equates to 4,000 deaths per day (Ngutsav *et al.*,2021).

Energy consumption is rising significantly in Nigeria due to population growth and improved living conditions, adversely affecting the environment. Nigeria's energy supply and usage follow a pattern where selecting the right mix of energy sources becomes crucial in our energy landscape (Ibrahim and Ukwenya, 2012). This suggests a pressing need for more extensive utilization of our energy reservoirs to meet future demands. As the landscape of household energy utilization undergoes profound transformations, understanding the preferences, patterns, and challenges in energy usage among households in Otukpo becomes a pivotal area of study. The choices surrounding household energy utilization in Otukpo are influenced by a confluence of factors ranging from socio-economic conditions to cultural practices and technological advancements.

The significance of this research lies in its potential to unravel the nuanced factors guiding the selection and utilization of household energy sources in Otukpo. By examining the preferences of residents regarding energy sources, alongside the socio-economic context that shapes these choices, this study endeavours to shed light on the dynamics driving energy decisions within households. Moreover, Otukpo's unique socio-cultural fabric, economic activities, and demographic diversity contribute significantly to the diversity of energy needs and consumption patterns among its residents. Understanding these dynamics is paramount for policymakers, energy providers, and stakeholders to develop tailored strategies aimed at promoting sustainable and efficient household energy utilization while addressing the challenges specific to this locality.

This survey of preferred household energy utilization in Otukpo Town, Benue State, Nigeria, seeks to fill a critical gap in understanding the intricacies of energy preferences and consumption patterns among residents. By providing empirical insights, the research aims to inform policy formulation, energy planning, and interventions geared towards fostering sustainable and accessible energy practices within the town.

MATERIALS AND METHODS

Study Area

This research was conducted within the confines of Otukpo metropolis, situated at the core of Benue State, Nigeria. Otukpo embodied a miniature representation of the intricate energy dynamics observed in numerous urban hubs across this region (Jande *et al*., 2020). Positioned within the Middle Belt geopolitical zone of Nigeria, Otukpo stands as a prominent town within Benue State. It bears the name of a subgroup of the Idoma people and geographically lies between longitude 7° 50′ and 8° 20′ East of the Greenwich Meridian and Latitude 6° 50′ and 7° 40′ of the equator (Jande *et al.*, 2020). Otukpo is encircled by various LGAs: Apa LGA to the North, Gwer West and Gwer LGAs to the East, Ado and Obi LGAs to the South, Okpokwu LGA to the Southwest, Ohimini LGA to the West, and Ankpa LGA of Kogi State in the Northwest (Joseph and Ikyernum, 2016). The population of Otukpo LGA was recorded as 266,411 individuals in the 2006 census (NPC 2006). Presently, the LGA consists of four districts—Otukpo, Ugboju, Adoka, and Akpa (Joseph and Ikyernum 2016) and comprises thirteen political wards, with ten situated in rural areas and three in the urban township. The primary socio-economic activities in Otukpo LGA encompass farming, trading, tailoring, hunting, and civil service (Joseph and Ikyernum, 2016).

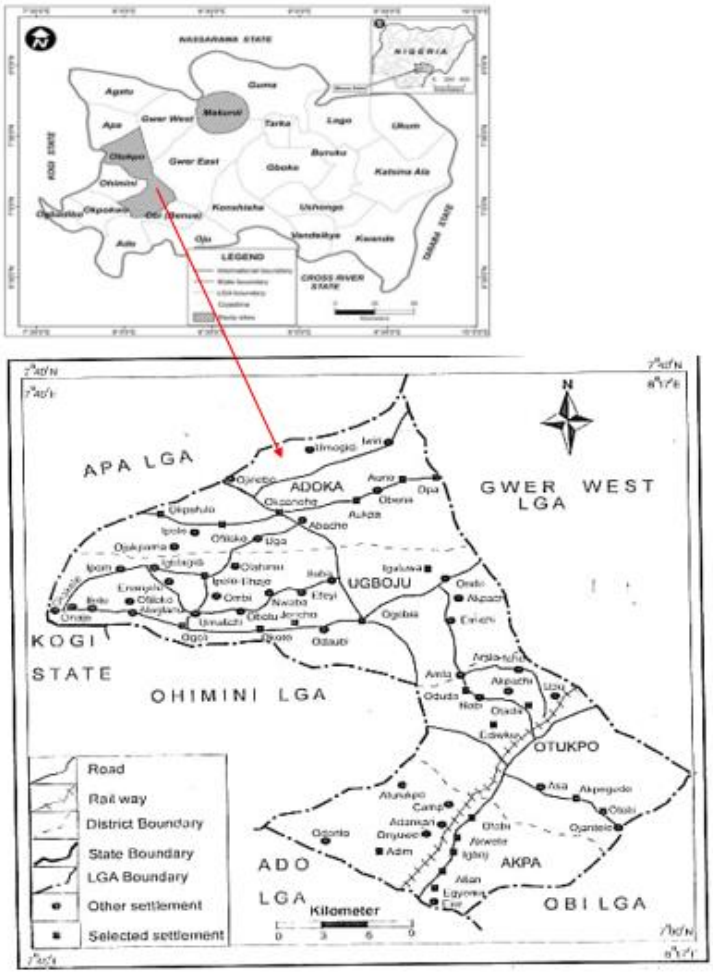

Figure 1: Benue State map showing Makurdi and Otukpo LGA

Experimental design

Multi-stage sampling technique was adopted for the survey of household energy used in the study area. 10 communities namely: Amoda, Owetor, Ogira, Upu, Asa, Eupi, Sabon Garry, Chito Ghana, Ampia and Pipeline. They were purposively selected for the study based on proximity. In each community, ten (10) households each was randomly chosen for data collection. From each household, a matured individual or respondent who uses household energy was chosen and interviewed. A total of one hundred (100) respondents was interviewed.

Data collection method

Data on household energy used was elicited through Google Form structured questionnaire. Each respondent was interviewed to provide information of different types of energy used in households. The questionnaire was structured into four (4) sections namely: Section A: socio-economic characteristics of respondents; Section B: information on household energy types; Section C: energy use and energy preferred for different income level of respondents and Section D: energy use and energy preferred for different employment status of respondents. Each respondent was interviewed following the online link via android phone. Geographic Positioning System (GPS) map camera lite was used to snap photographs of household energy used in Otukpo. The camera has an inbuilt app to indicate names of locations of the interview, longitudes, latitudes, altitude and dates the interview was done. This is to ensure authenticity of the study.

Data Analysis

Data was analyzed and collated with Microsoft excel and results will be presented in presented in tables, frequencies, percentage and charts.

Table 1: Names of communities in Otukpo samples for the study

S/No.	Name of Community	Frequency (F)	Percentage (%)
1.	Amoda	10	9.8
2.	Owetor	10	9.8
3.	Ogira	10	9.8
4.	Upu	10	9.8
5.	Asa	10	9.8
6.	Eupi	11	10.8
7.	Sabon Garry	12	11.8
8.	Chito Ghana	10	9.8
9.	Ampia	10	9.8
10.	Pipeline	10	9.8
Total	**10**	**102**	**100**

RESULTS

Demographic characteristics of respondents

Table 2 presents a comprehensive analysis of demographic characteristics based on responses from 102 respondents. The key variables, including sex, age, education, occupation, religion, marital status, family size, and type of house, were examined to gain insights into the composition of the surveyed population. The majority of respondents were females (91.2%), with only a small proportion being males (8.8%). The age distribution reveals a varied demographic profile. The largest age group is 31 - 40 years (43.1%), followed by those aged 21 to 30 years (27.5%). Educational attainment varies, with secondary education being the most common (49.0%), followed by tertiary education (41.2%). Business is the dominant occupation among respondents (69.6%), followed by civil servants (10.8%) and students (9.8%). The surveyed population is predominantly Christian (100%), with no respondents identifying as Muslim. The majority of respondents were married (62.7%), followed by singles (25.6%). Divorced individuals constitute a small percentage (1.0%). Family size varies, with the majority having 4 to 6 members (54.9%). The most common housing type is a flat (53.9%), followed by one-room apartments (31.4%).

Table 2: Demographic characteristics of respondents

Variables	Frequency	%
Sex		
Male	9	8.8
Female	93	91.2
Total	**102**	**100**
Age		
0 – 20	3	2.9
21 – 30	20	27.5
31 – 40	44	43.1
41 – 50	41	19.6
51 – 60	4	3.9
Over 60	3	2.9
Total	**102**	**100**
Level of Education		
Primary	4	3.9
Secondary	50	49.0
Tertiary	42	41.2
Informal	6	5.9
Total	**102**	**100**
Occupation		
Civil servants	11	10.8
Farming	8	7.8
Business	71	69.6
Student	10	9.8
Private Employment	2	2.0
Total	**102**	**100**
Religion		
Christianity	102	100
Islam	0	0
Total	**102**	**100**
Marital status		
Single	26	25.6
Married	64	62.7
Divorced	1	1.0
Widow	9	8.8
Widower	1	1.0
Total	**102**	**100**
Family Size		
1 - 3	30	29.4
4 - 6	56	54.9
7 – 10	15	14.7
11 - 15	1	1.0
Total	**102**	**100**
Type of house		
One room apartment	32	31.4
Flat	55	53.9
Duplex	6	5.9
Self-contained	9	8.8
Total	**102**	**100**

Analysis of monthly income and expenditure patterns of respondents

Figure 1 analyzes, the distribution of monthly income and expenditure among a sample population. A substantial (14.7%) respondents fall within the income bracket of 0 - ₦20,000 Naira. The largest percentage (43.1%) falls within the income range of ₦ 21,000 - ₦ 50,000, indicating a significant portion of the population in this income bracket. Approximately 22.5% of respondents have a monthly income between ₦ 51,000 and ₦ 100,000. A smaller percentage (6.9%) falls within the range of ₦101,000 - ₦151,000. A modest (2.9%) respondents have a monthly income between ₦151,000 and ₦160,000. Highest income (2.00%) is represented by respondents earning between ₦ 161,000 and ₦200,000. A total of 13.7% of respondents reported monthly expenditures on household energy within the range of 0 - N4,000. The largest percentage, 35.3%, falls within the expenditure bracket of ₦5,000 - ₦10,000, indicating a significant portion of the population in this expenditure range. Approximately, 33.3% of respondents have monthly expenditures on household energy between ₦11,000 and ₦15,000. A modest 12.7% of respondents fall within the expenditure range of ₦16,000 - 20,000. The smallest percentage, 4.9%, represents respondents with monthly expenditures on household energy between ₦21,000 and ₦25,000. The total number of respondents included in the analysis is 102, providing a comprehensive overview of monthly expenditure patterns on household energy.

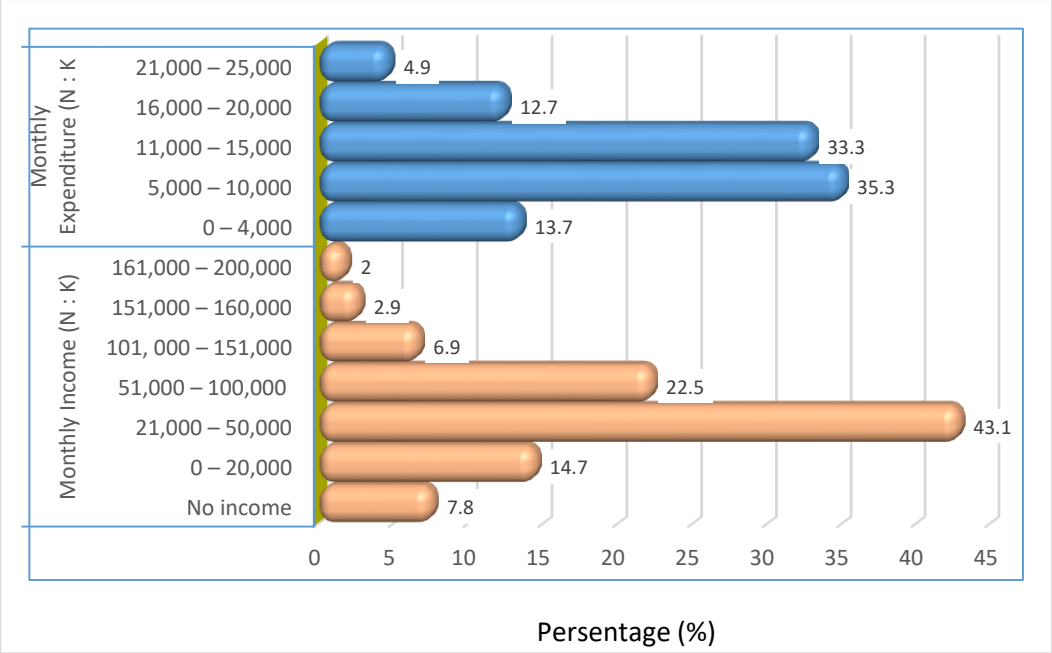

Figure 1: Monthly income and expenditure on Household energy of respondents

Types, preference and combination of household energy use by respondents

Most respondents (38.2%) preferred firewood as household energy in Otukpo, followed by charcoal (33.3%), gas (22.5%) and electricity (5.6%), respectively. A significant portion of respondents (68.6%) combines firewood and charcoal, highlighting the use of traditional biomass. Also, 25.5% of respondents use a combination of modern sources, incorporating both gas and electricity. A small percentage, 2.9%, opted for a combination of charcoal and kerosene. Similarly, 2.9% use a combination of gas and kerosene. A significant majority, 65.0%, uses a combination of fuel wood, charcoal, and kerosene, reflecting a mix of traditional energy sources. A minority (1.2%) combines fuel wood, charcoal, and gas. A small percentage (2.5%)

used a combination of fuel wood, kerosene, and electricity, showcasing a blend of traditional and modern sources.

Figure 3 presents the accessibility of various energy types to respondents. Results revealed that charcoal was the most (65.7%) easy and convenient accessible household energy followed by firewood (10.8%), cooking gas (11.8%), kerosene (8.8%) and electricity (3.9%). However, kerosene (25.5%) was the most difficult energy to access by respondents.

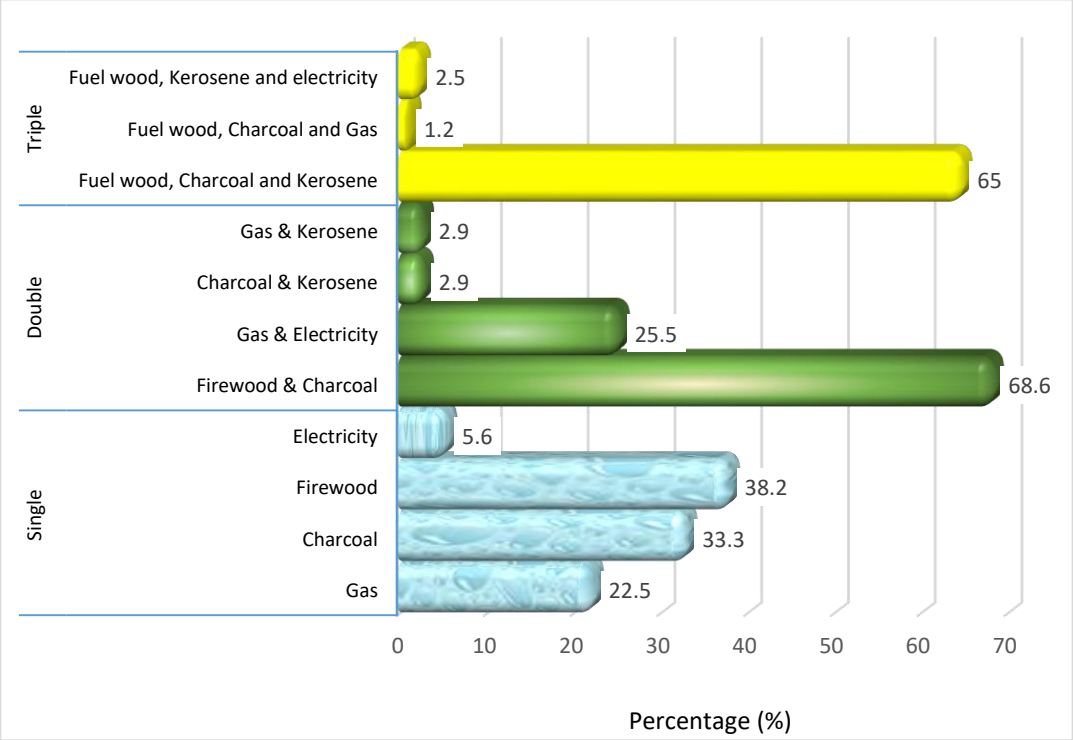

Figure 2: Types, Preference and combination of household energy use by respondents

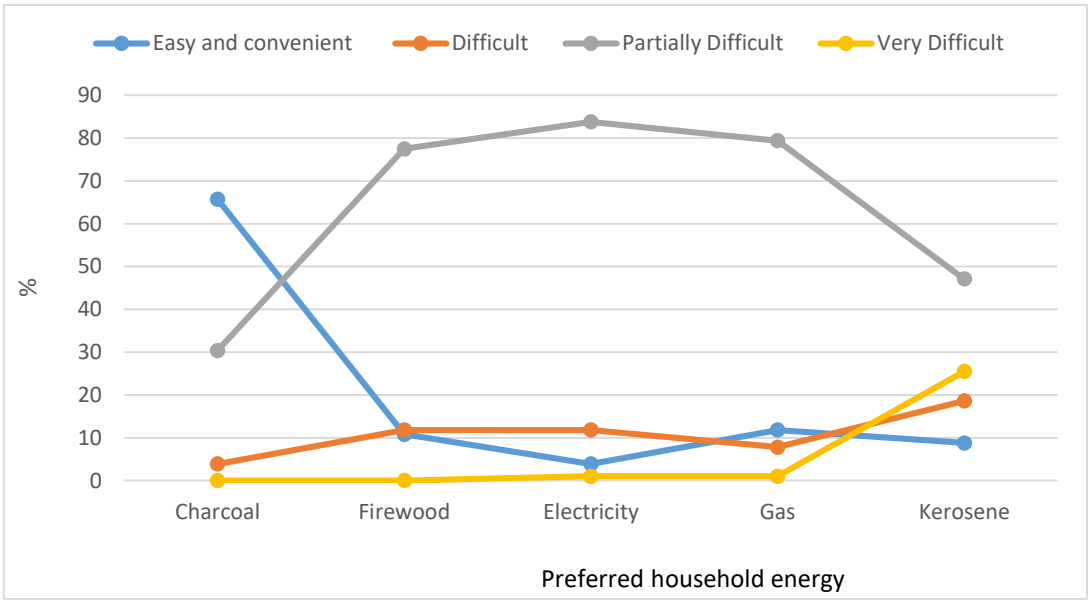

Figure 3: Respondents perceived accessibility of household use in Otukpo

Reasons for reference, Uses, frequency and factors influencing energy by respondents

Table 3 analyze the preferences, usage patterns, and influencing factors related to energy consumption in Utukpo households. The majority of respondents cited convenience (35.3%) and ease of accessibility (35.3%) as primary factors influencing their energy preferences. Additionally, low cost (18.6%) was a significant consideration, while a smaller percentage indicated a preference for energy sources that burn very fast (10.8%).

Domestic use (68.6%) overwhelmingly dominates, while a smaller percentage is attributed to business use (7.8%). Notably, a substantial portion of respondents (23.5%) indicated the dual use of energy for both domestic and business purposes. The majority of respondents (93.1%) reported using energy throughout the day, with morning (2.9%) and evening (3.9%) use being less common. Various factors play a role in shaping household energy consumption. e as a crucial determinant, underscoring the economic aspect of energy choices. Seasonal variations (24.5%) and location (18.6%) are also significant, indicating that environmental and geographical factors influence energy decisions. Notably, the cost of petroleum products (2.9%) and family size (11.8%) were mentioned by a smaller proportion of respondents.

Table 3: Reasons for reference, Uses, frequency and factors influencing energy by respondents

Variable	Frequency	Percentage (%)
Reason for energy preference		
Convenience	36	35.3
Low cost	19	18.6
Ease accessibility	36	35.3
Burns very fast	11	10.8
Uses of energy		
Domestic	70	68.6
Business	8	7.8
Domestic & Business	28	23.5
Frequency of energy use		
Morning	3	2.9
Evening	4	3.9
Morning, afternoon & Evening	95	93.1
Factors influencing household energy		
Season	25	24.5
Income	43	42.2
Location	19	18.6
Cost of petroleum products	3	2.9
Family size	12	11.8

Energy type preferences across income levels

Figure 4 presents results on relationship between household income levels and preferences for specific energy types. The preference for gas increased significantly with rising income levels, reaching a peak of 78.4% for respondents with income levels above ₦200,000. The use of kerosene is relatively low across all income levels, with a slight increase observed for respondents earning less than ₦21,000. Charcoal shows a gradual decline in preference as income levels rise, with a noticeable decrease from 34.7% for respondents with no salary to 17.6% for those with income above 200,000 Naira. Firewood is most prevalent among respondents with no salary, with a substantial decrease as income levels increase, reaching 10.8% for those earning above ₦ 200,000. Similar to Gas, the

preference for Electricity increases with higher income levels, with the highest percentage (8.8%) observed for respondents earning above ₦ 200,000.

Analysis of energy choice by respondents based on their employment status

Table 5 shows results on respondents' employment status and their choice of energy sources. The majority of Civil Servants opt for Gas as their primary energy source, with a significant percentage of 73.5%. Self-employed individuals also show a preference for Gas, though to a lesser extent (42.2%). Private employees (NGO and others) follow closely with 37.3%, while only a marginal 2% of the unemployed population chooses Gas. Kerosene is a relatively unpopular choice across all employment categories, with minimal representation. The highest percentage is observed among Civil Servants at 2%, while Self-employed and Private Employment categories show negligible usage. Charcoal emerges as a prominent energy choice among Self-employed individuals (43.1%) and those in Private Employment (49%). Civil Servants also contribute significantly with 22.5%. Surprisingly, the unemployed population shows a considerable preference for charcoal at 41.2%.

Firewood is a notable choice among the unemployed, constituting a substantial 60.8%. Self-employed and Private Employment groups also exhibit a preference for firewood, with percentages of 15.7%. Civil Servants show the lowest preference for firewood at 6.9%. Electricity is chosen by a relatively small percentage across all employment categories. The unemployed population shows the highest preference at 6.9%, while Civil Servants, Self-employed, and Private Employment groups exhibit lower percentages ranging from 3.9 - 5.9%.

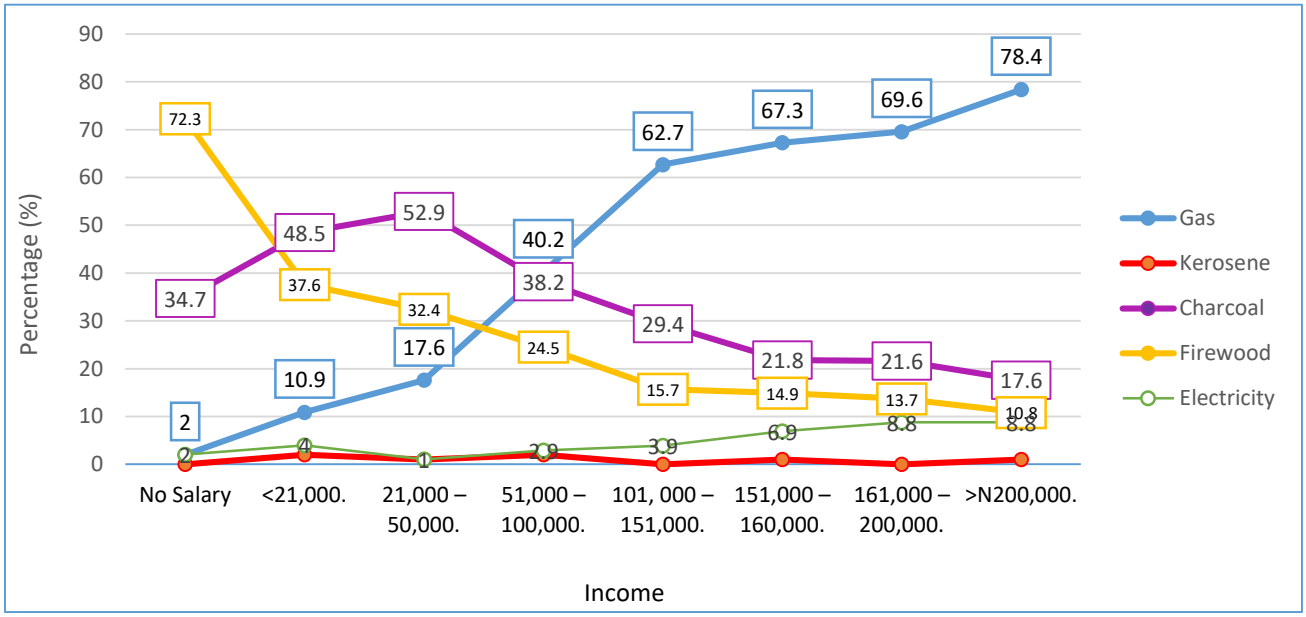

Figure 4: Energy Use and Energy Preferred for Different Income Level of Respondents

Table 5: Energy use and preference according to employment status of respondents

Energy	Respondents' employment status versus to energy choice (%)			
	Civil Servant	**Self-employed**	**Private Employment (NGO and others)**	**Unemployed**
Gas	73.5	42.2	37.3	2
Kerosene	2	0	1	0
Charcoal	22.5	43.1	49	41.2
Firewood	6.9	15.7	15.7	60.8
Electricity	4.9	5.9	3.9	6.9

Relationship between respondents' educational level and energy choices

Figure 5 presents result on respondents' educational levels and their preferences for different energy sources. Gas emerges as a preferred energy source, with a clear trend of increasing usage corresponding to higher levels of education. The percentages rise from 1% for respondents with no formal education to a substantial 86.3% for those with tertiary education. Kerosene usage is relatively low across all educational levels. Respondents with no formal education and those with tertiary education both show minimal reliance on kerosene. Charcoal is a popular choice among individuals with lower educational levels, with percentages decreasing as education levels rise. Respondents with primary education show the highest preference at 70.6%, while those with tertiary education exhibit the lowest preference at 11.8%.

Firewood is a common choice across all educational levels, with a noticeable decrease in preference as education levels increase. Respondents with no formal education have the highest preference at 50%, while those with tertiary education have the lowest at 8.8%. Electricity is chosen by a relatively small percentage across all educational levels. Respondents with tertiary education show the highest preference at 7.8%, while those with no formal education exhibit the lowest preference at 2.9%.

Average weekly and monthly consumption of firewood as household energy in Otukpo

Figure 6 results indicate significant percentage of households predominantly consume firewood on a weekly basis, with 40.0% of respondents using 1-5 bundles during this interval. The monthly consumption pattern also reveals a diverse range, with a notable peak at 21-25 bundles, representing 23.8% of respondents. Interestingly, the weekly consumption pattern shows a sudden drop in usage after the 10th bundle, suggesting a preference for smaller, frequent firewood purchases.

Charcoal bag consumption patterns by respondents in Otukpo

Figure 5 shows results of diverse patterns in charcoal bag consumption. For monthly usage, the majority of respondents (48.7%) consume 1 bag, while weekly usage shows a preference for smaller quantities, with 90.5% of respondents using 0.5 bags. The limited usage of higher quantities suggests a trend toward smaller, more frequent purchases.

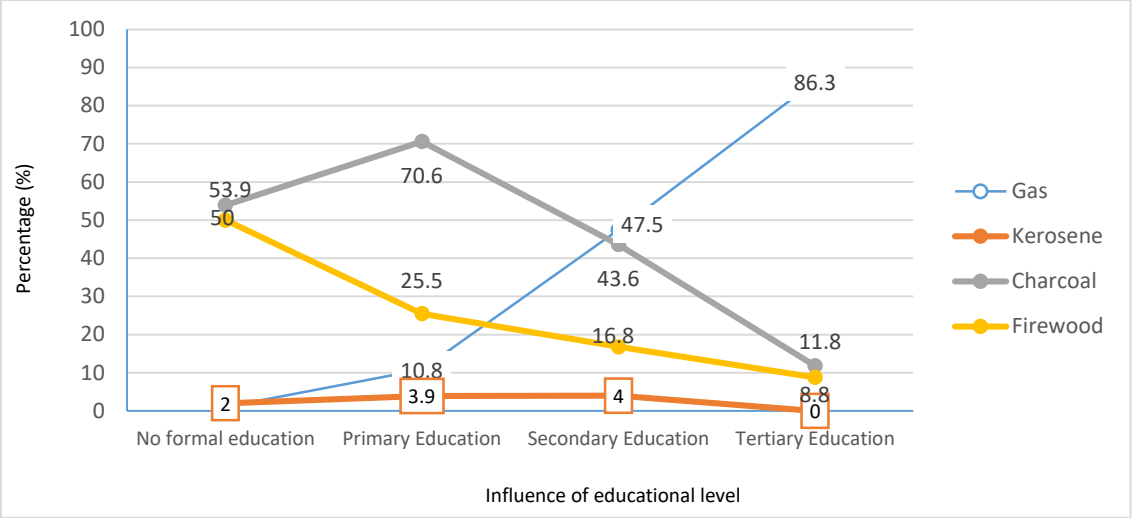

Figure 5: Energy use and preference according to Educational Level of respondents

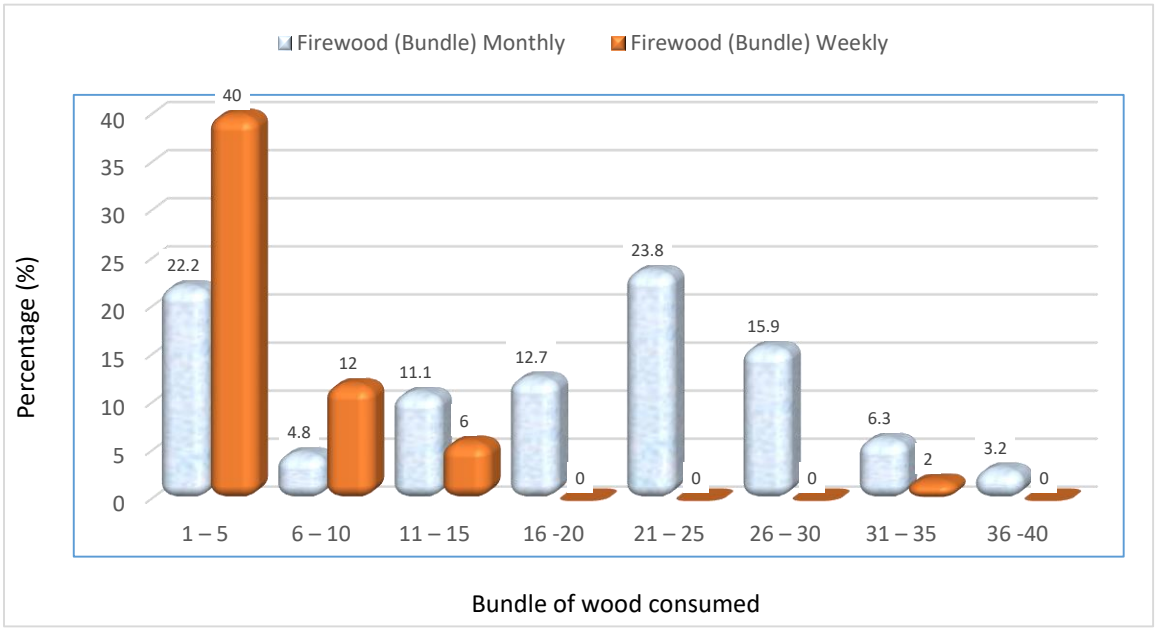

Figure 5: Average weekly and monthly consumption of firewood as household energy in Otukpo

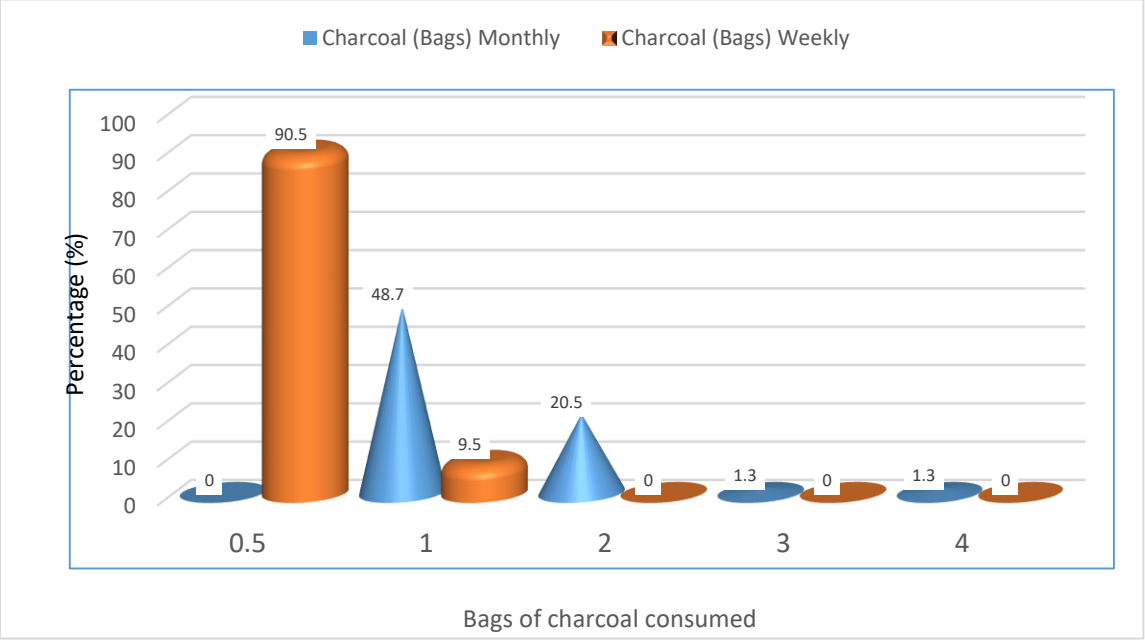

Figure 5: Average weekly and monthly consumption of charcoal as household

DISCUSSION

Most respondents surveyed were females, with only a small number being males. This agrees with the findings of Akinola and Aboluje (2019) who reported same for a study on energy usage trends in Ondo State, Nigeria. However, the finding is contrary to the report of Hamid and Islam (2020) that males were more on their study on lightening energy. The high percentage of females might be due to the traditional role women in handling household chores, including cooking, cleaning, and managing household appliances among others. The majority respondents in indicated a preference for firewood as their primary household energy source. This agrees with the study of Ngutsav *et al.* (2021) who also reported fuelwood as the primary energy source used for cooking in Otupko. Although the finding is contrary to the report of Akinola and Aboluje (2019) that kerosene was the most frequently utilized energy source in households, it agrees with the report of Hamid and Islam (2020) who stated firewood as the main source for cooking energy in their study. A substantial number of participants used combination of firewood and charcoal as paired energy use and were the easiest and convenient accessible household energy. The reasons for this energy preference could be that wood-based fuels like firewood and charcoal are readily available in rural areas; collected from communities' forests and obtained from nearby sources. It might also be that firewood and charcoal are generally more affordable or even free compared to other forms of energy such as gas or electricity, making them a cost-effective choice for households with limited financial resources.

In this study, convenience and ease of accessibility were primary factors influencing energy preferences in Otukpo. The majority of respondents reported using energy throughout the day, with only morning and evening use being less common. This suggests a consistent and widespread demand for energy across different times of the day. This study revealed that respondents' preference for gas and electricity increased significantly with rising income levels. This result corroborates with Emagbetere *et al.* (2016) that individuals with higher incomes predominantly utilize liquefied petroleum gas (LPG), which is their preferred choice for energy.

Higher-income households often have the financial capacity to afford the installation and ongoing costs associated with gas and electric appliances. They might perceive these options as more convenient and efficient for cooking and heating compared to traditional methods like charcoal or firewood. With increased income, there's often a desire for modernization and upgraded living standards. Gas and electric stoves are seen as more modern, clean, and efficient, aligning with the aspirations of higher-income households. Gas and electricity are perceived as more reliable energy sources, providing consistent and controllable heat or power compared to traditional fuels like firewood or charcoal, which might vary in quality and availability. The finding suggests that higher-income households prioritize cleaner energy sources, perceiving gas and electricity as more environmentally friendly compared to burning solid fuels like wood or charcoal, which contribute to indoor air pollution and deforestation.

Similarly, gas was most preferred energy source, with a clear trend of increasing usage corresponding to higher levels of education in Otukpo. Again, it finding agrees with and Obasi *et al*. (2019) and Emagbetere *et al*. (2016) that persons with a tertiary education opted for the usage of LPG. This might be because higher levels of education often correlate with increased awareness of modern energy options and their benefits. Individuals with higher education might have better access to information about the advantages of cooking gas in terms of convenience, cleanliness, and efficiency compared to traditional fuels like firewood or charcoal. Cooking gas is perceived as a safer and cleaner option for cooking. Educated individuals might be more conscious of health hazards associated with traditional cooking methods, such as indoor air pollution caused by burning solid fuels, and thus prefer the cleaner alternative of cooking gas. Higher-educated individuals might prioritize time efficiency and appreciate the controllability of gas stoves for cooking. Those with higher education might have a better understanding of environmental concerns associated with traditional cooking fuels like firewood and charcoal. This awareness might lead them to choose cooking gas, perceiving it as a more environmentally friendly option.

Finding from this study indicated that charcoal shows a gradual decline in preference as income levels rise among respondents. This agrees with the report of Nyamoga *et al.* (2022). Charcoal might be relatively more affordable for lower-income households compared to other energy sources. As income levels increase, households might opt for cleaner or more convenient options, even if they are more expensive. Firewood is most prevalent among respondents with no salary, with a substantial decrease as income levels increase. The majority of civil servants opted for cooking gas as their primary energy source, with a significant percentage while charcoal emerged as a prominent energy choice among self-employed individuals and those in private employment. Firewood is a notable choice among the unemployed. Firewood is a common choice across all educational levels, with a noticeable decrease in preference as education levels increase. This finding indicates that firewood is often freely available or relatively inexpensive compared to other energy sources like gas or electricity. This infer that individuals with no salary or low incomes might opt for firewood due to its cost-effectiveness. Also, Low-income earners might be less aware of or less concerned about the environmental impact of using firewood compared to other cleaner but costlier energy options.

CONCLUSION

In this study, majority of respondents were females who were middle age adults. Firewood was the most preferred single use energy whereas firewood plus charcoal, and wood, charcoal with kerosene were double and triple energy use respectively in Otukpo town. However, charcoal was the easiest and most convenient accessible energy for the respondents. Income was considered as major factor influencing energy preference. Preference for gas and electricity

increased progressively with increase in respondents' earning while preference for charcoal and firewood decreased with increase in income. As respondents' educational level increased, there was corresponding increase in the choice for gas and electricity and decrease in preference for charcoal and firewood energy. It is therefore recommended that to avoid aggressive deforestation and its consequences, the levels of income and education of respondents should be improved.

REFERENCES

Akinola A. O. and Aboluje O. M. (2019). A Study of the Household Energy Consumption Pattern in Ondo State, Nigeria. Saudi Journal of Engineering and Technology, 4(4): 155-163.

Hamid D., A., and Islam, R. (2020). Explorative Analysis of Household Energy Consumption in Bauchi State, Nigeria. IntechOpen. doi: 10.5772/intechopen.89597.

Emagbetere E. Odia J. and Oreko B. U. (2016). Assessment of Household Energy Utilized for Cooking in Ikeja, Lagos State, Nigeria. Nigerian Journal of Technology (NIJOTECH), 35(4), 796 – 804.

Obasi, I. O, Onwusuanya, K. M. and Mmerife, P. R. (2019). Empirical Analyses of Household Energy Expenditure and Preferences in Umuahia North LGA of Abia State, Nigeria. Nigerian Journal of Agriculture, 50(2): 100-104

Nyamoga, G. Z. Sjølie, H. K. Latta, G. Ngaga, Y. M. Malimbwi, R. and Solberg B. (2022). "Effects of Income and Price on Household's Charcoal Consumption in Three Cities of Tanzania", International Journal of Forestry Research, Article ID 9988979, Pp14. https://doi.org/10.1155/2022/9988979

Ogwumike F. O., Ozughalu, M. and Abiona G. A. (2014). Household Energy Use and Determinants: Evidence from Nigeria. International Journal of Energy Economics and Policy, 4(2): 248-262

Łaska, G. and Ige, A.R. (2023). A Review: Assessment of Domestic Solid Fuel Sources in Nigeria. *Energies*, *16*, 4722. https://doi.org/10.3390/en16124722.

Rotowa, J.A.; Egbwole, Z.T.; Adeagbo, A.A.; Blessing, O.M. (**2019).** Effect of Indiscriminate Charcoal Production on Nigeria Forest Estate. *Int. J. Environ. Protec. Policy*, *7*, 134–139.

Jande J. A., Nsofor G. N. and Abdulkadir A. (2020). Modelling of Urban Growth with Land Change Modeler in Otukpo Metropolis of Benue State, Nigeria. *International Journal of Engineering Applied Sciences and Technology.* 4(9): 26-40.

Ngutsav, A. S., Akiri S.E. and Onov G. A. (2021). Enhancing Household Dominant Energy Choice for Cooking and Lighting in Urban Areas of Benue State. *International Journal of Innovative Mathematics, Statistics & Energy Policies*, 9(2):1-13.

Ibrahim S. and Ukwenya J. (2012). Managing Energy Resources: Case Study on Energy Consumption Pattern. Leonardo Electronic Journal of Practices and Technologies, 21: 47 – 61.

Joseph E. and Ikyernum J. (2016). The role of remittances to rural infrastructural development in Otukpo Local Government Area on Benue State, Nigeria. *International Journal of Innovative Research and Development* 5(5):219-225.