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Households' Energy Choice Pattern for Cooking in Ado Ekiti, South West, Nigeria

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Abstract: This study investigated the patterns of domestic energy usage of households of Ado Ekiti and what influences their usage patterns. A multistage random sampling technique was adopted in selecting respondents from each household in the study area. Results show that closeness of fuel source, the cost of the energy type, whether the cooking energy produce smoke or not, cost effectiveness of energy type, affordability of other energy sources, satisfaction with the energy type used for cooking, consideration that cooking energy source is modern and familiarity with other energy sources apart from the one they use significantly influences the type of energy used for cooking, while safety during cooking with preferred energy source does not influence it significantly. The study also shows that accessibility, price and educational attainments are determinant for use of modern energy. Based on findings of this study, households in Ado Ekiti metropolis responded differently in their energy usage pattern. The use of gas on daily basis is high in the study area and the choice could be attributed to their level of education, age, gender, occupation, weather, accessibility, location, type of food prepared, income, available home appliance and energy price. The use of electricity and kerosene is mostly associated with its availability and high price, while firewood is associated with its cheapness, cultural preference and belief, low level of education and location and charcoal is associated with low energy price and low income.

Keywords: pattern; households; energy; cooking; Ado Ekiti

1. Introduction

The household cooking sector is the largest consumer of energy in Nigeria, which is derived from biomass, particularly fuel wood.[1] Household cooking energy is the energy utilized for cooking and does not includes energy used for food processing and preparation before purchase.[2] Energy for cooking is grouped into solid fuels and non-solid fuels. The solid fuels include fossil fuels -coal, peat and biomass-wood, dungs and agricultural products, while the nonsolid fuels consist of kerosene, liquefied natural gas and electricity.[3][4] further classified them into traditional (dung, agricultural residues and fuel-wood), intermediate-charcoal and kerosene or the modern sources-liquefied petroleum gas, biogas, ethanol gel, plant oils, dimethyl ether and electricity. The energy required for the running of homes, industries and the economy generally has been of global concern for some decades.[5] In terms of utilization, household energy accounts for about forty percent of the total energy consumption in developing countries.[6] Households energy are used for lighting, heating, cooling, ironing, food and drinks preservation, powering electronic devices, cooking and vacuum cleaning. As with many goods and services, the demand for energy and type of energy used depend on several factors. According to,[7] 74% of households in Asia use solid fuels, mostly in the form of biomass. The situation is not much different in Nigeria where traditional energy sources accounts for over 70% household energy suppl.[7] While rural households rely more on biomass fuels than those in urban areas, a substantial number of urban poor households' in Nigeria are dependent on fuel wood, charcoal, or wood waste to meet their cooking needs. According to,[8] the proportion is likely to increase since it is estimated that 61% of the world's population will be living in urban areas by 2025.

Energy is one of the essential inputs for improved well-being of individuals and socio-economic development of nations. In spite of the importance of energy, most households' in Ado Ekiti are still faced with the over-consumption of low grade traditional energy sources. However, the collection and utilization of traditional energy sources is at some cost which often manifest in forms of in-door air pollution, flood/erosion, desertification and loss of biodiversity. The energy use patterns of urban households may differ to that of the rural households since they have different geographical characteristics. The type of energy used in Ado Ekiti in recent times, especially the poor households, have not been helped by poverty and increasing prices of other more efficient energy types like electricity and gas. Gasoline prices in Nigeria, where two-thirds of the

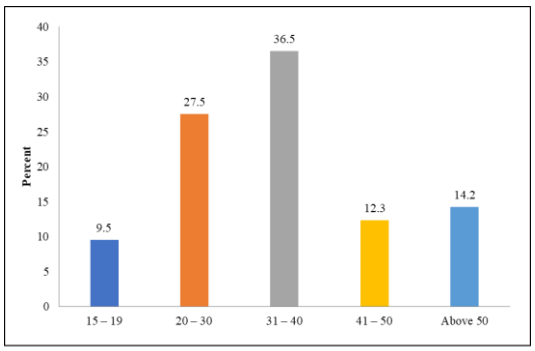

Fig. 1. Age groups of respondents from households.

population of about 164 million live on less than $1.25 a day, surged after the fuel price had been capped at 145 naira a litter, with undermined investment in refineries that results in the country importing about 70 Percent of its fuel.[9] This constantly affects the pricing of petroleum products yearly in the country over years.

It is against this backdrop that this study sought to investigate the patterns of domestic energy usage among Ado Ekiti households. Also, the study would investigate what influences their usage patterns putting into considerations the household energy uses attributable to different energy sources as well as some factors that influence their choice of energy consumption and the preferences of households.

It is against these problems that this study sought to investigate the patterns of domestic energy usage of households of Ado Ekiti and what influences their usage patterns putting into considerations the household energy uses attributable to different energy sources as well as some factors that influence the choice of energy consumption and the preferences of households if given an option in order to ensure a balanced development introduction of the article should appear here.

2. Experimental Section

2.1. Study Area

Ado Ekiti lies on latitude 7° 40' N and longitude 5° 16' E with a land area of 265 km^2 and an elevation of 400 meters above sea level[10] and a population of 313,690 as at 2006 census (Ado Population Commission).

2.1.1. Sampling Techniques

The research was conducted in Ado Ekiti, Nigeria in 2019. Thirteen (13) electoral wards of the city were selected for this study, which includes Idofin, Inisa, Idolofin, Ijigbo, Orereowu, Okeyinmi, Oke ila, Ereguru, Dalimore, Okesa, Irona, Igbeyin, and farm settlement respectively. A multistage random sampling technique was adopted in selecting respondents from each household in the 13 electoral wards of Ado Ekiti. Each ward was divided into zones and each zone was divided into units while each unit was divided into randomly selected households. From each selected household, people who met the study criteria and were designated to provide the most reliable information about household cooking were selected. This could be the male or female head of household or other

Table 1. Demography of the respondents.

		Frequency	Percent
Gender of respondents	Male	73	34.6
	Female	136	64.5
	Non – response	2	0.9
	Total	211	100.0
Marital status	Single	60	28.4
	Married	124	58.8
	Divorced	4	1.9
	Widowed	20	9.5
	Non – response	3	1.4
	Total	211	100.0
Level of education	No formal education	19	9.0
	Primary education	17	8.1
	Secondary education	34	16.1
	Tertiary education	105	49.8
	Others	35	16.6
	Non – response	1	0.5
	Total	211	100.0

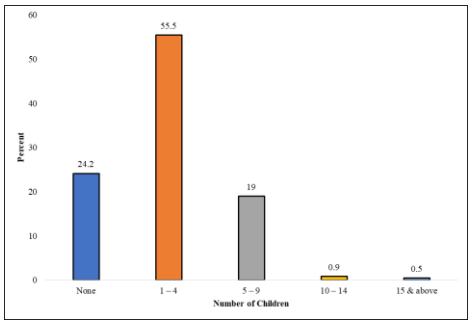

Fig. 2. No of children per households.

representative of the household. Ten (10) households from each of the thirteen electoral wards in Ado-Ekiti were selected in each of the 13 electoral wards; Fifteen (15) questionnaires each were distributed in the entire electoral.

2.1.2. Data collection

Questionnaire were distributed and collected between 21st July and 5th August, 2019. The questionnaire focused on Households' energy choice pattern for cooking fuel in Ado-Ekiti. Several visits were made at different times to the various areas and respondents who could not read nor write were assisted in filling the options they chose. The questionnaire response recorded a 77% return rate of the total **questionnaires** distributed with only 100 was correctly filled and returned. The structured questionnaire was divided into themes: socio-demography of the respondents, age group, number of children in selected households, socio-economic characteristics, energy preference for family consumption, type of energy used in cooking by households, knowledge, perception and preferences of energy sources, frequency of usage, availability, affordability and accessibility of cooking energy.

2.1.3. Data Analysis

The data generated were organized and analysed using the Statistical Package for Social Sciences (SPSS) ver.20. Descriptive statistical analysis was used to analyse socio-economic characteristics of respondents on monthly income level and type of cooking energy, weather influence and locations. Inferential statistics was used to analyse preference for energy usage by households. Association

Table 2. Socio-Economic characteristics of the respondents

		Frequency	Percent
Occupation	Public servant	57	27.0
	Self - employed	76	36.0
	Unemployed	19	9.0
	Artisan	25	11.8
	Others	34	16.1
	Total	211	100.0
Income/earnings per month	None	34	16.1
	< 20,000	54	25.6
	20,000 - 50,000	75	35.5
	51,000 - 100,000	30	14.2
	> 100,000	17	8.1
	Non – response	1	.5
	Total	211	100.0
Housing type	Modern	157	74.4
	Traditional	50	23.7
	Non – response	4	1.9
	Total	211	100.0

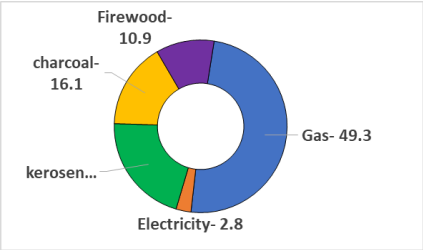

Fig. 3. Percentage of type of energy used in cooking by households.

between the closeness of fuel source they use in their home and energy preference for family consumption, association between the cost of the energy type and energy preference for cooking, association between the cooking energy and smoke that they produce and Energy preference for cooking, association between their cooking fuel source and their safety, association between preference for other energy sources and its affordability, association between cooking fuel usage satisfaction and energy preference for family consumption, association between cooking fuel usage and its cost, association between their cooking energy source whether it is modern and energy preference for family consumption was all carried out at $p < 0.05$.

3. Results

3.1. Demography of the respondents

As shown in table 1, 34.6% of respondents households are male, 64.5% are female while 0.9% did not state their gender; table 1 also reveals that 28.4% of the respondents from the households are single, 58.8% are married while 11.4% are either divorced or widowed and 1.4% did not respond. Lastly, only 9% of the respondents from the households had no formal education, 8.1% had primary education, 16.1% had secondary education, 49.8% had tertiary education and 16.6% had other forms of education while 0.5% did not respond.

3.1.1. Age groups of respondents from households

Fig. 2 reveals that 9.5% of the respondents households are aged between 15 – 19 years, 27.5%, between 20 – 30 years, 36.5%, between 31 – 35 years, 12.3%, between 41 – 50 years and 14.2% are above 50 years.

3.1.2. Number of children per households

As presented in fig. 2, 24.2% of the households have no children, 55.5% have only 1 – 4 children, 19% have 5 – 9 children, about 1% have 10 – 14 children and half percent have above 14 children.

3.1.3. Socio-Economic characteristics of the respondents

The socio - economic characteristics of the households as shown in table 2 reveals that 27% of the respondents are public servants, 36% are self – employed, 9% are unemployed, 11.8% are artisans and 16.1% have other occupations. Also, on the income/ earnings per month of households, 16.1% of them have no source of income, 25.6% earns below ₦20,000, 35.5% earns between ₦20000 and ₦50000, 14.2% earns between ₦51000 and ₦100000 and only 8.1% earns above ₦100000 while 1 respondent did not respond. Lastly, 74.4% of the households' lives in modern house, 23.7% lives in traditional houses while 1.9% did not respond.

3.1.4. Percentage Energy preference for cooking

Fig. 3 shows that 43.1% of the households prefer gas as source of fuel for cooking, 32.2% prefer electricity, 18.5% prefer kerosene, 5.7% prefer charcoal while 0.5% did not respond.

Table 3 shows that 97.6% of the respondents are familiar with other energy sources apart from the one they use presently, 70.6% reported closeness of the fuel source they use to their home, 57.8% reported that the cost of the energy type influenced their preference for it, and 33.6% noted their cooking energy produce smoke. In addition, 83.4% of the respondents considered cooking with their preferred energy source safe, 51.2% would have preferred other energy sources if they could afford it, 71.6% are satisfied with the energy type they use for cooking, 61.1% considered their energy type cost effective and 74.4% considered their cooking energy source modern.

Table 3. Knowledge, perception and preferences of energy sources

S/N	Knowledge, perception and preferences of energy sources	Yes	Percent
1.	Familiarity with other energy sources apart from the one they use presently	206	97.6
2.	Closeness of the fuel source they use to their home	149	70.6
3.	The cost of the energy type influenced their preference for it	122	57.8
4.	Their cooking energy produce smoke	71	33.6
5.	Considered cooking with their preferred energy source safe	176	83.4
6.	Would have preferred other energy sources if they could afford it	108	51.2
7.	Satisfied with the energy type they use for cooking	151	71.6
8.	Considered their energy type cost effective	129	61.1
9.	Considered their cooking energy source modern	157	74.4

Table 4. Frequency of usage of Energy type

S/N	Usage	None of the time (%)	Little of the time (%)	Some of the time (%)	Most of the time (%)	All the time (%)	NR (%)
1.	Use their energy type to cook	3 (1.4)	3 (1.4)	18 (8.6)	76 (36.0)	110 (52.1)	1 (0.5)
2.	Number of times they have considered stopping the use of their energy type	105 (49.8)	27 (12.8)	47 (22.3)	24 (11.4)	6 (2.8)	2 (0.9)
3.	Frequency of developing health problem due to the cooking type they use	155 (73.5)	31 (14.7)	22 (10.4)	2 (0.9)	-	1 (0.5)
4.	Number of times their neighbours complained because of the energy source they use	154 (73.0)	19 (9.0)	27 (12.8)	7 (3.3)	3 (1.4)	1 (.5)
5.	Number of times they consider their cooking better due to their energy source	48 (22.7)	34 (16.1)	52 (24.6)	27 (12.8)	49 (23.2)	1 (0.5)
6.	Number of their cooking energy was not available of in their area	67 (31.8)	103 (48.8)	30 (14.2)	6 (2.8)	4 (1.9)	1 (0.5)

Table 5. Availability, affordability and accessibility of cooking energy

S/N	Availability, affordability and accessibility of cooking energy	SA (%)	A (%)	U (%)	D (%)	SD (%)	NR (%)
1.	I find it difficult to get my cooking energy to buy in my area	10 (4.7)	20 (9.5)	-	112 (53.1)	68 (32.2)	1 (1.5)
2.	There is always challenges getting my cooking energy	5 (2.4)	25 (11.8)	1 (0.5)	143 (67.8)	36 (17.1)	1 (0.5)
3.	A lot of people in my area use the same cooking energy that I use	54 (25.6)	112 (53.1)	7 (3.3)	24 (11.4)	13 (6.2)	1 (0.5)
4.	Availability of preferred cooking energy will make for more demands from the people	39 (18.5)	97 (46.0)	8 (3.8)	56 (26.5)	10 (4.7)	1 (0.5)
5.	Where I get my cooking energy is far from my home	20 (9.5)	40 (19.0)	-	125 (59.2)	25 (11.8)	1 (0.5)
6.	I get my cooking energy to buy whenever I need it	64 (30.3)	116 (55.0)	2 (0.9)	21 (10.0)	6 (2.8)	2 (0.9)
7.	I would love other energy sources but cannot afford it	50 (23.7)	51 (24.2)	1 (0.5)	49 (23.2)	59 (28.0)	1 (0.5)
8.	I always enjoy cooking with my energy type	95 (45.0)	72 (34.1)	5 (2.4)	33 (15.6)	5 (2.4)	1 (0.5)
9.	Cooking with my energy type makes me sick	5 (2.4)	29 (13.7)	8 (3.8)	54 (25.6)	114 (54.0)	1 (0.5)
10.	There are complaints from my neighbours when I am cooking due to the energy type	11 (5.2)	39 (18.5)	3 (1.4)	20 (9.5)	137 (64.9)	1 (0.5)

Table 6. Association between the closeness of fuel source they use to their home and energy preference for cooking

Variables	**Category**	**Closeness of fuel source they use to their home**		**Total**	**Chi Square (df = 3)**	***p***	**Remarks**
		No (%)	**Yes (%)**				
Energy preference for family consumption	Gas	34 (37.4)	57 (62.6)	91 (100.0)	9.503	0.023	Sig.
	Electricity	17 (25.0)	51 (75.0)	68 (100.0)			
	Kerosene	5 (12.8)	34 (87.2)	39 (100.0)			
	Charcoal	5 (41.7)	7 (58.3)	12 (100.0)			
	Total	**61 (29.0)**	**149 (71.0)**	**210 (100.0)**			

Table 4 records that 88.1% of the households use their energy type to cook most or all of the time, 8.6% some of the time and 1.4% none of the time. The table also shows that about 1% of the households considered stopping the use of their energy type most of the time, 22.3% some of the time and 49.8% none of the time. In addition, only 4.7% of the households reported their neighbours complained because of the energy source they use most or all of the times, 12.8% some of the time, and 73% none of the time. Furthermore, 26% of the households said they consider their cooking better due to their energy source most or all of the time, 24.6% some of the time and 22.7% none of the time. Lastly, 4.7% of the households reported their cooking energy was not available in their area most or all of the time, 14.2% some of the time and 31.8% none of the time.

In table 5 above, 14.2% of the respondents agree or strongly agree that they find it difficult to get their cooking energy to buy in their area, 14.2% agree or strongly agree that there are always challenges getting their cooking energy, 78.7% agree or strongly agree that a lot of people in their area use the same cooking energy that they use and 64.5% of the household agree or strongly agree that availability of preferred cooking energy will make for more demands from the people. Also, 28.5% of said that where they get their cooking energy is far from their home, 85.3% of them agree or strongly agree that they get their cooking energy to buy whenever they need it, 47.9% agree or strongly agree that they would love other energy sources but cannot afford it, 79.1% agree or strongly agree that they always enjoy cooking with their energy type, 16.1% of them agree or strongly agree that cooking with their energy type makes them sick and 23.7% agree or strongly agree that there are complaints from their neighbours due to the type of cooking fuel they use.

3.1.5. Hypothesis Testing

Hypothesis 1

H_1: There is no association between knowledge, perception and preferences of energy sources and energy preference for family consumption.

Table 6 shows that 62.6% of households that prefer gas, 75% for electricity, 87.2% for kerosene and 58.3% for charcoal for cooking have their energy sources close to their home. The chi square value obtained was 9.503(df-3), p-value of 0.023) shows that energy

Table 7. Association between the cost of the energy type and energy preference for cooking

Variables	Category	The cost of the energy type influences their preference for it		Total	Chi Square (df = 3)	*p*	Remarks
		No (%)	Yes (%)				
Energy preference for family consumption	Gas	62 (68.1)	29 (31.9)	91 (100)	52.406	<0.001	Sig.
	Electricity	8 (11.8)	60 (88.2)	68 (100)			
	Kerosene	13 (33.3)	26 (66.7)	39 (100)			
	Charcoal	6 (50.0)	6 (50.0)	12 (100)			
	Total	**89 (42.4)**	**121 (57.6)**	**210 (100)**			

Table 8. Association between cooking energy and smoke it produces

Variables	Category	Cooking Energy produce smoke		Total	Chi Square (df = 3)	*p*	Remarks
		No (%)	Yes (%)				
Energy preference for family consumption	Gas	82 (90.1)	9 (9.9)	91 (100)	53.466	<0.001	Sig.
	Electricity	41 (60.3)	27 (39.7)	68 (100)			
	Kerosene	14 (35.9)	25 (64.1)	39 (100)			
	Charcoal	2 (16.7)	10 (83.3)	12 (100)			
	Total	**139 (66.2)**	**71 (33.8)**	**210 (100)**			

Table 9. Association between considering cooking with their preferred energy source safe and energy preference for family consumption

Variables	Category	Considered cooking with your preferred energy source safe		Total	Chi Square (df = 3)	p	Remarks
		No (%)	Yes (%)				
Energy preference for family consumption	Gas	9 (9.9)	82 (90.1)	91 (100)	5.730	0.126	Not Sig.
	Electricity	16 (23.5)	52 (76.5)	68 (100)			
	Kerosene	8 (20.5)	31 (79.5)	39 (100)			
	Charcoal	2 (16.7)	10 (83.3)	12 (100)			
	Total	**35 (16.7)**	**175 (83.3)**	**210 (100)**			

Table 10. Association between preference for other energy sources if they could afford it and energy preference for family consumption

Variables	Category	Preference for other energy sources if they could afford it		Total	Chi Square (df = 3)	*p*	Remarks
		No (%)	Yes (%)				
Energy preference for family consumption	Gas	66 (72.5)	25 (27.5)	91 (100)	40.191	<0.001	Sig.
	Electricity	27 (39.7)	41 (60.3)	68 (100)			
	Kerosene	8 (20.5)	31 (79.5)	39 (100)			
	Charcoal	2 (16.7)	10 (83.3)	12 (100)			
	Total	**103 (49.0)**	**107 (51.0)**	**210 (100)**			

preference for family consumption is significantly associated with closeness of source of cooking ($p < 0.05$).

Table 7 reveals that 31.9% of households prefer gas as source of energy, 88.2% prefers electricity, 66.7% prefers kerosene and 50% prefer charcoal as source of fuel for cooking. Their preference is based on the cost of the energy type. The chi square value (52.406), df (3), p-value < 0.00) shows that energy preference for cooking is significantly associated with the cost of the energy type ($p < 0.05$).

Table 8 reveals that only 9.9% of households that prefer gas, 39.7% of those that prefer electricity, 64.1% that prefer kerosene and 83.3% that prefer charcoal for cooking have their energy produce smoke. The chi square value (53.466, df (3), p-value < 0.001), reject the null hypothesis and therefore concluded that energy preference for cooking is significantly associated with whether the cooking energy produce smoke ($p < 0.05$). In a nutshell, households prefer to use energy source that do not produce smoke; smoke is an environmental menace to the human respiratory system as it produces noxious gases like Carbon monoxide which combine with the human red blood cell causing suffocation to human. Smoke is also an irritant to the eye and the human body.

Table 9 reveals that 90.1% of households that prefer gas, 76.5% of those that prefer electricity, 79.5% that prefer kerosene and 83.3% that prefer charcoal for cooking considered cooking with their preferred energy source safe. The chi square value obtained (5.730; df(3), p-value of 0.126) accept the null hypothesis and concludes that energy preference for family consumption is not significantly associated with the consideration that cooking with their preferred energy source is safe ($p > 0.05$).

Table 10 shows that only 27.5% of households that prefer gas, 60.3% of those that prefer electricity, 79.5% that prefer kerosene and 83.3% that prefer charcoal for family consumption would have preferred other energy sources if they could afford it. The F_{cal} (40.191)(df3), p-value <0.001. The null hypothesis is therefore rejected and it is concluded that energy preference for family consumption is significantly associated with preference for other energy sources if they could afford it ($p < 0.05$).

Table 11 shows that 91.2% of households that prefer gas, 60.3% of those that prefer electricity, 51.3% that prefer kerosene and 50.0% that prefer charcoal for cooking are satisfied with the energy type they use for cooking. The F_{cal} (32.033, df(3),p-value <0.001 concludes that energy preference for family consumption is significantly associated with satisfaction with the energy type they use for cooking ($p < 0.05$).

Table 12 shows that 51.6% of households that prefer gas, 82.4% of those that prefer electricity, 56.4% that prefer kerosene and 25.0% that prefer charcoal for family consumption consider their energy type to be cost effective. The F_{cal}(23.250, df (3), p-value <0.001 >F_{tab}, the null hypothesis is rejected and it is concluded that energy preference for family consumption is significantly considering that energy type is cost effective ($p < 0.05$).

Table 11. Association between satisfactions with the energy type they use for cooking and energy preference for family consumption

Variables	Category	Satisfied with the energy type they use for cooking		Total	Chi Square (df = 3)	*p*	Remarks
		No (%)	Yes (%)				
Energy preference for family consumption	Gas	8 (8.8)	83 (91.2)	91 (100)	32.033	<0.001	Sig.
	Electricity	27 (39.7)	41 (60.3)	68 (100)			
	Kerosene	19 (48.7)	20 (51.3)	39 (100)			
	Charcoal	6 (50.0)	6 (50.0)	12 (100)			
	Total	**60 (28.6)**	**150 (71.4)**	**210 (100)**			

Table 12. The association between considering their energy type to be cost effective and energy preference for family consumption

Variables	Category	Considered their energy type cost effective		Total	Chi Square (df = 3)	*p*	Remarks
		No (%)	Yes (%)				
Energy preference for family consumption	Gas	44 (48.4)	47 (51.6)	91 (100)	23.250	<0.001	Sig.
	Electricity	12 (17.6)	56 (82.4)	68 (100)			
	Kerosene	17 (43.6)	22 (56.4)	39 (100)			
	Charcoal	9 (75.0)	3 (25.0)	12 (100)			
	Total	**82 (39.0)**	**128 (61.0)**	**210 (100)**			

Table 13. Association between their cooking energy source, if modern and energy preference for cooking

Variables	Category	Considered their cooking energy source modern		Total	Chi Square (df = 3)	*p*	Remarks
		No (%)	Yes (%)				
Energy preference for family consumption	Gas	9 (9.9)	82 (90.1)	91 (100)	56.961	<0.001	Sig.
	Electricity	13 (19.1)	55 (80.9)	68 (100)			
	Kerosene	21 (53.8)	18 (46.2)	39 (100)			
	Charcoal	11 (91.7)	1 (8.3)	12 (100)			
	Total	**54 (25.7)**	**156 (74.3)**	**210 (100)**			

Table 14. Association between familiarity with other energy sources apart from the one they use and energy preference for cooking

Variables	Category	Familiarity with other energy sources apart from the one they use		Total	chi square (df = 3)	*p*	Remarks
		No (%)	Yes (%)				
Energy preference for family consumption	Gas	1 (1.1)	90 (98.9)	91 (100)	13.002	0.005	Sig.
	Electricity	0 (0.0)	68 (100.0)	68 (100)			
	Kerosene	4 (10.3)	35 (89.7)	39 (100)			
	Charcoal	0 (0.0)	12 (100.0)	12 (100)			
	Total	**5 (2.4)**	**205 (97.6)**	**210 (100)**			

Table 13 shows that 90.1% of households that prefer gas, 80.9% of those that prefer electricity, 46.2% that prefer kerosene and only 8.3% that prefer charcoal for cooking consider their cooking energy source modern. The chi square value obtained was 56.961, (df)(3) and p-value <0.00 concludes that energy preference for cooking is significant in as much as that cooking energy source is modern ($p < 0.05$).

Table 14 shows that 98.9% of households that prefer gas, 100% of those that prefer electricity, 89.7% that prefer kerosene and 100% that prefer charcoal for family consumption are familiar with other energy sources apart from the one they use. The F-cal (13.002)(df3), p-value of 0.005. The null hypothesis is therefore rejected it is concluded that energy preference for family consumption is significantly associated with familiarity with other energy sources apart from the ones they use ($p < 0.05$).

Summarily, hypothesis 1 shows that closeness of fuel source to their home, the cost of the energy type, whether the cooking energy produce smoke or not, cost effectiveness of energy type, affordability of other energy sources, satisfaction with the energy type used for cooking, consideration that their cooking energy source is modern and familiarity with other energy sources apart from the one they use significantly influences the type of energy used in cooking while safety cooking with preferred energy source does not influence it significantly.

Hypothesis 2

H_2: There is no association between knowledge, perception and preferences of energy sources and type of house-hold energy used for cooking.

Table 15 shows the measure of association between type of household energy used for cooking and knowledge, perception and preferences of energy sources. It shows that 68.3% of households that use gas for cooking, 50.0% of those that use electricity, 81.8% that use kerosene, 85.3% that use charcoal and 43.5 that use firewood for cooking consider the closeness of fuel source to their home. The F_{cal}15.860, df(4); p-value of 0.003)>$F\text{-}_{tab}$(<0.001) shows that the type of energy used in cooking is significantly associated with consideration for the closeness of fuel source to their home ($p < 0.05$).

Table 15 also shows that 45.2% of households that use gas for cooking, 66.7% of those that use electricity, 86.4% that use kerosene, 52.9% that use charcoal and 65.2 that use firewood for cooking reported that the cost of the energy type influences their preference for it. The F-cal (22.539), df (4) p<0.001) shows that type of energy used in cooking is significantly associated with the cost of the energy

Table 15. The association between knowledge, perception and preferences of energy sources and type of household energy used for cooking

Knowledge, perception and preferences of energy sources	Type of Energy used in cooking					Total	Chi square	*p*
	Gas	**Electricity**	**Kerosene**	**Charcoal**	**Firewood**			
Closeness of fuel source to their home	71 (68.3)	3 (50.0)	35 (81.8)	29 (85.3)	10 (43.5)	149 (70.6)	15.860	0.003
The cost of the energy type influences their preference for it	47 (45.2)	6 (66.7)	38 (86.4)	18 (52.9)	15 (65.2)	122 (57.8)	22.539	<0.001
Cooking energy produce smoke	3 (2.9)	2 (33.3)	20 (45.5)	24 (70.6)	22 (95.7)	71 (33.6)	107.217	<0.001
Considered cooking with their preferred energy source safe	99 (95.2)	4 (66.7)	36 (81.8)	29 (85.3)	8 (34.8)	176 (83.4)	51.126	<0.001
Would have preferred other energy sources if they could afford it	16 (15.4)	6 (100.0)	37 (84.1)	31 (91.2)	18 (78.3)	108 (51.2)	106.649	<0.001
Satisfied with the energy type they use for cooking	103 (99.0)	3 (50.0)	21 (47.7)	17 (50.0)	7 (30.4)	151 (71.6)	79.121	<0.001
Considered their energy type cost effective	63 (60.6)	3 (50.0)	33 (75.0)	19 (55.9)	11 (47.8)	129 (61.1)	5.996	0.199
Considered their cooking energy source modern	104 (100.0)	5 (83.3)	32 (72.7)	15 (44.1)	1 (4.3)	157 (74.4)	11.752	<0.001
Familiarity with other energy sources apart from the one they use	104 (100.0)	6 (100.0)	41 (93.2)	34 (100.0)	21 (91.3)	206 (97.6)	11.237	0.024

type ($p < 0.05$). 2.9% of households that use gas for cooking, 33.3% of those that use electricity, 45.5% that use kerosene, 70.6% that use charcoal and 95.7 that use firewood for cooking reported that the cooking energy produce smoke (table 15). The F_{cal} (107.217), df (4), p-value <0.001> concludes that type of energy used in cooking is significantly associated with whether the cooking energy produce smoke ($p < 0.05$).

In addition, it shows that 95.2% of households that use gas for cooking, 66.7% of those that use electricity, 81.8% that use kerosene, 85.3% that use charcoal and 34.8 that use firewood for cooking considered cooking with their preferred energy source safe. The F-cal (251.126)(df-4), p-value <0.001. The null hypothesis is therefore rejected and it is concluded that type of energy used in cooking is significantly associated with consideration that cooking with their preferred energy source is safe ($p < 0.05$).

Furthermore, it shows that 15.4% of households that use gas for cooking, 100% of those that use electricity, 84.1% that use kerosene, 91.2% that use charcoal and 78.3 that use firewood for cooking would have preferred other energy sources if they could afford it. The F-cal(106.649)(df4), p-value <0.001. The null hypothesis is therefore rejected and it is concluded that type of energy used in cooking is significantly associated with the affordability of other energy sources ($p < 0.05$).

Also, it reveals that 99.0% of households that use gas for cooking, 50.0% of those that use electricity, 47.7% that use kerosene, 50% that use charcoal and 30.4 that use firewood for cooking are satisfied with the energy type they use for cooking. The F-cal (79.121) (df 4), p-value <0.001. The null hypothesis is therefore rejected and it is concluded that type of energy used in cooking is significantly associated with satisfaction with the energy type they use for cooking ($p < 0.05$).

It also reveals that 60.6% of households that use gas for cooking, 50.0% of those that use electricity, 75.0% that use kerosene, 55.9% that use charcoal and 47.8 that use firewood for cooking considered their energy type cost effective. The F-cal (5.999) (df 4), p>0.199. The null hypothesis is therefore not rejected and it is concluded that type of energy used in cooking is not significantly associated with consideration that their energy type is cost effective ($p > 0.05$).

Furthermore, it shows that 100% of households that use gas for cooking, 83.3% of those that use electricity, 72.3% that use kerosene, 44.1% that use charcoal and only 4.3% that use firewood for cooking considered their cooking energy source modern. The F-cal (11.752)(df4),p-value <0.001. The null hypothesis is therefore rejected and it is concluded that type of energy used in cooking is significantly associated with consideration that their cooking energy source is modern ($p < 0.05$).

Lastly, it reveals that 100% of households using gas, electricity and charcoal for cooking, 93.2% that use kerosene, and 91.3% that use firewood for cooking are familiar with other energy sources apart from the one they are using presently. The F-cal(11.237; df(4), p-0.024. The null hypothesis is therefore rejected and it is concluded that the type of energy used in cooking is significantly associated with familiarity with other energy sources aside the ones they use at the moment ($p < 0.05$).

Summarily, hypothesis 2 shows that closeness of fuel source to their home, the cost of the energy type, whether the cooking energy produce smoke, consideration that cooking with their preferred energy source is safe, affordability of other energy sources, satisfaction with the energy type used for cooking, consideration that their cooking energy source is modern and familiarity with other energy sources apart from the one they use significantly influences the type of energy used in cooking while consideration that their energy type is cost effective does not influence it significantly.

Hypothesis 3

H_3: There is no significant association between housing type and energy preference for family consumption and type of energy used.

Comparing energy usage type for cooking by housing type in table 16 shows that 98.1% of those that use gas lives in modern houses while 1.9% lives in traditional houses;100% of those that uses electricity lives in modern houses, 62.8% of those that use kerosene lives in modern while 37.2% lives in traditional houses; also 62.5% of those that uses charcoal resides in modern houses while 37.5% resides in traditional houses and only 13% of those that use firewood consider their house modern while 87% considers their houses as traditional. The F-cal(86.278)(df4), p-value < 0.001 shows that type of energy used by household is significantly associated with their house type.

Table 16. Association between housing type and type of energy used in cooking

Variables	Category	Housing type		Total	Chi Square (df = 4)	*p*	Remarks
		Modern	Traditional				
Type of Energy used in cooking	Gas	101 (98.1)	2 (1.9)	103 (100)	86.278	<0.001	Sig.
	Electricity	6 ((100.0)	0 (0.0)	6 (100)			
	Kerosene	27 (62.8)	16 (37.2)	43 (100)			
	Charcoal	20 (62.5)	12 (37.5)	32 (100)			
	Firewood	3 (13.0)	20 (87.0)	23 (100)			
	Total	**157 (75.8)**	**50 (24.2)**	**207 (100)**			
Energy preference for family consumption	Gas	84 (83.3)	6 (16.7)	90 (100)	49.311	0.005	Sig.
	Electricity	53 (79.1)	14 (20.9)	67 (100)			
	Kerosene	15 (38.5)	24 (61.5)	39 (100)			
	Charcoal	5 (50.0)	5 (50.0)	10 (100)			
	Total	**157 (76.2)**	**49 (23.8)**	**206 (100)**			

Table 16 also compared energy preference for family consumption by housing type. It shows that 83.3% of those that use gas lives in modern houses while 16.6% lives in traditional houses, 79.1% of those that use electricity stay in modern buildings while 20.9% stays in traditional houses, 38.5% of those that use kerosene resides in modern buildings while 61.5% resides in traditional buildings and 50% of those that use charcoal lives in modern houses while 50.5% lives in traditional houses. The table value (49.311, df (3), p-value of 0.005) shows that there is a significant association between energy preference for family consumption and housing type

4. Discussions

Demographic and socio-economic attributes study includes: gender, age, marital status, level of education, occupation, income, type of the household and size of the households. Majority of respondents were female while there were few males. This greater gender variation is in line with the marital status and educational background in the study areas where males function as household's head except in some areas where females function as household's head either as widows or divorcees. Educational status sometimes reflects the energy utilization pattern of people. The majority of respondent had tertiary education while primary education was few in the study areas. Age is an important criterion in accessing the socio-economic effects of household energy because adult people are more likely to engage in energy issues than dependent age group. This result confirms that age group between 31-40 years mostly partake in energy utilization in Ado Ekiti. Occupations determine the level of income of a person, thus there is a link between occupation of people and energy utilization and consumption. Table 2 shows that most of the respondents in the study areas were self-employed, also, the study respondents have public service occupants. Income is a major determinant of standard of living; hence household energy has correlation with standard of living. Table 2 indicates that monthly earning of the respondents living in study areas is relatively high. This high income can be as a result of the economic activities majorly of secondary and tertiary economic activities in the study area.

In Ado-Ekiti, the commonly used energy types for cooking in the study area is gas and kerosene although some households also use charcoal and firewood for cooking, while electricity is least used. In summary, the most used energy type per day is gas and kerosene. Accessibility of the different energy types was found to be a strong determinant of its use especially in Ado-metropolis. Majority of the farm settlement dwellers in Ado-metropolis agree that firewood is collected for free and this influence its high usage in the area, while the urban households resort to the use of gas and kerosene. The type of food prepared and cultural beliefs is a determinant because respondents agree to the use of modern energy source to cooking a particular type of food and some have this belief that food made with firewood and charcoal is more natural possibly making its usage is dominant in the rural areas.

Accessibility, price and educational attainments are also a determinant as the educated ones use more of modern energy than the less educated. This study also agrees with some of the empirical studies of[11-16] and the concept of energy ladder model as used by different researchers on household energy.[17-21] found that income, fuel prices, government policies, intra-household income distribution, fuel availability, distribution network proximity, cultural preferences, demographic distribution, physical environment (rural or urban) and household characteristics influence energy consumption levels.

The urban and farm settlements areas of Ado metropolis responded differently to the use of household energy for cooking, In the farm settlements area of Ado metropolis, few people did not agree to the use of modern energy for cooking and a high percentage agrees to its use for cooking activities, however, they complained about low income and accessibility. The study agrees with[12] that if modern household energy was made available, affordable and the users earned higher income; fuel wood would tend to be replaced by kerosene and kerosene replaced by gas or electricity for cooking. Also[15] study agrees with this, they found out that many people prefer to use gas for convenience, efficiency and neatness but cannot afford it. The concept of energy ladder hypotheses according to[23] is believed that people with low incomes generally use traditional fuels as their main energy source and people with higher incomes tend to use modern fuels. They do more of fuel stacking and not totally abandon the traditional fuel) Further it assumes that cleaner fuels are normal economic goods while traditional fuels are inferior goods.[24] In summary when all options are made available to households like affordable price, higher income and when these energy sources are accessible, people tends to climb the energy ladder to cleaner energy but this theory does not consider the cultural beliefs and preferences of people when it comes to energy use. Looking at the stack model theory, according to[18] farm settlements household of Ado metropolis do not switch fuels entirely, but more generally follow a multiple fuels or fuels stacking

model. Energy Stack Model is ability of households to combine both traditional and modern fuels to meet their domestic energy needs. This model rejects the linear simplification of the energy ladder, suggesting that households do not wholly abandon inefficient fuels in favor of efficient ones. Modern fuels are rather integrated slowly into energy-use patterns, resulting in the contemporaneous use of different cooking fuels.[22]

5. Conclusions

Based on findings of this study, households in Ado metropolis responded differently in their energy usage pattern. The use of gas (49.3%) on daily basis is high in the areas and the choice could be attributed to their level of education, age, gender, occupation, weather, accessibility, location, type of food prepared, income, available home appliance and energy price. The use of electricity is mostly associated with its availability. Kerosene usage is associated with its availability and high price, which for firewood it's associated with its cheapness, cultural preference and belief, low level of education and location while charcoal is associated with low energy price and low income.

Making modern energy available and affordable as well as sensitizing households on the impact of traditional energy use in Ado metropolis would help ensure healthy and safe environment. Based on findings in this study, it could be concluded that households in Ado metropolis area tends to climbs from low grade energy types to modern energy when income increases.

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Conflicts of Interest

The authors declare no conflict of interest.

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