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Determinants of Household Energy Use for Cooking in Tanzania

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Abstract

This article examines the determinants of household energy use for cooking among households in the Tanzania mainland. The study employed descriptive and inferential statistics to analyse data from the 2017/18 Tanzania Household Budget Survey. Regarding the primary source of energy used for cooking, descriptive statistics revealed that the majority (66.5%) of households use firewood for cooking, 24.6% use charcoal, while only 8.8% use other (non-biomass fuels). This indicates that the majority (91.1%) rely on traditional fuel (biomass) for cooking in Tanzania. Based on inferential statistics, the chi-square test found that employment status, marital status, education level, place of residence, income, age, and household size were statistically significant predictors associated with household energy use for cooking in Tanzania at a 5 percent significant level. On the other hand, multinomial logistic model results showed that households with few members, younger heads, heads with a higher level of education, and households located in urban areas were less likely to use firewood and charcoal as the primary fuel type for cooking than other types of energy such as electricity, kerosene, industrial gas, coal, generator, and solar. The researcher recommends using these findings in formulating appropriate policies regarding reducing or removing taxes on cooking gas, appliances, spare parts, and subsidies on electricity connections to improve access to affordable modern energy and lessen the environmental and health impacts of biomass energy use.

Keywords: Households Traditional energy, Modern Energy fuel, Multinomial Logistic Model

1. Introduction

The global effort to promote cleaner cooking practices is evidenced through the 7th Sustainable Development Goal (SDG), which, according to the UNDP (2020), strives to achieve universal access to sustainable modern energy use by 2030.

Approximately 2.4 billion people globally lack access to clean cooking energy in the year 2021. Of these, 40 percent and 55 percent reside in sub-Saharan Africa and developing Asia, respectively (IEA *et al.*, 2023). Due to the COVID-19 pandemic and increased fuel prices, especially Liquefied Petroleum Gas (LPG), which doubled in 2022 compared to 2019, many people worldwide have had to rely on traditional biomass cooking fuel. As a result of cost constraints, about 75 million people who recently gained access to electricity may lose it, and 100 million have reverted to using biomass cooking fuels despite having previously switched to clean cooking fuels (IEA *et al.*, 2023). Suppose we do not take global action to achieve universal access. In that case, around 660 million people will still be without energy access by 2030, with sub-Saharan Africa and developing Asia being the

most affected regions. In addition, it will be difficult for sub-Saharan Africa to achieve its sustainable development goals by 2030 if most of the population continues to lack access to clean fuels for cooking and other technologies.

Globally, over 2.4 billion people still rely on traditional solid fuels for cooking despite their significant harm to the environment and human health (Haines *et al*., 2017; Mosses *et al*., 2023). The use of non-modern biomass fuels for cooking causes almost 4 million premature deaths yearly and contributes to environmental degradation and climate change (WHO, 2022).

The Government of the United Republic of Tanzania has implemented several measures to achieve universal access to affordable, reliable, sustainable, and modern energy by 2030 in line with the 7th Sustainable Development Goal, such as increasing access to electricity, establishing the Tanzania Rural Electrification Expansion Programme (TREEP), expanding the national electricity grid, and developing solar home systems and mini-grid markets (Rugaimukamu *et al*., 2023; Omari *et al*., 2020).

Despite Tanzania's effort to achieve universal access to affordable, reliable, sustainable, and modern energy by 2030, only 78.4% of the population in mainland Tanzania had access to electricity, and out of those, only 37.7% were connected to it (NBS/REA, 2020). However, the majority of those who were connected used electricity for lighting purposes (77%), followed by refrigeration (4.7%), cooling (2.9%), and security (2.8%). The remaining 5.8% was used for other purposes. Surprisingly, only a tiny fraction of households (2.5%) used electricity as their primary source of energy for cooking. In urban areas, this number was slightly higher at 3.8%, while in rural areas it was only 1.8%. (NBS/REA, 2020). These statistics motivate the researchers to determine household energy use for cooking in Tanzania by identifying socio-economic and demographic determinants and the extent to which they play their roles in determining the choice of the primary source of cooking energy in households.

Generally, the Tanzania national grid network is mainly used for lighting (about 77%), not income-generating or domestic activities. The HBS (2020) report showed that nearly 90% of households in mainland Tanzania still rely on firewood and charcoal for cooking. This underutilization of electricity for income-generating and domestic activities beyond lighting represents missed opportunities for families to benefit from modern energy sources. Adopting efficient cooking methods could reduce fuel costs and improve productivity, ultimately benefiting individuals and communities (Masami, 2021).

This indicates a need for concerted efforts, policies, and investments to increase the rate of electricity connections and make modern energy services more accessible to a significant portion of the population. Access to modern household energy and cooking options is limited in Tanzania, posing a significant challenge to the country's socioeconomic development. Although electricity is available to most of the population, only a tiny fraction of people are connected to it, and even fewer use it as their primary source of cooking energy. This low adoption of electricity as a cooking source indicates a challenge in transitioning to cleaner and more efficient energy options. Transitioning to modern cooking methods is essential for reducing the environmental impact of traditional fuels and improving health outcomes (World Bank,2022). This also

motivates the researcher to examine factors determining household energy use for cooking in Tanzania.

Nnaji *et al.* (2020) studied household cooking energy options in Nigeria. The study employed mixed analysis methods to assess household cooking fuel choice economics. The findings showed that the best alternative household energy for cooking in Nigeria is liquefied petroleum gas (LPG). Unimproved solid fuel use contributed 69.1% and 68.6% of household energy cooking choices over the five years 2013 and 2018 despite its harmful effects on the economy's health, productivity, and environmental sustainability.

Debebe *et al.* (2023) examined Ethiopia's household energy choice determinants. Descriptive results showed that households' energy utilization pattern is skewed towards biomass fuels, particularly fuelwood (87%), while only a few families use charcoal (32%) and electricity (17%) for domestic chores. Multivariate probit model estimates showed that a mix of factors, including age, gender, household size, education, income, access to electricity, off-farm activities, access to market, distance to forest, and housing type, determine household cooking energy choice and the extent of dependency on it.

Mperejekumana *et al.* (2021) examined the factors that influence the households' cooking fuel choices in Northern Sudan, and a multinomial logit model (MNL) was used to analyse the data collected. The findings show that the most utilized fuels are still firewood and charcoal, which 63.4% of all respondents use. The results also revealed that socioeconomic factors impact household fuel choice, where one additional unit of credit access may boost the possibility of choosing LPG by 22.7%. Furthermore, they found that one extra level of education would reduce 5.4% of charcoal users while raising 10% of current Liquefied Petroleum Gas (LPG) users. The study recommends initiating mobilization and training programs to raise awareness and encourage the use of cleaner fuels.

This study seeks to contribute to understanding factors influencing the choice of cooking energy sources in Tanzania, where modern energy access, particularly for cooking, remains a significant challenge. The study aims to provide insights that can encourage cleaner and more sustainable cooking practices, with the following specific contributions:

- It highlights the significant gap in access to clean cooking energy and the heavy reliance on solid fuels in Tanzania, contributing to a better understanding of the extent of the problem.
- The study findings are crucial for policymakers working to bridge this gap and align energy access with household needs.

Ishengoma and Igangula (2021) examined the relationship between household choice of cooking energy-mix or Liquefied Petroleum Gas (LPG) and households' socioeconomic attributes in Dar es Salaam. A multinomial regression model on a survey of 345 randomly selected households was used, and the results verify the energy ladder hypothesis by showing that even in the context of energy stacking, an increase in income raises the odds and probability of choosing the energy mix with a high share of LPG and the use of LPG. Households' awareness of the hazardous environmental and health consequences of fuelwood and access to LPG market information increases the odds and probability of choosing the energy mix with a high share of LPG and the use of LPG. However, increasing households' propensity to hold that

LPG is unsafe reduces the probability of utilizing it.

Mangula *et al.* (2019) examined energy sources for cooking and its determinants in rural areas of Tanzania. A multinomial Logistic Regression (MLR) technique was used to estimate the parameters of factors determining the choices of energy sources for cooking in rural areas of Tanzania. The findings show that firewood is the primary source of energy for cooking, followed by charcoal, Liquefied Petroleum Gas (LPG), and electricity in rural areas of Tanzania. The study shows that the education, household size, occupation, income, and age of respondents determine the choices of energy sources for cooking. Previous studies conducted in Tanzania revealed that the education of the head of household, the household size, occupation of the head of household, income of the household, and the age of the head of household are among the key determinants that influence households' energy use choices for cooking in Tanzania's mainland.

This study's findings showed that household size, age of head of household, education level of head of household, and place of residence are among the key determinants influencing households' energy use choices for cooking in Tanzania's mainland. Section 1 of this paper presents the introduction, Section 2 shows the methodology, Section 3 deals with the results and discussion, and the last section presents the conclusion and recommendations.

The study aims to contribute to promoting cleaner and more sustainable cooking practices. The research question posed in this study seeks to identify the determinants influencing energy source choices for cooking, which can serve as a basis for designing targeted interventions and policies to address energy access, public health, and environmental and socioeconomic challenges by providing answers to the question.

2. Materials and Methods

2.1. Study Area

This study covered both rural and urban households in the whole of Tanzania's mainland. Families of all income levels and sizes were included in the study. Estimates were provided for the Tanzania mainland population as a whole.

2.2. Research Design

This study employed a cross-sectional research design to uncover determinants of household energy use in Tanzania's mainland. The data used in this study was derived from the 2017/18 HBS data collected by the Tanzania National Bureau of Statistics (NBS). The HBS collects information on several social, economic, and demographic variables from which the relevant variables for this study were derived. The 2017-18 HBS sample covered the population residing in private households in the Tanzania mainland. A representative probability sample of 9,552 households was selected. This sample was designed to allow separate estimates for each of the 26 regions of the Tanzania mainland and urban and rural areas separately at the national level.

2.3. Description of variables used in the study.

The dependent variable of this study was the primary source of cooking energy. The dependent variable (the primary source of cooking energy) and independent variables included in the study were identified from a literature review as indicated in Table 1.

Table 1: Description of variables used in the study.

Variable	Variable Description	Measurement scale
Dependent Variables		
Energy Fuel	The primary source of cooking energy	Nominal
Independent Variables		
Age	Age of the household head	Interval
Sex	Sex of the household head	Nominal
Education level	Education level of household head	ordinal
Employment	Employed status of household head	Nominal
Marital status	Marital status of household head	Nominal
Residence	Residence of household head	Nominal
Household size	Number of persons in a household	Ratio
Income	Total household expenditures, monthly	Ratio

Source: Adopted from theory or other empirical literature

2.4. Method of Data Analysis

Descriptive and inferential statistics were used for analysis using Predictive Analytics Software (PASW). The descriptive statistics used included frequency tables and percentages. In contrast, inferential statistics included the Chi-square test at the 5% level of significance used to examine the association (relationship) between the dependent variable and independent variables, and a multinomial logistic regression model was performed to assess the effect of the independent variables on the dependent variable.

2.4.1. Specification of Multinomial Logistic Model

The study employed a multinomial logistic model to analyse the effect of the independents on the dependent variable. This Model was Chosen because the dependent variable has more than two unordered categories: firewood, charcoal, and others involved electricity, industrial gas, coal, generator, and solar and was preferred due to its straightforward computational process and its enhanced predictive capability in contrast to the Multinomial Probit Model (FO, 2023). Mathematically, the multinomial logit model is expressed as:

$$P(Y=j)=\frac{e^{\beta_j' x_i}}{1+\sum_{k=1}^{J} e^{\beta_{ik}' x_i}} \quad \text{for } j=1,2,\ldots,J \qquad \ldots\ldots(1)$$

$$P(Y=0)=\frac{1}{1+\sum_{k=1}^{J} e^{\beta_{ik}' x_i}} \qquad \ldots\ldots(2)$$

Where there are J outcomes, x is a vector of explanatory variables, β_j is a vector of parameters associated with outcome j. Estimated parameters are presented as relative risk ratios (i.e. e^{β_j}). Parameters greater than one indicate that, the regressor is associated with a probability of the outcome more significant than the base case's probability. The parameters below suggest that the variable causes the result to have a more negligible probability than the base case.

2.5. Study limitations

This research was conducted in the Tanzania mainland. Although the study covered only Tanzania's mainland, it is believed that the findings of this study will shed light on household energy use for cooking in the United Republic of Tanzania. In addition, this study used only households' demographic and socio-economic characteristics as determinants of household energy use for cooking in Tanzania. Moreover, the sample used for this study allows estimates only at the regional level of the Tanzania mainland and urban and rural areas at the national level.

3. Results and Discussion

3.1. Results

3.1.1. Characteristics of the Respondents

Table 2 shows that the majority (25.6%) of respondents were between 35 and 44 years old, followed by 25 and 34 years (20.6%) and then 45 and 54 years (20.5%). As for education level, the majority (48.5%) of the heads of households have a primary level of education, followed by the heads of households with no education (21.9%), household heads with secondary and above, and incomplete primary education 14.9% and 14.7% respectively. Concerning employment status, the majority (88.1%) were employed or self-employed and 11.9% were unemployed. Moreover, a majority (72.1%) were married or living together; household heads who were widowed, divorced, or separated and never married were 13%, 9.5%, and 5.4%, respectively. Furthermore, males headed a majority (72.7%) of households, and only 27.3% were headed by females. Most respondents (70.5%) were in rural areas and only 29.5% were in urban areas. Regarding the primary source of energy used for cooking, the majority (66.5%) of households use firewood for cooking, 24.6% use charcoal, and only 8.8% use other (non-biomass) cooking energies that electricity, kerosene, industrial gas, coal, generator, and solar.

These statistics indicate that most respondents (around 66.5%) rely on firewood as their primary source of cooking energy. Addressing this high reliance on firewood could be crucial for improving both environmental sustainability and the well-being of households, as cleaner and more sustainable cooking energy sources might help mitigate deforestation, air pollution, and health risks associated with using solid fuels.

Table 2: Characteristics of the Respondents

Variable	N(9463)	%
Age		
Under 15	1	.0
15 – 24	326	3.4
25 – 34	1949	20.6
35 – 44	2419	25.6
45 – 54	1939	20.5
55 – 64	1425	15.1
65 +	1402	14.8
Education level		
No education	2072	21.9
Primary incomplete	1390	14.7
Primary complete	4586	48.5
Secondary and above	1406	14.9
Employment Status		
Employed or self-employed	8338	88.1
Unemployed	1125	11.9
Marital status		
Never married	507	5.4
Married or living together	6821	72.1
Divorced or separated	900	9.5
Widowed	1228	13.0
Household sex		
Male	6882	72.7
Female	2581	27.3
Residence		
Rural	6675	70.5
Urban	2788	29.5
The primary source of cooking energy		
Firewood	6296	66.5
Charcoal	2330	24.6
Others (Non-biomass)	837	8.8

3.1.2. Association between Choice of primary sources of Energy for Cooking and Independent Factors

The chi-square test findings in Table 3 show that the employment status of the head of household, marital status of the household head, education level of the head of the household, place of residence, income of the head of household, age of the head of household and household size significantly associated with the primary source of cooking energy used in the household. On the other hand, the sex of the household head is insignificantly associated with the primary source of cooking energy at a 5% level. These findings highlight that socio-economic and demographic factors play a significant role in determining the choice of the primary source of cooking energy in households. The associations observed in the study can provide valuable insights for policymakers and

organizations that promote cleaner and more sustainable cooking energy options, especially in areas with a high reliance on traditional biomass fuels.

Table 3: Association between Cooking Energy and Independent Factors

Variable	The primary source of cooking energy			χ2	p-value
	Firewood (6296)	Charcoal (2330)	Others (837)		
Employment status					
Employed	5753(91.4)	1919(82.4)	666(79.6)	195.897	0.000**
Unemployed	543(8.6)	411(17.6)	171(20.4)		
Marital status					
Married	2772(44)	946(40.6)	386(46.1)	10.956	0.004**
Unmarried	3524(56)	1384(59.4)	451(53.9)		
Education Level					
Primary and below	4152(91.6)	1478(69.3)	403(52.4)	1028.454	0.000**
Secondary	315(6.9)	497(23.3)	221(28.7)		
Diploma and higher	66(1.5)	158(7.4)	145(18.9)		
Residence					
Rural	5758(91.5)	694(29.4)	223(26.6)	3963.501	0.000**
Urban	538(8.6)	1636(70.2)	614(73.4)		
Household sex					
Male	4579(72.9)	1674(71.8)	629(75.1)	3.389	0.184
Female	1717(27.3)	656(28.2)	208(24.9)		
Income					
Lower-income	4125(65.5)	917(39.4)	304(36.3)	866.09	0.000**
Middle income	1582(25.1)	813(34.9)	229(27.4)		
High income	589(9.4)	600(25.8)	304(36.3)		
Age					
< 35	1254(19.9)	746(32.0)	276(33.0)	262.488	0.000**
35 - 64	3912(62.1)	1393(59.8)	478(57.1)		
65+	1129(17.9)	190(8.2)	83(9.9)		
Household size					
0 - 5	3810(60.5)	1735(74.5)	697(83.3)	293.385	0.000**
6 - 10	2171(34.5)	562(24.1)	132(15.8)		
10+	315(5.0)	33(1..4)	8(1.0)		

** Significant at the 5% level

3.1.3. Multinomial regression model estimates

Findings in Table 4 show that the overall model was significant, indicating that predictors significantly affect the primary source of energy for cooking (chi-square value = 4740.331, and the p-value is 0.0000). Furthermore, the level of education, household size, age of the household head, employment status of the household head, and place of residence were significant predictors of the household's primary source of cooking energy. Marital status and income of household heads were not statistically significant at the 5% level.

Regarding using firewood, the odds ratio for household age is 1.011. This indicates that as

the age of a household increased by one unit, the odds of using firewood as a source of cooking energy compared to other sources of cooking energy increased by 1.011 while holding all other variables in the model constant. Similarly, as household size increased by one unit, the odds of using firewood as a source of cooking energy compared to other sources of cooking energy increased by 1.378. In addition, households in rural areas are 27.037 more likely to use firewood as their primary cooking energy source than in urban areas. Also, household heads with primary education and below are more likely (14.665 times) to use firewood as a primary source of cooking energy than other sources of cooking energy compared to household heads with diplomas and higher education. Likewise, household heads with secondary education are more likely (3.871 times) to use firewood as a primary source of cooking energy than other sources of cooking energy as compared to household heads with diplomas and higher education.

Furthermore, employed household heads are more likely (1.394 times) to use firewood as a primary source of cooking energy than other sources of cooking energy as compared to household heads who were not employed.

In regards to the use of charcoal, the odds ratio for household age is 0.993, meaning that as the age of the household increases by one unit, the odds of using charcoal as a source of cooking energy compared to other sources of cooking energy decreased by 0.993 while holding all other variables in the model constant. Similarly, as household size increased by one unit, the odds of using charcoal as a source of cooking energy compared to another source of cooking energy increased by 1.214. In addition, households located in rural areas are 1.227 times more likely to use charcoal as a primary source of cooking energy than other sources of cooking energy as compared to households located in urban areas. Also, household heads with primary education and below are more likely (3.362 times) to use charcoal as a primary source of cooking energy than other sources of cooking energy as compared to household heads with diplomas and higher education. Likewise, household heads with secondary education were more likely (2.195 times) to use charcoal as a primary source of cooking energy than other sources of cooking energy as compared to household heads with diplomas and higher education.

The household's income is an essential determinant factor in selecting cooking energy in most societies in developing countries. However, in this study, the income of household heads was not statistically significant at a 5% level of significance in determining the choice of cooking energy.

Table 4: Estimation for Multinomial Regression Model

Primary sources of energy for cooking	Variable	B	OR	p-value	95% CI	
					Lower	Upper
Firewood	Intercept	-4.876		.000***		
	Age	.018	1.018	.000***	1.011	1.025
	HH size	.321	1.378	.000***	1.313	1.446
	Income	.000	1.000	.219	1.000	1.000
	Rural	3.297	27.037	.000***	21.923	33.344
	Urban	0	.	.	.	.
	Primary and below	2.685	14.665	.000***	10.095	21.303
	Secondary	1.354	3.871	.000***	2.571	5.828
	Diploma and above	0	.	.	.	.
	Employed	.332	1.394	.009***	1.087	1.789
	Unemployed	0	.	.	.	.
	Married	-.096	.908	.345	.744	1.109
	Unmarried	0	.	.	.	.
Charcoal	Intercept	-.449		.037		
	Age	-.007	.993	.030**	.986	.999
	HH size	.194	1.214	.000***	1.159	1.272
	Income	.000	1.000	.259	1.000	1.000
	Rural	.205	1.227	.043**	1.007	1.496
	Urban	0	.	.	.	.
	Primary and below	1.213	3.362	.000***	2.587	4.369
	Secondary	.786	2.195	.000***	1.653	2.916
	Diploma and above	0	.	.	.	.
	Employed	.080	1.083	.461	.876	1.339
	Unemployed	0	.	.	.	.
	Married	-.073	.929	.433	.773	1.116
	Unmarried	0	.	.	.	.

Note: OR means Odd ratios, B= Coefficient of variables, CI= Confidence intervals, 0 = means a reference category, the steric ***, **, and * show 1%, 5%, and 10% significant levels, respectively.

3.2. Discussion of Key Findings

The findings indicate that the household head's age significantly impacted determining the primary source of cooking energy. As the age of household heads increases, the odds of using firewood compared to other sources of cooking energy also increase. Similar findings were also found by Debebe *et al*. (2023). However, as the age of household heads increases, the odds of using charcoal decrease compared to other sources of cooking energy. The findings revealed that household size significantly positively impacts the choice of the primary source of cooking energy. These results implied that households with many members are more likely to use firewood and charcoal as the primary cooking energy source than other sources such as industrial gas,

electricity, coal, generators, and solar. Increasing family sizes implies abundant labor for fuel collection, limiting the need to move to modern fuels. Besides, a large household requires more energy and thus chooses biomass energy sources. Similar results were reported by Mangula *et al*. (2019) and Egunjobi (2020) on determinants of energy used for cooking which revealed that large households are more likely to use solid energy sources such as firewood and charcoal.

Household income is assumed to be the main driver when choosing the type of energy. Although income plays a vital role in cooking fuel, this study's findings revealed that the household head's income is not statistically significant in determining the primary source of cooking energy. However, this is contrary to the study by Egunjobi (2020), which found that the income and employment status of the household are significant predictors of the primary source of cooking energy. A study by Floess *et al*. (2023) and Nyuyki *et al*. (2022) was also contrary to this finding, as it reported that household income, education level, and employment status are significant factors in predicting the primary source of cooking energy.

Education is an important policy tool to raise households' awareness about the benefits of modern energy sources and the risks of biomass fuels. Results indicate that household heads with primary education and below are more likely to use firewood and charcoal as a primary source of cooking energy than other sources of cooking energy as compared to household heads with diplomas and higher education. Likewise, household heads with secondary education are more likely to use firewood and charcoal as the primary sources of cooking energy than other sources of cooking energy as compared to household heads with diplomas and higher education. Education increases awareness of the effects of solid energy on personal health and the environment. The study findings indicate that household heads who spend more years in school are more likely to use modern energy sources such as industrial gas, electricity, generators, and solar. Similar findings were also found in the study of Mperejekuman *et al*. (2021), which found that households with higher education were more likely to use only LPG than Wood. Also, this is similar to Ishengoma and Igangula (2021), who reported that the education level of household heads increases awareness of the hazardous environmental and health consequences of fuel wood.

The research findings revealed that employed household heads are more likely to use firewood as a primary source of cooking energy than other sources of cooking energy, as compared to household heads with no employment. It is believed that employed household heads are more likely to switch to modern sources of energy such as LPG and electricity because they can afford to buy them. This finding contradicts that of Mangula *et al*. (2019), who disclosed that employed household heads engaging in farming use traditional energy sources while those working in employment sectors use modern and clean energy sources for cooking.

In addition, households in rural areas are more likely to use firewood as a primary source of cooking energy than other sources of cooking energy as compared to families in urban areas. Descriptive statistics show that the majority (86.6%) of rural households used firewood, and only 3.3% used modern energy sources. At the same time, households in urban areas are more likely to use charcoal and contemporary energy sources at 58.7% and 22%, respectively. A similar finding was reported by Onyekuru (2020), who found that

households in rural areas are more likely to use solid fuel due to its availability.

4. Conclusion and Recommendation

4.1. Conclusion

This study analysed the determinants of household energy use in Tanzania's mainland. The results indicated that 66.5 percent of the households used firewood as their primary type of energy for cooking, 24.6 percent used charcoal, and only 8.8 percent used other types of energy as their primary source. Generally, it shows that most households (91.1 percent) in Tanzania's mainland used biomass, in this case, firewood and charcoal, as their primary fuel for cooking. Only 8.9 percent of the households used other (non-biomass) types of energy for cooking: electricity, kerosene, industrial gas, coal, generator, and solar.

The chi-square test showed significant associations between the employment status of the household head, marital status, education level, and residence, and the primary type of household`s energy use for cooking. There was no statistically significant association between the sex of the head of the household and the primary type of household`s energy for cooking.

The multinomial logistic models used in the study found that household size, age of the head of household, employment status of the household head, education level of the head of household, and place of residence of the household were significant factors determining the primary type of household`s energy use for cooking. Marital status and the income of the household head were not essential factors influencing household energy use for cooking.

Furthermore, the multinomial logistic model findings showed that households with the following characteristics (few members, younger heads, not employed heads, heads having a higher level of education being located in urban areas) were less likely to use firewood and charcoal as the primary fuel type for cooking than other types of energy such as electricity, kerosene, industrial gas, coal, generators and solar.

4.2. Recommendations

4.2.1. Recommendation for policy implication

The study found that biomass (firewood and charcoal) was the primary household cooking fuel; therefore, the government of Tanzania should take necessary and sufficient steps in formulating appropriate policies such as reduction or removal of taxes on cooking gas together with its appliances and spare parts and subsidies on electricity connections to improve access to affordable modern energy to lessen the environmental and health impact of biomass energy use.

4.2.2. Areas for Future Research

The study was confined to Tanzania's mainland. Similar studies involving both Tanzania mainland and Zanzibar would be beneficial to generalize the results for the United Republic of Tanzania. Moreover, future research needs to look at determinants of the quantity of energy consumed by households and other factors, including preferences, dependability of supply, cost, cooking habits, and the availability of technology, which can influence household fuel and energy use. Lastly, there is a need for more studies to be conducted to assess household fuel and energy use in different areas of Tanzania and other countries, especially in the developing world.

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