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The Health Impact of Fuel Wood Utilization on Users in Yelwa Village, Nasarawa State, Nigeria

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Abstract

The health effects associated with the use of domestic's energy in rural Nigeria, is associated with epileptic power supply, cost of other source of domestic energy, these has necessitated rural dwellers to highly dependent on traditional means of energy as there source of domestic energy supply, these has led to associated indoor pollution, unsafe level of toxic emission, air pollution, deforestation and consequently leads to health hazard in the area. These coupled with closeness to the forest, high levels of poverty, weak management and lack of coordination between households, local and traditional leaders in the provision of alternative source of domestic's energy other than fuel wood in the study area. These have constituted one of the major causes of health hazard, deforestation and massive destruction of indigenous trees in Nigeria. The study attempts to highlight how the households in Yelwa village utilized domestic energy and investigate the health impact of fuel wood utilization in Yelwa village. Poverty and income has been identified as the major factors influencing rural households choice of domestic energy consumption in Africa especially Nigeria. In rural areas, overdependence on fuel wood has universally been recognized as one of the major threat to forestry ecosystems. The resultant effects of the consumption of this resource are various environmental problems such as climate change, erosion, flooding, and deforestation, among others. Other fuel wood related impacts on human include air pollution, eye problem, respiratory problem, and heart disease among others.

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Based on these identified problems caused by the overdependence on fuel wood, this study sought to assess the health impact of fuel wood utilization on users, and the possible means of controlling the identified impact on households in Yelwa village, Toto LGA, Nasarawa State. Questionnaires were administered to households. The study found Fuel wood utilization in the study area is increasing on daily basis as a result of the lack of access to clean and affordable energy. Consequently, Poverty, household's size, income level of the dwellers, among others are the drivers of fuel wood utilization in the study area, leading to several health problems. Recommendation for the potentials of exploitation of renewable energy resources of energy in place of fuel wood; with the aim of removing the present pressure of rural Nigerian on forest resources for fuel wood as the mainstay of domestic cooking energy.

Keywords: Energy; Utilizatio; Fuel; Wood; Health.

1. Introduction

In the last few years, Epileptic power supply, couple with poverty, unemployment and increase in the price of oil have necessitated the need for people to find alternative means of making a living in respect to domestic energy consumption in Nigeria. An estimate of 2.5 billion people lack access to modern energy services According to [1]. This has constrained their opportunities for economic development and improved living standards. Many analysts use the very low levels of modern energy consumption in Africa to argue that, energy consumption is by definition not a major issue and its environmental impact should not be of significant concern. They argue that African policy makers should be more concerned by the continued "under consumption "of modern energy - an important indicator of high levels of poverty and under-development. While there is some evidence supporting the aforementioned assertion, it fails to capture other important characteristics that would support the need for careful assessment of domestic's energy utilization in Africa. Fuel wood is a source of energy derived by burning wood materials like logs and twigs and is common among the rural dwellers. It is a traditional source of energy, which has remained the major source of fuel for over half of the world's population [2]. According to the UNDP, [3] the share of various energy sources in the total primary energy supply in Nigeria is made up of oil, 10.4%; gas, 6%; hydro, 0.6%; and commercial renewable energy, 83%. The greater portion of the commercial renewable energy is wood, while other agricultural wastes constitute the remaining 2 smaller portion. The over-dependence on fuel wood for energy is chiefly because of its relatively low prices and easy accessibility [4]. Other reasons are constraints in the supply of the conventional fuels and the growing population with a larger segment still falling below incomes that cannot afford the cost of conventional fuels [4]. In Northern Nigeria where there is a large poor population, poverty is the most significant parameter that drives extensive traditional use of fuel wood and residues [3]. Fuel wood is consumed in diverse ways and at different levels and the life of the majority of rural dwellers depends either directly or indirectly on fuel wood. However, meeting rural household, wood fuel energy needs in the country has become a herculean task due to the enormous quantity of wood required. Daily consumption of firewood by the rural communities in Nigeria is estimated at 27.5 million kg/day [5]. This observation was buttressed by another recent data published by The Solar Cooking Archive [6]. Which put the estimate of Nigeria's fuel wood consumption as percentage of energy at about 87%. Therefore, majority of the Nigerian rural people have been using and will continue to use the dried biomass fuels for energy for many years to come. Firstly, by focusing

only on modern energy, one misses the serious negative impacts associated with traditional biomass energy use in Africa which range from indoor air pollution to health challenges [7]. As at 1999 on a worldwide basis, 1.9 million deaths annually were blamed on rural indoor pollution while 450,000 deaths annually were attributed to urban indoor air pollution [8]. A significant proportion of the deaths occurred in Africa. In poor developing country households, wood, charcoal and other solid fuels (mainly agricultural residues and coal) are often burned in open fires or poorly functioning stoves. Incomplete combustion leads to the release of small particles and other constituents that have been shown to be damaging to human health in the household environment. Too little is known, however, to distinguish any differences in health effects of smoke from different kinds of biomass. Given that levels of household solid fuel use are expected to remain high, efforts to improve household air quality are concentrated on improving stove efficiency and venting the smoke away from the home. With proper stoves and good fuel burning practices, fuel wood and charcoal as well as other biomass can be burned cleanly, producing mostly carbon dioxide and water. Such conditions are difficult to achieve in poor rural and urban areas where small-scale inexpensive wood-burning stoves are used, however. Fuel Wood that is not properly burned to carbon dioxide is diverted into products of incomplete combustion – primarily carbon monoxide, but also benzene, butadiene, formaldehyde, polyaromatic hydrocarbons and many other compounds posing health hazards. The best single indicator of the health hazard of combustion smoke is thought to be small particles, which contain many chemicals. Secondly, certain regions in Africa (for example South Africa and North Africa) have experienced rapid growth in energy consumption that is somewhat similar to industrializing countries of Latin America and Asia. The key challenge facing Africa is not to increase energy consumption, but to ensure access to cleaner energy services, preferably through energy efficiency and renewable energy thus promoting sustainable consumption. Unlike most industrialized countries which progressed from traditional energy to unsustainable conventional energy consumption patterns and which are now struggling to move to a sustainable energy path, Africa could, in a number of sectors, leapfrog directly from current traditional energy consumption patterns to sustainable energy options. Consequently, the careful examination of energy consumption patterns and trends in Africa should be of interest to the sustainable development community. Fuel wood gathered from the forest, either by lopping branches, collecting fallen wood or cutting down dry and diseased trees, is the most common source of domestic energy supply in the rural areas of many developing countries [9]. Demand for fuel wood, which together with animal dung and agricultural waste residue is one of the main cooking fuels. The use of wood as a fuel source for heating is as old as civilization itself. Historically, it was limited in use only by the distribution of technology required to make a spark. Wood fuel is wood used as fuel. The burning of wood is currently the largest use of energy derived from a solid fuel biomass. Wood fuel can be used for cooking and heating, and occasionally for fueling steam engines and steam turbines that generate electricity. Wood fuel may be available as firewood, charcoal, chips, sheets, pellets and sawdust. The particular form used depends upon factors such as source, quantity, quality and application. There should be a balance in the needs of society, the economy and the environment through sustainable development. Sustainable development is the ability to improve the quality of human life while living within the carrying capacity of supporting ecosystems. The study aims at assessing the health impact of fuel wood utilization on users in rural areas and possible means of controlling the negative implications in the area. The study attempts to highlight how the households in Yelwa village utilized domestic energy and investigate the health impact of fuel wood utilization in Yelwa village. The study will also investigate the effects of fuel wood utilization on households in

the study area, which could be valuable in providing remedy to effective management of health impact of fuel wood utilization on individual users in Yelwa village of Toto Local Government Area of Nasarawa State. This study also hopes to sensitize the people on the health implications of fuel wood utilization and calling on Government to provide other sources of energy for households use.

2. Literature review

2.1 Ethnic/Cultural Group

The people of Yelwa are 98 percent Gbagyi people. Christianity religion is the dominant religion and traditional worshippers. Throughout Nasarawa state, it is difficult to find any village dominated by Gbagyi people like Yelwa. The economic activities in this area are stagnant as a result of this mono-cultural nature of this area.

2.2 Economic Activities

The major economy activity of Gbagyi people being the inhabitants of Yelwa is farming. They are mainly subsistence farmers if not for the modern day Gbagyi people who have been educated on commercial farming that are gradually practicing, though not in an international quantity. As already mentioned, they are excellent and extensive farmers and they rely to a very large extent on the sale of their crops for income. Some of them are into local pot making, local bags and weaving of grass mat. Several of their ancient women are into local beer (Burukutu) Production. Surplus fuel wood and guinea corn are used in production of the local beer and large quantity is consumed during festivals.

2.3 Vegetation and Climate

Nasarawa state generally experiences a moderate climate, the average annual rainfall is between 1,100m-2000mm.The heaviest rainfall is often recorded between the months of June and early August. Yelwa village falls within the tropical grassland with wet and dry climate. Trees found here are mainly deciduous that shed their leaves during the dry season so as to reduce moisture loss to transpiration, while they are fresh and luxuriant during rainy season. Grasses here are very good for grazing and therefore support cattle rearing. The vegetation of the area falls within the southern Guinea Savannah zone. The occupation of the population is mainly farming due to conducive weather that support growth of all most all types of crops in Nigeria. The theory of household fuel energy choice is often based on the “energy ladder” model [10] and the associated fuels switching. This model placed more emphasis on household income and relative fuel prices as the basis for fuel choice [11]. Based on household income, the energy ladder model depicts a linear three-stage switching process. The first stage involves a heavy reliance on centuries old biomass fuels, while in the second stage household moves to “transition” fuels involving the use of kerosene, coal and charcoal, and in the third stage, they switch to the use of LPG, natural gas or electricity which is a function of increased household income, and other factors such as deforestation and urbanization [12]. The simple nature of the energy ladder model, placing emphasis on income, wealth and substitution as a determinant of household fuel choice has been criticized by many studies [10,13,14,15] for its assumption that as household income increases, the household discards the consumption of traditional fuels for the use of modern clean fuels which they can afford. These studies have shown that

households often do not fully ascend the "energy ladder" but rather 'fuel stack', which means that with an increase in income, traditional fuels are not completely discarded, but are rather used in conjunction with modern clean fuels. These study share a common principle with the energy ladder theory, as rural households domestic energy needs is greatly influence by income. Households in rural Nigeria tends to switch from traditional source of domestic energy utilization which is basically fuel wood to modern clean fuels as income increases, also this study is in consensus with theory of energy ladder which identify other factors that influence household fuel choices which include the distance of the household from biomass sources [16], increased fuel wood availability [17], and fuel wood shortages as a result of deforestation [18]. Never the less, there are exceptions to these energy ladder theories. In some rural areas of many developing countries like Nigeria, a large proportion of middle-income households who could in principle afford modern and convenient form of fuels continue to rely fully or partly on traditional biomass fuels [10]. A number of factors such as age, family size, level of education of household head, type of food cooked and taste of food cooked with fuel wood, whether or not the household owns the dwelling units are important factors that determine household cooking fuel choice [19]. It therefore suggests that income, although very important, is not the only determinant of household cooking energy source. Many other factors both on the demand and supply sides are now considered [12]. Household energy source is now explained as a portfolio choice rather than as a ladder process [19]. Therefore, the determinate of households' fuel energy choice is considered under the general framework of consumer theory [20], which suggests that consumers derive utility not from a commodity but from the attributes embedded in a commodity. Information at households' disposal about the various fuels influences their decisions which are driven by households' economic and non-economic constraints. The economic factors may include availability and market price of fuel, household income and expenditure, while the non-economic factors may include socio-economic characteristics such as household size, age, gender, house ownership, type of dwelling, location of residence, distance to fuel source, and access to electricity [19]. Yelwa village is a typical rural setting which is not an exception to the energy ladder theory, where income plays a key role in household's energy choice. Other factors that influence household's energy choice in Yelwa village include easy access to fuel wood, and cultural belief fuel Incomplete combustion of household fuel wood releases smoke that is damaging to human health; efficient stoves and adequate ventilation are essential. Dependence on fuel wood by the majority of the population of Africa in general, and Nigeria in particular has been a cause for great concern [21,22].This is evident in the level of scholarly works that have been carried out to address the issue of the soaring level of fuel wood utilization and its attendant social and health impacts [23,21,22,24,25]. There is a robust amount of literature on the impacts of fuel wood utilization [23]. However, holistic research on the multidimensional impacts of fuel wood utilization in the developing countries is seldom carried out [24], neither is there any dependable research on the sustainability impacts of fuel wood consumption [25]. Consequent upon this claim, some extant related literatures on the health impact of fuel wood utilization are reviewed in this chapter. Zafar and his colleagues [26] identified some of the health problems associated with the use of fuel wood includes catarrh, eye irritation, cough, sneezing, dry throat and nausea, shortness of breath, headache, dizziness and skin irritation. Though fuel-wood is an important source of energy for domestic use in rural areas but is also a major source of air pollutants such as carbon monoxide, particulate matters, Polycyclic aromatic hydrocarbons (PAHs) and others which are detrimental to human health. Poverty, lack and/or inadequacy of alternative energy sources have promoted the use of fuel-wood which creates high levels of air pollutants.

Exposure to these substances leads to increased risk of a variety of diseases including pneumonia, chronic respiratory diseases and lung cancer [27]. Biomass fuel smoke has been classified as a probable human carcinogen and coal smoke as a proven human carcinogen [28], mutagens [29] and is as dangerous to health as breathing in emissions from a car exhaust or tobacco smoke [30]. Comparison of the burden of illness and premature death from solid fuel use (e.g. fuel-wood) with other major risk factors, including outdoor air pollution, tobacco smoking and hypertension indicated that solid fuel use may be responsible for 800,000 to 2.4 million deaths each year. [31,32] Inhaled air pollutants have diverse effects on people that are exposed, depending on body constitution, lifestyle, nutritional status and age. Studies have shown that women and children, who are the most exposed and vulnerable to the pollutants, are two to six times at risk of contracting serious respiratory infections [29,33]. Interest in respiratory health impacts of air pollutants from fuel-wood utilization has been increasing rapidly probably as a result of high cases of illnesses recorded. Traynor and his colleagues [34] among rural women and children observed that long time exposure to biomass combustion results in chronic obstructive lung diseases, heart diseases, acute respiratory infections, low birth weight, eye disorder, conjunctivitis, blindness and cancer [35]. Children strapped on their mothers' back while cooking with open cook stoves contracted pneumococcal infections 2.5 times higher than nonexposed ones [29,36]. Epidemiological studies in developing countries have also linked exposure to air pollutants from dirty (biomass) fuel to Acute Respiratory Infection (ARI) in children; chronic obstructive lung diseases such as asthma and chronic bronchitis; lung cancer; and still-births and other related problems which include irritation of the skin, eyes, nose and throat; dizziness, nausea and long-term chronic health effects [37]. Furthermore, studies have found strong links between chronic lung diseases in women and exposure to smoke from open cook stoves due to high concentration of NO2 and SO2 [38,39,40]. While another found a strong correlation between the high elemental concentration of aerosol particles, high mortality and high morbidity on fuel wood users [41]. Owning to the predominant use of fuel wood for cooking in rural parts of Ogun state and the potential respiratory health hazards that may result. There is paucity of data relating to the concentration, levels of air pollution from sources such as fuel-wood combustion in Nigeria, hence the need for the constant monitoring and assessment of air pollutants from fuel-wood utilization. Ndwiga and his colleagues [42] stated Biomass Fuel (BMF) refers to burned plant or animal material; wood, charcoal, dung and crop residues which account for more than half of domestic energy in most developing countries and for as much as 95% in low income countries. It is estimated that about 3 billion people in the world rely on biomass fuel for cooking, heating and lighting. The biomass fuel chain includes gathering, transportation, processing and combustion. These processes are predominantly managed by women where they work as gatherers, processors, carriers or transporters and also as end users or cooks. Thus, they suffer health hazards at all stages of the biomass fuel chain. The research revealed that women suffer different type of physical ailments due to the biomass fuel chain. Physical exhaustion, neck aches, headaches, knee aches and back aches. These are reported as the principal health effects associated with the third stage of the biomass fuel chain. Irritation of the mucus membrane of the eyes, nose and throat, coughing, burns, shortness of breath and exacerbation of asthma were identified as principal health effects associated with the fourth stage of the biomass fuel chain (cooking). Indoor air pollution is responsible for more than 1.6 million deaths per year and 39 million dailies due to pneumonia, chronic respiratory disease and lung cancer. Other diseases and conditions associated with indoor air pollution include asthma, bronchitis, tuberculosis, cataracts, low birth weight and heart disease. According to the World Health Organization, in high mortality developing

countries indoor air pollution causes approximately 3.7 percent of the overall disease burden, fourth in impact after malnutrition, unsafe sex, and lack of sanitation and safe water. The majority of victims of exposure to indoor air pollution are women and children. In low-income homes, especially in rural areas and informal urban settlements, women often spend between 3 and 7 hours per day near a traditional open fire cooking meals, and in cold months may tend to stay near a fire for heat for a large part of the day. Young children are often carried on their mother's back or kept close to the warm hearth. Consequently, children spend many hours breathing indoor smoke during their first year of life when they are developing. WHO [43] reports indoor air pollution more than doubles the risk of pneumonia and other acute lower respiratory infection (ALRI) and thus is responsible for more than 900,000 of 2 million annual deaths from pneumonia and other ALRI. Women exposed to indoor smoke are three times as likely to suffer from Chronic Obstructive Pulmonary Disease (COPD), such as chronic bronchitis, than women who cook and heat with electricity, gas and other cleaner fuels. Consequently, indoor air pollution is responsible for more than 700,000 out of 2.7 million global deaths due to COPD. In a 1987 study, the USA environmental Protection Agency ranked indoor air pollution fourth in cancer risk among the 13 top environmental problems analyzed. Globally one million people die from lung cancer annually and indoor air pollution is responsible for approximately 1.5% of these deaths. In the African region indoor air pollution is responsible for 41,000 deaths per year due to COPD and 350,000 deaths due to ALRI. More than one third of all child deaths causes by air pollution occur in the African continent. Many developing-country households use wood fuel stoves that lack working chimneys or hoods for venting the smoke outdoors. Although there have been no large-scale statistically representative surveys, hundreds of small studies around the world in typical local situations have shown that such stoves produce substantial indoor concentrations of small particles – typically 10 to 100 times the long-term levels recommended by the World Health Organization in its recently revised global air quality guidelines for protecting health [44]. Even stoves with working chimneys, however, do not completely eliminate indoor pollution, as there is often substantial leakage into the room and some smoke returns into the house from outside. The significant emissions of health-damaging pollutants per unit activity, combined with daily use in close proximity to large human populations, means that household biomass fuel use produces substantial total population exposure to important pollutants – probably more exposure, in fact, than is caused by global fossil fuel use [32]. Exposure I s highest among poor women and young children in developing countries, both rural and urban, as these are the groups most often present during cooking. Environment Australia [45], however, have suggested that hardwood species generally have somewhat lower emissions than softwood species for combustion in fireplaces, which may provide the closest comparison with typical stoves in developing countries. Differences by species, however, are unlikely to be significant compared to those resulting from other parameters affecting human exposure, such as fuel moisture, burning rate, ventilation and cooking behavior. Zaku and his colleagues [46] have empirically examined the level fuel wood usage in Kaduna State, with particular reference to the rural settlements of the State. Their aim was to establish the reasons behind dependence on fuel wood as domestic energy source. The research was able to evaluate the consumption of wood fuel in Kaduna State using the energy ladder as a basic theory. However, the study relied solely on secondary information available from different sources, such as, published reports and documents of R&D and academic institutions, individual researchers, and so on. The collection of primary data for the purpose of this study was not considered. However, the major reason why people used wood fuel as the alternative source for heat energy as identified by these study is directed towards poor income, poverty and like

of adequate national grid. Energy purposes. Sambo [47] examined that, Women and children are greatly involved in the collection and transportation of fuel wood from the bush to the home. On many occasions depending on the situation, they have to travel far and wasted their time in the process. At times, women have to carry heavy loads to reduce the number of trips required to provide fuel wood for their households. They may headload fuel wood as heavy as 35 kilogram or more over a long distance of up to 10 km in often difficult terrain. Carrying such heavy loads over long distance has adverse health implications on the women especially those within the child-bearing age. This may damage spice and cause difficulties during pregnancies and childbirth because substantial amount of energy is involved coupled with poor access to good medical facilities in most of the rural areas in Nigeria. The implication of fuel-wood use and governance to the local environment was examined by Ndamase [48] in ward seven of Port St John's municipality in the Eastern Cape with the aim of investigating the choice and patterns of fuel wood exploitation. He stated that forests are essential resources which protect the environment and also provide ecological, economic, social, religious and cultural benefits. Ndamase [48], however, decried the fact that a number of human activities have led to destruction and general decrease of existing forests as result of increasing fuel wood consumption. He lamented that despite the visible ecological impact of over 80% of fuel wood dependency among the low and middle income classes in Africa, Asia and Latin America. In other word, he emphasized that the world population depending on fuel wood as both primary and secondary sources of energy is ever increasing to the detriment of the ecosystem at large. Adopting a semi structured questionnaire as the sole instrument for collecting his data, Ndamase was able to justify that the reliance on fuel wood can be said to have socioeconomic dimension, vis-à-vis, gender and poverty. His findings revealed that women rely more on wood as a source of fuel than their male counterparts. Démurger and Fournier [49], consequently, have opined that heavy reliance on biomass fuels in developing countries has raised global concerns over both environmental consequences such as forest degradation and soil erosion, and the adverse health consequences of indoor air pollution generated by burning wood, animal dung or agricultural residues [27]. Using the household wealth index as their study methodology, they discovered that firewood collection has significant impact on forest and that the dependence on firewood as source of domestic fuel is linked to the nature of the livelihood of the household. Thus, according to them, the level of fuel wood consumption can be traced to the livelihood system of the consumer [50]. This may be attributed to the traditional affiliations of such households [51]. Therefore, though the findings of Démurger and Fournier [49] are of significance to this research, they are not in any way holistic. The econometric Analysis of Factors Influencing Fuel Wood Demand in Rural and Peri-Urban Farm Households was also examine by Onoja and Idoko [21], with the aim of investigating the various variables influencing fuel wood demand in rural areas. The research was conducted basically using Primary data which was obtained through the use of structured questionnaires and interviews of the farm and non-farm households that make use of fuel wood in the study area, also the research make use of data sourced from published texts, journals, periodicals, and online and offline computer resources, such as DVDs and CDs. Onoja and Idoko [21], were able to find out that the determinants of fuel wood demand in the study area were the price of fuel wood, kerosene's price, household size and personal incomes of the household heads. In light of these research findings, the researcher's recommends that the reduction of kerosene prices, investment in renewable energy, cooking gas and electricity and use of agricultural extension agents to educate farmers on sustainable farming will help in the reduction of depletion of forests resources.

3. Materials & Methods

Nasarawa state is located on latitude 7◦ 45' N and 7.333N of the Equator and longitude 7◦ E and 9.37'E of the Greenwich Meridian. Toto LGA is one of the thirteen (13) LGAs of Nasarawa State; it has an area of 2,903km and a total population of 119,077 at the 2006 census. Yelwa is one of the villages found in ShafaAbakpa ward, Toto local government area. The area under study is Yelwa village, Toto Local Government Area of Nasarawa State, Nigeria. In this regards, the population for this study is the total number of people who lives in Yelwa village. Projecting from the 2006 population figure of 1400 using 2.8% percent as the growth rate, [52], the population figure is put at 1795 for an increase in 9years. As at 2006, the estimated population of Yelwa village was (1400) and at 2015, the estimated population of Yelwa was calculated to be (1795). In this study, 30 questionnaires were distributed around the above mention 6 axis of the areas covered for the investigation; hence the area which the investigation is to cover has the total estimated population of 863 people, which is 50 percent of Yelwa village with estimated population of 1,795 people, while Toto Local Government Area has estimated total population of 149,083 people according to the standard giving by the National population commissions of Nigeria; with 2.8% growth rate format per annum for 9years from last census of 2006. Below is the techniques use for the total population projection of Toto Local Government Area from the 2006 census to 2015, the statistical estimation is applied using 2.8% growth rate per annum to exemplified; 2.8% of 119,077 (2006 census) = 3334; interval of years from 2006 to 2015 is 9 years. Therefore, 2.8% of 119,077 multiplied by 9 years i.e. (3334 * 9years = 30,006). Hence, census 2006 + 2.8% growth rate estimation for 9 years = total population (i.e. 119,077 + 30,006 = 149,083). Thus, the six sampled areas within Yelwa village is assumed to have covered land size that is estimated to be 435.45 square kilometer as 15% of the total land area covered by Toto L.G.A as recorded by the area from Bureau of Lands and survey Toto 2005 which is 2,903 square kilometer. Therefore, sampling size using 15% land area covered with the population size of 1,795 people in Yelwa village (i.e. 50%) of the total population of Toto L.G.A tends to be 4% of each of the area covered for sampling. Sampling size percentage showed work: using Yaro Yemen's formulae on heterogeneous population rate as; n = N / 1 + N (E) ^2. Where;

n = sampling size

N=total population of Toto L.G.A, and

E = level of significance.

Thus, N = 149,083, E = 50% i.e. 0.5.

n = 149,083 / 1 + 149,083(0.5) ^2

n = 149,083 / 149,084 (0.25)

n = 149,083 / 37270

n = 4%

Table 1: Showing Area of Residence, Population Size and Number of Questionnaires Administered

Area of residence	Population size	Questionnaires administered
Jerusalem	120	2
Angwan Sarki	239	4
Angwan Sunday Poniyi	359	6
Angwan Danlami Dogo	359	6
Angwan Sabo Zhiajekpi	239	4
Angwan Amadu Dabyilo	479	8
Total	1,795	30

The population size is distributed in the ratio of **1:2:3:3:2:4** of 1,795 total population.

Ratio = number * total population / total number

4. Results & Discussions

4.1 Socio-Economics

4.1.1 Gender of Respondents

This study revealed that 57% of the female respondent use domestic fuel wood compared to the male with only 43% responds. This is due to the fact that most female respondent tends to use fuel wood primarily for cooking as the major source of domestic energy utilization. Hence the female respondents are more adversely affected by the use of fuel wood compared to the men

4.1.2 Age Group

Over 60% of the respondents fell within the age group of 21- 30, while the respondents were between the age group of 31-40 accounted for 20% of the sampled population. While the remaining 20% was fell within the age groups of 41-40, under 20 and 50 above on the basis of 17% and 3% respectively. This shows that the domestic use of fuel wood is not tied to a particular age group.

4.1.3 Household Size

The household size of 11-15 had 4%, followed by 37% for the household size of 6-10. While families with the household size of 1-5 had 50%. This implies that the household size influence the choice of using domestic fuel wood.

4.1.4 Level of Education

The educational level of the respondents in the study area tends to affect their individual level of fuel wood consumption. As over 20% of them attended only primary school, 20% attended secondary school, 20% has university degree/HND. While the remaining 30% did not attend school.

4.1.5 Income Level of Respondent

Over 67% of the population earns less than USD 50 a month, while the remaining 33% earned between USD 50-100

4.2 Fuel Wood Energy Utilization in Yelwa Village

The study found the predominant domestic energy consumed in Yelwa village is fuel wood as shown in Figure 1, is at 94% for Fuel wood, Kerosene is at 3.3%, charcoal is at 3.3% and Electricity and gas usage is at 0% each.

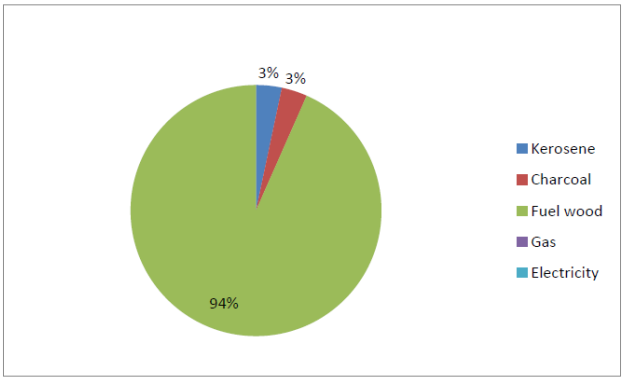

Figure 1: Fuel Wood Energy Utilization by Respondents

There are alternative sources of energy in Toto LGA, but the inhabitant of Yelwa village preferred the use of fuel wood as the cultural belief is meals prepared using fuel wood taste better. Figure 2 shows fuel wood in use for cooking.

Figure 2: Fuel Wood Utilization for Cooking

4.3 Fuel Wood Preference

Preference is a key reason why households in Yelwa village make use of fuel wood, according to the surveyed households in the study area, 20% of the respondents prefer the use of fuel wood due to its safety, other reason for the use of fuel include easy access to fuel wood, low cost, cultural belief which represent 30%, 33%, 17%, respectively as shown in Figure 3.

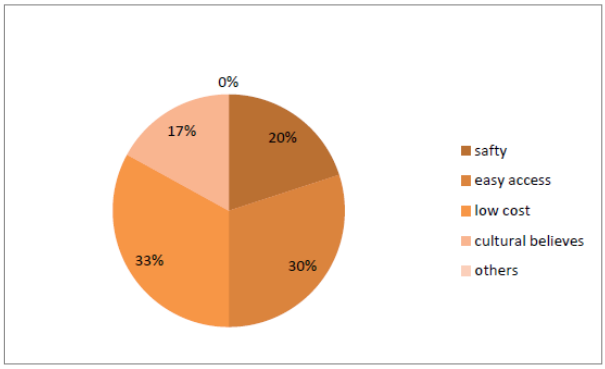

Figure 3: Fuel Wood Preferences

4.4 Source of Fuel Wood in Yelwa village.

There are various source of fuel wood supply in the study area, as 77% of the respondent get their fuel wood from the forest, while other sources include buying, hand picking , nearby bushes, which represents 6%, 0%, and 17% respectively as shown in Table2.

Table 2: Fuel Wood Sources

Fuel Wood Sources	Frequency	Percent
Forest	23	77
Buying	2	6
Hand Picking	0	0
Nearby Bushes	5	17
Total	**30**	**100**

Figure 4 shows one of the forest resource located close to Yelwa village and Figure 5 shows the fuel wood selling point within Yelwa village.

The study shows that 100 % of the respondents make use of fuel wood for cooking. While heating, lightening, baking and industrial use has 0%.

4.5 Frequency Level of Fuel Wood Usage

The study shows that 90% of the respondents make use of fuel wood always, 7% make use of fuel wood occasionally. While 3% make use of fuel wood seasonally.

Figure 4: Forest as a Source of Fuel Wood at Yelwa Village

Figure 5: Fuel Wood Selling Point at Yelwa Village

4.6 Duration of Exposure to Smoke Due to Fuel Wood Usage

The time duration of daily exposure to smoke and heat from the usage of fuel wood has health implications. According to the survey, those that make use of fuel wood " between" 30 minute –1hr represent 37 %, 2hrs - 3hrs represent 47%, 3hrs -4hrs 16%. While 5hrs and above is represented by 0% as shown in Table 3.

Table 3: Duration of Exposure Daily

Duration of exposure using fuel wood	Number of Resp.	Percent
30 minutes – 1hr	11	37
2hrs – 3hrs	14	47
3hrs – 4hrs	5	16
5hrs above	0	0
Total	30	100

4.7 Health Challenge Associated with the Use of Fuel Wood in Yelwa Village

The respondents suffered from a variety of health problems currently; 47% of respondents had eye irritation, 23% had cough, 17 had persistent sneezing during usage and 13% had shortness of breath as shown in Table 4.

Table 4: Health Problems Experienced by Respondents

Health problem frequently experience	Number of Resp.	Percent
Catarrh	0	0
Eye irritation	14	47
Cough	7	23
Sneezing	5	17
Dry throat/nausea	0	0
Shortness of breath	4	13
Total	30	100

Ten respondents were blind but others factor could be responsible for that condition

4.8 Common Health Challenges Associated with the Use of Fuel Wood in Yelwa Village

Based on past literature common health challenged directly attributed to the prolonged usage of fuel wood were also surveyed. It was found that 40% of the sample population have fire burns from the usage of fuel wood. While 33% of the respondents have eye blindness, 20% of the respondents have heart disease, 3% of the respondents have lung cancer, 3% of the respondents have ulcer and 0% of the respondents have skin cancer. In summary, the study found women partake more when it comes to domestic energy utilization as they tends to do more of the cooking compared to the men. The findings further identifies other significant factors influencing households domestic energy choice such as marital status as married people requires more domestics energy, the more the households size the more energy required, the income level of the people is very important determinant of households energy choice, findings revealed that 67% earn below USD 100 naira monthly. Similarly the findings from the study further reveal that the respondents use fuel wood and also derive satisfaction from the use of fuel wood. The study further affirms the presence of other source of energy apart from fuel wood such as kerosene and charcoal. Some health implications of the use of fuel wood has been identify. Finally the study has deduced that 90% of the respondents make use of fuel wood always and 100% of the respondents use fuel wood for cooking.

5. Conclusions

Fuel wood utilization in the study area is increasing on daily basis as a result of the lack of access to clean and affordable energy. Consequently, Poverty, household's size, income level of the dwellers, among others are the drivers of fuel wood utilization in the study area, leading to several health problems. As such, more effort is needed from the government, traditional rulers, and individual to work together to provide sustainable energy to meet the domestic needs of their community.

6. Recommendations

With the problems identified in the study area, there is need for relevant and achievable recommendations to tackle the problems, to achieve healthy and habitable environment and also reduce the health implication of the use of fuel wood on users in the study area. Domestic energy is essential in rural households to meet their basic needs. Consequently there is need to improve the energy sector to reduce the over reliance on forest resource by rural dwellers, as such the government needs to put programs in place to provide clean and affordable energy.

- Poverty, low income, and educational level among others has been identified as the major basis for rural dwellers to rely on fuel wood for domestic use, it is recommended that the joint effort of both individual, community leaders, and the Government to provide jobs opportunity for rural dwellers, raise the standard of living, so as to increase their income level and consequently reduce poverty.

- The use of renewable sources of energy should be encouraged with utmost vigor to reduce the pressure on forest resources.

Providing affordable alternative energy sources will also reduce the carbon emissions from the area, thus global warming from the usage of fuel.

- The federal government of Nigeria has to intervene and subsidize the price of other energy; this policy will reduce health implications and other health challenges associated with the use of fuel wood.

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