UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI

SCHOOL OF GRADUATE STUDIES

HOUSEHOLD USAGE OF FIREWOOD, ITS CHALLENGES AND EFFECTS ON ITS USERS IN THE KWABRE EAST MUNICIPAL

(A CASE STUDY IN KWABRE EAST MUNICIPAL IN ASHANTI REGION)

BEATRICE BOADI

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BEATRICE BOADI

(190014382)

A Dissertation in the Department of HOSPITALITY AND TOURISM EDUCATION Faculty of VOCATIONAL AND TECHNICAL EDUCATION, submitted to the school of Graduate Studies, University of Education, Winneba in partial fulfillment of the requirement for the award of Master of Technology Education (Catering and Hospitality) degree

SEPTEMBER, 2020

DECLARATION

Candidate's Declaration

I hereby declare that apart from the references to other people's work which have been duly acknowledged, this project work is of the result of my own original investigation and that no part of it has been presented for another degree in this university or elsewhere.

Signature: …… Date: ……..

NAME OF STUDENT: BEATRICE BOADI

Supervisor's Declaration

I, hereby declare that the preparation and presentation of this project work was supervised in accordance with the guidelines on supervision of project work laid down by the University of Education, Winneba.

Signature: ……. Date: ……

NAME OF SUPERVISOR: DR. MRS. ELLEN OLU FAGBEMI

DEDICATION

I dedicate this project to my lovely husband, Mr. Antwi-Agyei Boateng and my children and to all those who helped in a way to make this study successful.

ACKNOWLEDGEMENT

I am very grateful and thankful to the Almighty God who strengthened me, for His care, guidance and protection throughout the project work.

I express my profound gratitude and appreciation to my supervisor Dr. Mrs. Ellen Olu Fagbemi who in spite of her busy schedule, had time to read through my scripts and made the necessary advice and corrections during the period of this project. I really appreciate her patience, guidance, comments and valuable suggestions and directions which greatly enhanced my work.

I appreciate the effort of all the lecturers of University of Winneba-Kumasi Campus for the knowledge, guidance and inspiration offered me to put ideas together for a successful work done.

Finally, I am thankful to my lovely husband and my family for their immense support. I say may God Almighty unleash His blessings on you all.

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ABSTRACT

The usage of firewood, as fuel, to cook has been an important traditional method in the Kwabre East Municipality. Many people in households in the Kwabre East Municipal have been adversely affected as a result of constant exposure to the smoke from the firewood. The study sought to find out factors influencing the choice of firewood as fuel, its usage challenges and the adverse effects it has on its users in households in the Kwabre East Municipal of Ashanti Region. The study adopted quantitative and descriptive research design to draw conclusion between variables. Simple random technique was used to sample out 250 respondents for the study. Questionnaire was used as instrument for data collection. The study finds out that the population preferred firewood (as fuel for cooking) to other sources due to its affordability. Some challenges associated with the use of firewood were the smoke it comes along with, the excessive heat it habours, and its inability to get food cooked very fast. The study also finds out that the usage of firewood (as fuel for cooking), has adverse effects on its users. They were health complications, unpleasant body odour, and modifying in food taste and smell. Finally, the study recommends that strategies and interventions aimed at reducing its effects should be employed. Also, the government should subsidize cost of other clean fuels such as Liquefied Petroleum Gas (GAS) to encourage to shift from the use of firewood for cooking.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Firewood is an age-old source of energy and has been used by man for ages to satisfy their energy need for both domestic and industrial purposes. However, as years lingered on the after-math of its usage had not auger well. Research proves that right from its source of obtainment to its use by man, it has had directly or indirectly negative impact on nature from felling to burning to effect as it may from various forms of human activities. (Environmental Protection Agency Ghana, 2005).

Over two billion people worldwide meet their energy needs by ways fuel wood (Cline-Cole et al., 2015: Smith, 1981). The majority of these people are found in both rural and urban areas of the third world countries. De Montalembert and Clement (1983) reports that, fuel wood meets about 90% of energy needs in rural areas of Africa south of the Sahara and Latin America.

In recent times, Food and Agriculture Organization (FAO) estimate suggest that in 1980 approximately three-fourths of the population of the developing world, 2000 million people depended on traditional fuels for their domestic energy requirements, and that by the year 2000 this number could grew to 3000 million (FAO, 2003). Firewood a traditional fuel is a large portion of the overall energy consumption in most developing countries and is used extensively and often exclusively in meeting the household needs of people in both rural and urban areas. They are also used to a varying extent in the commercial, agricultural and industrial sectors, including some large-scale industrial uses. (Russell deLucia, 2000).

The most significant health concern using firewood is the smoke, especially, when the burning happens indoors without proper ventilation or chimneys. Smoke contains carcinogens and small particles, which damage the lungs and respiratory organs (WHO 2009).

1.2 Statement of the problem

Firewood is still widely used among all classes of people across sub Saharan Africa and Ghana falling within this category of countries is of no exception. The fact that charcoal usage is dominated by urban dwellers does not count them out because wood is the primary raw material for the production of charcoal so it refutes the accusation that rural folks is the problem to deforestation per the usage of firewood as the supplies taken from rural areas directly affects local availability of firewood. Kwabre East Municipality, as a fast-growing municipality, is experiencing the effect and challenge of the usage of firewood as fuel in towns such as Mamponteng, Ntonso, Asonomaso, and Adanwomase all because they are easily accessible.

With a current population of 20 million and an annual growth rate of 2.6 percent, Ghana's population is expected to double to around 33 million in the year 2024 and with indications that about 32 percent of Ghana's population lives below the poverty line. The high price of alternative energy sources, such as gas, oil and electricity, and their uncertain supply encourages the use of firewood to these sources.

For many of the poor, particularly those in rural communities near forests, forest resources including firewood directly or indirectly contribute to sustaining their livelihoods. These activities results in depletion of the forest areas due to unchecked human activities.

Women have been adversely affected by the use of firewood since they are the prime users. Firewood, with its accompanying smoke and heat, also affects children's health. The extent at which food is cooked and quality achieved from food cooked with firewood can have different quality and taste. .

Collecting firewood requires time and physical energy. A study conducted in the Taita Hills in 1986, showed that already at that time, a firewood search involved long distances, approximately 6–8 kilometers, several times a week. To meet energy needs it is particularly laborious for those who do not have enough woody vegetation in their own farm or who cannot afford to buy firewood and this, in addition to other domestic or farm work, reduces the time that could be used for education, acquiring additional incomes or social interactions. Therefore, reliance on firewood as a primary energy source restrains the development of rural economies and hinders income generating activities as well as poverty alleviation (UNEP 2006).

Smoke contains carcinogens and small particles, which damage the lungs and respiratory organs (WHO 2009). This indoor air pollution strongly increases the risk of pneumonia and chronic respiratory diseases. It also increases the exposure to lung cancer, cataracts and tuberculosis by weakening the condition of the respiratory organs. There has also been found tentative connections between indoor air pollution and low birth weight, or ischemic heart disease as well as nasopharyngeal and throat diseases (WHO 2005). In this regard, I am undergoing this study.

1.3 Purpose of the study

The purpose of the study is to probe into the household usage of firewood and its challenges as fuel in the Kwabre East Metropolitan area.

1.4 The objective of the study is to:

1. Establish factors influencing the choice of firewood consumed as fuel energy.

2. Examine the challenges associated with usage of firewood as fuel.

3. Ascertain consequences from the use of the firewood as fuel.

1.5 Research questions

1. What factors influence the choice of firewood consumed as fuel energy?

2. What are the challenges associated with the use of firewood as fuel?

3. What are the consequences of the use of the firewood as fuel?

1.6 Significance of the study

This study has enormous significance that ranges from the global scale to the national. In the view of continuous global call to conserve the environment against ever growing demand and supply of wood fuel with its ascending environmental and health threats. Research of this sort is very crucial in achieving results that would inform the on-going discourse. The current efforts in combating global health challenges are traceable to environmental imbalances.

Secondly, the research shows that the national forest of Ghana is rapidly depleting. Thus, in the last few decades, Ghana has lost close to 70% of its wildlife and about 75% of its 8.2 million hectors of forest (Resource Watch Agenda, 2010; Lurimuah, 2011). Factors accountable for this situation include unsustainable methods of charcoal burning, constant bushfires, deprived farming practices and logging. The research results and references could serve as significant data in handling the situation.

This study aims to contribute to the body of knowledge to academics and policy makers as well as rural communities in their bid to sustain their livelihood of maintaining micro-economic stability at the local communities. The general hope is that, government agencies including the District Assemblies in the study area could also enact and enforce effective environmental and fire wood bye-laws based on the research findings and recommendations.

1.7 Delimitations of the study

The research was conducted in the Kwabre East Municipal of the Ashanti region. It looked at the household usage of firewood and its challenges as fuel. The research also focused on the implications of using fire wood and challenges that comes with it.

1.8 Organization of the study

The study was organized into five chapters. Chapter one introduces the major concepts of the study. Chapter two reviews literature related to subject matter of the study precisely the research questions. Chapter three discusses the methods used in study, which include the techniques for sampling, the source of data, as well as the data collection and data analysis methods. Chapter four presents the findings of the studies and discusses the results and the practical implications of the findings. Chapter five summarizes the study and concludes on the research questions guiding the studies.

CHAPTER TWO

LITERATURE REVIEW

2.1 Firewood as fuel for cooking

It is processed and is in some sort of recognizable log or branch form, compared to other forms of wood fuel like pellets. Firewood is any wooden material that is gathered and used for fuel (Sidney et al., 2009). Generally, firewood is not highly or chips. Firewood can be seasoned (dry) or unseasoned (fresh/wet). It is generally classified as hardwood or softwood (Sidney et al., 2009).

Since fire was first harnessed, wood has been the primary fuel for it. Although most of the developed world now gets the majority of its energy for cooking and heating from fossil fuels like coal and petroleum, wood fuels are still a major source of energy for people in developing countries where, wood fuels account for between 50 and 90 percent of the fuel used (FAO, 2010).

2.2 Chemical composition of firewood

The chemical composition of wood cannot be defined precisely for a given tree species or even for a given tree (Petersen, 2009). According to Petersen (2009) chemical composition varies with tree part (root, stem, or branch), type of wood (i.e., normal, tension, or compression) geographic location, climate, and soil conditions.

Brewer (2005) addressed this issue as although the chemical composition of wood varies from species to species, wood is primarily composed of carbon, hydrogen, oxygen, calcium, potassium, sulfur, nitrogen and magnesium. Most wood contains some amount of water as well.

Hickey and King (2001) also sees wood as a porous and fibrous structural tissue found in the stems and roots of trees and other woody plants. They describe it as an organic material naturally of cellulose fibers that are strong in tension and embedded in a matrix of lignin that resists compression and concluded that wood can also be considered as only the secondary xylem in the stems of trees.

The chemical composition of wood varies from species to species, but it is approximately 50% carbon, 42% oxygen, 6% hydrogen, 1% nitrogen, and 1% other elements (mainly calcium, potassium, sodium, magnesium, iron, and manganese) by weight. It is also augured that wood also contains sulfur, chlorine, silicon, phosphorus, and other elements in small quantity.

Baucher et al., (2003) states that aside from water, wood has three main components including cellulose, a crystalline polymer derived from glucose, constitutes about 41–43%. Next in abundance is hemicellulose, which is around 20% in deciduous trees but near 30% in conifers. It is mainly five-carbon sugars that are linked in an irregular manner, in contrast to the cellulose. Lignin is the third component at around 27% in coniferous wood verses 23% in deciduous trees. According to Baucher et al., (2003) these three components are interwoven and direct covalent linkages exist between the lignin and the hemicellulose. To conclude they stated that in chemical terms, the difference between hardwood and softwood is reflected in the composition of the constituent lignin. Hardwood lignin is primarily derived from sinapyl alcohol and coniferyl alcohol. Softwood lignin is mainly derived from coniferyl alcohol.

Analytical data accumulated from various researches over the years and from many different laboratories have helped to define average expected values for the chemical composition of wood. Ordinary chemical analysis can distinguish between hardwoods (angiosperms) and softwoods (gymnosperrns) but unfortunately, such techniques cannot be used to identify individual tree species because of the variation within each species and the similarities among many

species though further identification is possible with detailed chemical analysis of extractives chemotaxonomy (Woods, 2017).

Petersen (2009) have it that there are two major chemical components in wood: lignin (18–35%) and carbohydrate (65–75%) and both are complex, polymeric materials. He also recorded that minor amounts of extraneous materials, mostly in the form of organic extractives and inorganic minerals (ash), are present in wood (usually 4–10%). Overall, wood has an elemental composition of about 50% carbon, 6% hydrogen, 44% oxygen, and trace amounts of several metal ions. A complete chemical analysis accounts for all the components of the original wood sample. Thus, if wood is defined as part lignin, part carbohydrate, and part extraneous material, analyses for each of these components should sum to 100%.

Carbohydrates:

The carbohydrate portion of wood comprises cellulose and the hemicelluloses. Cellulose content ranges from 40 to 50% of the dry wood weight, and hemicelluloses range from 25 to 35%.

Cellulose:

Cellulose is a glucan polymer consisting of linear chains of 1,4- β β-bonded an hydroglucose units. (The notation 1,4- β β describes the bond linkage and the configuration of the oxygen atom between adjacent glucose units.) Figure 2.1 shows a structural diagram of a portion of a glucan chain. The number of sugar units in one molecular chain is referred to as the degree of polymerization (DP).

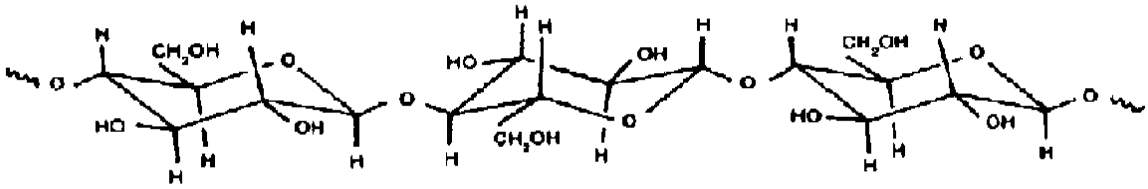

Figure 1 The partial molecular structure of cellulose [$(C_6H_{10}O_5)$] in the 1,4 ß-D glucopyranose form

Emissions by chemical class for particle and vapor constituents in woodsmoke

Chemical	Particle-phase (mg/kg wood burned)	References	Vapor-phase (mg/kg wood burned)	References
Carbon monoxide	—		130,000	(McDonald et al., 2000)
		Hydrocarbons		
Alkanes (C2–C7)	0.47–570	(Rogge et al., 1998; Fine et al., 2002)	1.01–300	(Schauer et al., 2001; McDonald et al., 2000)
Alkenes (C2–C7)	0.58–280	(Rogge et al., 1998; Fine et al., 2002)	92–1300	(McDonald et al., 2000)
Polycyclic aromatic hydrocarbons (PAHs) and substituted PAHs	5.1–32,000	(Oros & Simoneit, 2001; Fine et al., 2002; Rogge et al., 1998; McDonald et al., 2000)	43.4–355	(Schauer et al., 2001; McDonald et al., 2000)
Methane	—		4100	(Schauer et al., 2001)
Total nonmethane hydrocarbons C2–C7	[Included in vapor phase]		390–4000	(Schauer et al., 2001; McDonald et al., 2000)
Unresolved complex mixture (UCM)	300–1,130,000	(Oros & Simoneit, 2001; Fine et al., 2002)		
		Oxygenated organics		
Alkanols	0.24–5400	(Oros & Simoneit, 2001; Fine et al., 2002)	120–9200	(McDonald et al., 2000)
Carboxylic acids	6200–755,000	(Oros & Simoneit, 2001; Fine et al., 2002; Rogge et al., 1998)	2.4	(Schauer et al., 2001)
Aldehydes and ketones	[Included in vapor phase]		0.94–4450	(Rogge et al., 1998)[a] (Schauer et al., 2001; Fine et al., 2002; McDonald et al., 2000)
Alkyl esters	0.37–4450	(Oros & Simoneit, 2001; Fine et al., 2002)		
Methoxylated phenolic compounds	28–1000	(Rogge et al., 1998; Fine et al., 2002; McDonald et al., 2000)	1200–1500	(Schauer et al., 2001)
		Other organics		
Other substituted aromatic compounds	5.0–120,000	(Oros & Simoneit, 2001; Fine et al., 2002; Rogge et al., 1998)	110–3600	(Schauer et al., 2001; McDonald et al., 2000)
Sugar derivatives	1.4–12600	(Oros & Simoneit, 2001; Fine et al., 2002)		
Coumarins and flavonoids	0.71–12	(Fine et al., 2002)		
Phytosteroids	1.7–34.0	(Rogge et al., 1998; Fine et al., 2002)		
Resin acids and terpenoids	1.7–41,000	(Oros & Simoneit, 2001; Fine et al., 2002; Rogge et al., 1998)	21–430	(McDonald et al., 2000)
Unresolved compounds	1.2–120	(Fine et al., 2002)	20–600	(Schauer et al., 2001; McDonald et al., 2000)

Source: Naeher et al. :woodsmoke health effects (2020)

2.3 Household Fire Wood Energy Consumption Pattern

2.3.1 Consumption of Wood Fuels

Since fire was first harnessed, wood has been the primary fuel for it. Although most of the developed world now gets the majority of its energy for cooking and heating from fossil fuels like coal and petroleum, wood fuels are still a major source of energy for people in developing countries. In such countries wood fuels account for between 50 and 90 percent of the fuel used (FAO, 2010). The figure 2.2 shows how some rural and urban dwellers in developing countries use wood fuel in cooking.

Figure 2 Consumption of firewood

Source: Author's field survey 2020

Energy security is related to development. According to Gordon et al. (2004), energy resources are not evenly distributed across the world nor are their different usages all environmentally maligned. Energy as an important engine for economic growth

continues to be a challenge in developing countries especially where percentage distribution of households using biomass fuels exceeding 80 percent is dominant in Africa. Increasing prices of fossil fuels continues to be an issue of concern. While there is no Millennium Development Goal (MDG) specifically on energy, access to energy services is a prerequisite to the achievement of all eight MDGs. This was realized at the World Summit for Sustainable Development (WSSD) in Johannesburg in 2002 (UNDP, 2005). Apparently, much greater quantities and much greater quality of energy services will be required to meet these MDGS than are presently available in developing countries. Access to needed energy services is an important tool in helping promote economic growth, social equality, and environmental sustainability (IEA, 1998). It is at least important to ensure that rural households have access and can afford the domestic cooking and heating energy.

The household sector alone accounted for 52 percent of the total energy consumption in Ghana for the year 2000 (Ministry of Energy, 2002). Household energy consumption is primary for cooking and lighting. Fuel wood is used in the forms of firewood and charcoal in many places for reasons of availability and affordability. About 69 percent of all urban households in Ghana use charcoal a bi-product of wood for cooking and heating and the annual per capita consumption is around 180 kg (Ministry of Energy, 2002). The total annual consumption is about 700,000 tons, 30 percent of which is consumed in the capital, Accra (Ministry of Energy, 2002). It is reliably estimated that 14 million m^3 of wood is consumed in Ghana, for energy production (Ministry of Energy, 2002). It has also been estimated that the volume of fuel wood consumed in Ghana rise to 20 million m^3 by the year 2010 (Ghanaian Chronicle, 2006).

Projections of energy consumption in Ghana (Table 2.1) indicate a steady rise, which is only natural due to a steadily increasing population. Although the growth rate of the use of Liquefied Petroleum Gas (LPG) is the highest (Ministry of Energy, 2002), there is a greater amount of biomass fuels being consumed in the forms of charcoal and firewood.

Table 2.1 Projections of fuel consumption (000 tonnes) 1995-2000

Fuel	1990	1995	2000	Annual Growth Rate %
LPG	6	11.55	22.24	14.0
Kerosene	167	168.68	170.37	0.6
Charcoal	637	812.99	1,037.61	5.0
Fuelwood	7,019	7,941.35	6,984.91	2.5

Source: Field Data 2020

Charcoal is especially important since it demands greater volumes of wood to produce charcoal irrespective of the dwindling supplies from forest resources of Ghana (EPA, 2005). In addition, it is believe that the use of fuel wood for domestic purposes will hardly fizzle out in most developing countries. It has been estimated that approximately half the global population and up to 90 percent of rural households in developing countries still rely on biomass fuels (WRI, 1999). Considering the fact that 70 percent of the total national energy consumption is accounted for by biomass in either the direct or the processed form (KITE, 1999), the big question that remains to be answered is whether Ghana's dwindling forest resources can sustain the increasing demand for fuel wood. Firewood and charcoal alone accounts for more than 93 percent of energy used for cooking (Figure 2.3).

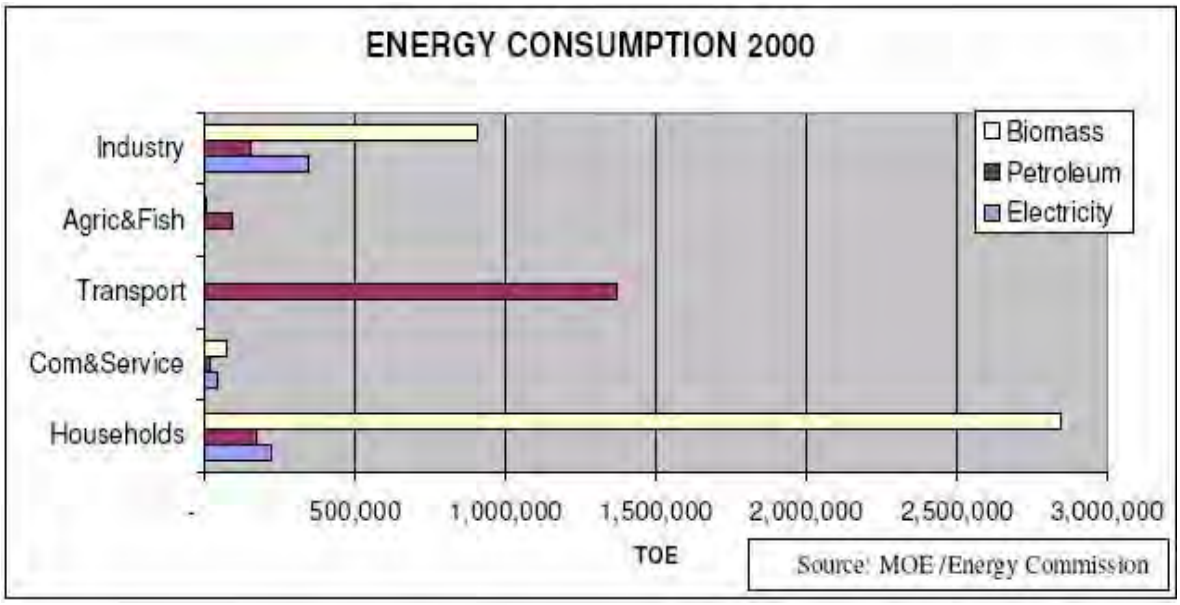

Figure 3 Energy consumption in Ghana (2000)

Source: Ministry of Energy Ghana, 2002.

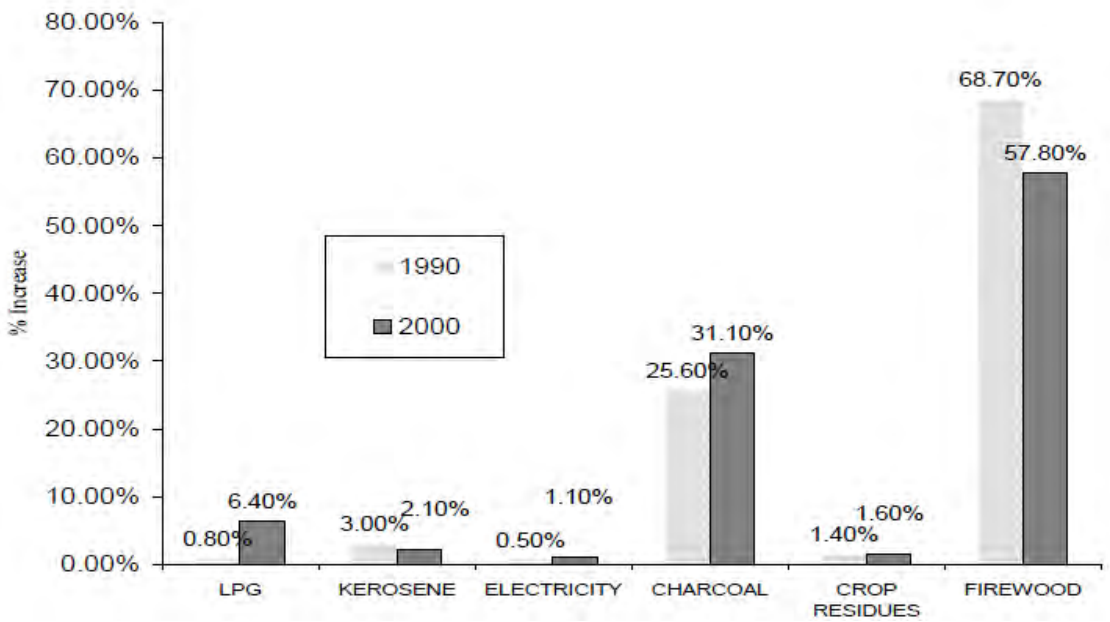

Fig 4: Percentage main household cooking energy trend in Ghana

Source: Adapted from Ahiataku-Togobo, 2007

It is also worth mentioning that 67 percent (24,890 GWh/yr) of total energy consumption in the household is for cooking. LPG, kerosene and electricity use though cleaner, accounts less (Figure 2.4). Despite efforts to ensure access to modern cooking fuel, the effect has been negligible and over 90 percent of households in Ghana still use fuel wood (Ahiataku-Togobo, 2007).

2.3 Factors Influencing Choice of Firewood as Fuel Energy

Households use fuels for basic activities such as cooking and heating, and other activities that are important for the general well-being of each household member (Heltberg et al., 2000; Chen et al., 2006). Fuel is fundamental for a household; when households have problems in covering fuel requirements or when they spend more than 10 percent of their total expenditure on fuel, they are considered to be in "fuel poverty" (Legendre and Ricci, 2015).

Although the geographical context is important, it is within households that the fuel choice decisions are made. Depending on the context, each family uses one or more fuels, including biomass fuels, like firewood, coal, charcoal, crop residues, dried cattle dung, and "modern" fuels, like LPG, biogas, and electricity. One of the factors that determines which fuels are used is availability and accessibility (Heltberg, 2005). For instance, delivery of LPG requires highways, and it also requires a gas stove in the household which most cannot afford on regular bases (Clement, 1993).

Firewood, on the other hand, does not require a special kitchen stove. In many countries biomass fuels are less expensive than cleaner fuels like LPG or electricity (Woods, 2017). Other factors influencing the use of firewood over LPG are the economic and cultural characteristics of a region or country (Woods, 2017).

The choice of fuels can be modeled as a technology adoption process, using the random utility framework (McFadden, 1974; Manski and McFadden, 1981). Based on that theoretical model, Heltberg et al. (2000) describe the relationship between household fuel choice and forest degradation in India, and finds that households choose fuels based on available forest stock. Whenever the stock is reduced they substitute firewood for other fuels, such as charcoal. Amacher et al. (1996) found that firewood in two regions in Nepal is relatively scarce and prices are higher in the mid-hills, and that households respond to deforestation by using their own land for production of firewood. Many papers analyze the determinants of household fuel choice attest that firewood has become the obvious choice for many (Brouwer, 1997).

Distance to markets is an important factor that reduces the probability that fuels such as gas, biogas or electricity are used, and increases the probability of using biomass fuels such as firewood, charcoal, or dried dung, as seen in studies by Hou et al. (2017) for China, Jan and Akram (2018) for Pakistan, van der Kroon et al. (2014) for Kenya, Heltberg (2005) for Guatemala, and Jumbe and Angelsen (2011) for Malawi.

Another important factor is the age of the head of household. There is a negative relationship between age and the use of certain fuels, and a positive relationship to the use of biomass fuel, as noted in these same studies, as well as in others by Heltberg (2004) for eight developing countries, Mensah and Adu (2015) for Ghana, Alem et al. (2016) for Ethiopia, and Özcan et al. (2013) for Turkey.

Research have it that female household heads and a larger proportion of women in the household both have a positive relationship to the use of clean fuels and a negative one to the use of biomass, as shown by Israel (2002) for Bolivia, Heltberg (2005) for Rahut et al. (2016) for Bhutan, Gupta and Köhlin (2006) and Hou et al. (2017) for China. There is also consensus in all the studies mentioned in this section that the

level of education of the household head and spouse are positively related to the use of clean fuels and negatively to the use of biomass.

In addition, variables related to wealth, such as higher income or household expenditures, accessibility to household assets, and better services (electricity, bathroom, drainage, solid floor), are positively related to the use of clean fuels and negatively to biomass (Hou, et al., 2017; Jan and Akram, 2018; van der Kroon et al., 2014; Heltberg, 2004, 2005; Jumbe and Angelsen, 2011; Mensah and Adu, 2015; Alem et al.,2016 and Özcan et al., 2013).

Again, on the household side, there are a couple of reasons to believe that rural people will be more adversely affected than their urban counterparts will when it comes to energy usage. Food, housing, and transportation account for about 75 percent of the energy consumption of a typical rural household. The proportion of a family's budget spent for energy either direct or indirect is inversely related to level of income. Since low-income families assign a significantly larger share of their income to these items, their dependence on energy is relatively greater. An increase in the cost of energy therefore has a relatively greater impact on lower-income families (Abakah, 1990). Since rural incomes are somewhat lower than urban incomes, the effect on the rural population is proportionately greater (Abakah, 1990).

At the local level, the impact of fuel wood demand takes on special significance. In a town in central Sudan, for example, 38 percent of all fuel wood is used by bakeries, restaurants, schools, and the local prison and hospital (Bonkoungou et al,. 2004). In Ouagadougou the making of traditional millet beer alone consumes 15 percent of that city's daily wood supply (Bonkoungou et al,. 2004). A brick-making plant in Niger is reported, to require 30 tons of wood every day, roughly equivalent to the domestic energy needs of 6000 people (Bonkoungou et al,. 2004). In tobacco-growing regions,

the curing of tobacco leaves consumes an extraordinary amount of wood. In Tanzania, it is estimated that an entire hectare of woodland is used to cure one hectare of tobacco, or 1 stacked cubic meter of wood for every 7.5 kg of tobacco leaf (FAO, 2007).

A clear illustration of the poor in developing countries paying far higher prices per unit of energy with urban counterparts better off is seen in research in Beira Mozambique household where the use of charcoal for cooking and kerosene for lighting costs about US $ 5 and US $2.10 respectively a month. This is expensive when wages of the head of household is less than $30 implying 27 percent incomes for energy as compared to United Kingdom average household spending on energy, which is 4 percent (FAO, 1993).

Charcoal production for domestic energy uses is one is a choice that cannot be without firewood or its bi-product. A detailed UNDP/WB study predicted in the mid-1990's that lands would become scarcer and charcoal producers would turn to other sources to obtain wood. A lack of alternative sources of wood, i.e., plantations or farmland, would result in large-scale land clearing for the purpose of providing wood for charcoal. If the demand for charcoal does not simultaneously subside, then other areas will have to be exploited (World Energy Assessment, 2000). This is the point where sawmill waste production of charcoal using the Kiln method may be one of the better and perhaps wise option to exploit for fuel wood in these timber producing and processing districts of the Brong Ahafo Region.

In many countries, the rural people and even charcoal producers are too poor to use charcoal, and the demand for firewood for domestic use is found in the rural areas compared to the urban areas. This often means that the charcoal is produced far from the demand points and must be transported, typically via truck, to the user. As the fuel

wood supply and potential agricultural land supply dwindles, transport distances may approach 1000km. Easily accessible fuel wood is then also co-opted for the urban dwellers, leaving rural areas with fewer accessible biomass supplies (Kammen and Lew, 2005).

Ghana is likely to consume more than 25 million tonnes of fuel wood by the year 2020 (EPA, 2005). The savanna and forest-savanna transition zones of the Ashanti and Brong Ahafo Regions are major producing areas for the commercial firewood trade which supplies Ghana's major urban centers where different social actors engage in these wood fuel-related activities in different ways like schools, chop bars, hospitals and tobacco farmers also make use of large amounts of fuel wood in curing tobacco leaves. (Afikorah - Danquah, 1996)

Charcoal and firewood are distinct fuels, each with its own market and applications. Unlike firewood, charcoal is always produced, transported, and sold commercially. People do not forage for charcoal as they might for wood nor is charcoal likely to be widely used where firewood can be readily obtained free of charge especially in rural communities. Thus, the domestic consumption of charcoal depends largely on its price relative to firewood (Wood and Baldwin, 1985). In the case of Ghana, it is no different as Figure 2.5 shows that prices in the study show a relatively stable prices trend for fuel wood as compared to electricity, kerosene and LPG whose supply and pricing is rather erratic.

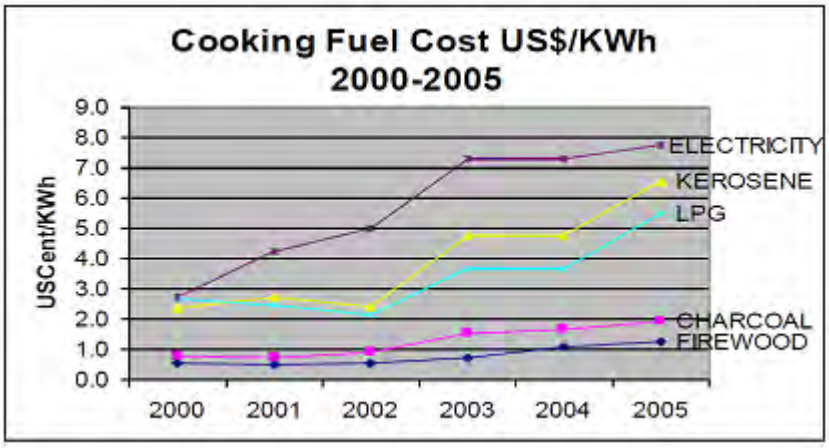

Figure 5 Cost of cooking energy in Ghana

Source Ahiataku-Togobo, 2020

Most biomass users prefer charcoal over other biomass fuels nevertheless it having firewood as it primary raw material, this is because charcoal has a higher energy density than other biomass fuels and can be stored without fear of insect problems. It has excellent cooking properties. It burns evenly for a long time and can be easily extinguished and reheated (Kammen and Lew, 2005).

Pricing factor may be a number one contemplation or even the major factor of consideration in household fuel choices. Fuel wood, which is near the bottom of the cooking energy ladder due to inconvenience, and smoke which makes is not necessarily the cheapest of energy options. In many cases, the availability of fuel supplies determines preferences (Ribot, 1993).

Table 2.2 Wood fuels consumption in some selected countries Country

Wood fuels consumption in some selected countries Country	Consumption per capita(m/tanno)
Angola	0.96
Kenya	1.48
Madagascar	0.59
Malawi	0.90
Malaysia	0.50
Mali	0.58
Mozambique	0.96
Niger	0.58
Nigeria	0.84
Senegal	0.55
Sudan	1.75
Uganda	1.77
Zaire	0.91
Zimbabwe	0.96

Source: Field Data 2020

2.4 Environmental Challenges in Using Firewood as Fuel Energy

The pace of interventions slowed when it became clear that forest degradation and loss could not be stopped by handing out new cook stoves. More than 2 billion people use wood, charcoal, dung or agricultural residues as the primary fuel for their cooking and heating needs, leading to significant negative health, economic and environmental consequences. Burning wood or agricultural residues produces smoke with a variety of irritant pollutants, some of which are known carcinogens. More than 1.5 million deaths a year are caused by acute respiratory infections from breathing smoke from indoor cooking fires. Women and children are generally exposed to the greatest levels of pollutants and it is children who suffer the greatest health risk – respiratory

infections are the leading cause of death of young children worldwide (Smith, 2000). Figure 3 illustrates the effect of wood fuel on the vegetation.

Figure 6 Effects of wood fuel production on the natural environment

Source: Author's field survey 2020

2.5 Fuel Wood and Deforestation

The total land area of Ghana had 34 percent originally rainforest coverage. Today, very little is covered by forest. Since the colonial era, the exploitation of timber for commercial purposes has been part of Ghana economy income. It is only since the start of the Economic Reforms Program (ERP) in 1983 that deforestation has become a serious concern because of the over-exploitation of the forest resources. Forest resources in Ghana are being depleted at a faster rate than before compared to other developing countries. Since 1981, the average annual rate of deforestation in Ghana is estimated at 2.0% compared to 0.9% for all tropical forest, 0.6% for Zaire, and 0.6% for Brazil (WRI, 1990). In Ghana, efforts by government to reduce deforestation have yielded limited success, primarily because many of the initiatives were misguided, political crippled and or failed to deal with deforestation as a complex, dynamic and interwoven process (Marfo, 2010).

Trees and logs used for fuel wood are gather from the natural forest. A research conducted by Agyemang et al (2012) on fire wood and sustainable community development of the Upper West region revealed that about 88% of the users use live trees taken from the natural forest. His probe further revealed that producers used live trees because dead ones were almost depleted from the natural forest. Furthermore, the live trees are easier to fell and process than the dead ones leading to the felling of more trees. It was further revealed that about between 22% and 48% of the charcoal producers had strong preferences for Shea trees and mahogany as wood. The remaining 30% were indifferent and used any tree they chanced upon in their search for wood the primary raw materials for commercial charcoal production. According to him the Shea tree which has numerous economic benefits but have between 20 and 25 years of gestation are under threat of depletion from the research communities without the need for permits, the identified trees are harvested from the natural forest because it is seen as a common property resource.

Apart from the loss of food and livelihoods as a result of the cutting down of trees the earth mould method of getting firewood inflicts damage to the vegetation. The process often causes bush fires, which has implications for the sustenance of flora and fauna in the communities. Harvesting of the trees for solid fuels also destroys the ecosystem and the habitat of the animal species in our forest. It also exposes water bodies to the risk of drying up which is gradually affecting the rainfall pattern and climatic conditions of the country (Agyemang et al., 2012). This finding supports the claim that felling of trees for domestic or commercial charcoal production causes severe environmental degradation in terms of deforestation and denudation (Friends of the Earth, 2002; Makhabane, 2002; Nsuya et al.., 2011; Ottu-Danquah,2010; Songsore, 2003; Agyeman et al., 2012).

In the Kintampo North district, local chiefs issue threats of banning charcoal production as it primary raw material is wood gotten from trees because there were fears that the youth are abandoning other occupation to take up charcoal production and this could result in depleting of the forest which is largely savannah. (Amanor et al.., 2005). Although forestry management is improving and projects in countries like Malawi have encouraged use of plantation wood, the bulk of charcoal wood is clear cut from secondary and in some cases, primary forests. This is very different from small-scale rural forestry practices, where wood is often less intensively and more sustainably harvested (Bradley, 1991; Kammen and Lew, 2005).

Wood for fuel is one of the main products of the forests. Approximately 60% of the World's total wood removals from forest and outside forests are used for energy purposes. Whilst the developed countries use only 30% of wood produced for energy, the developing countries use 80% for the same purpose and the extraction of timber for wood fuels accounts for 61% of the total wood removals (FAO, 2005; Craster Herd, 2007). Energy provision is a basic human need and consumption is closely related to the level of a country's development. Wood fuels marketing actives serve as a source livelihood for most rural people and the increasing number of urban dwellers engaged in the charcoal and wood fuel trade (Anang et al, 2011).

2.6 Air Pollution

When wood burns, complete combustion gives off light, heat, and the gases carbon dioxide and water vapor (Smith et al., 2005). According to Hanna and Oliva (2015) because when wood burns complete combustion does not occur, it also produces wood smoke, which contains the following major air pollutions because of their known health effects:

Carbon Monoxide (CO) – An odorless, colorless gas, produced in large amounts by burning wood with insufficient air. CO reduces the blood's ability to supply oxygen to body tissues, and can cause stress on your heart and reduce your ability to exercise. Exposure to CO can cause long-term health problems, dizziness, confusion, severe headache, unconsciousness and even death. Those most at risk from CO poisoning are the unborn child, and people with anemia, heart, circulatory or lung disease.

Oxides of Nitrogen (NOx) – NOx impair the respiratory system and its ability to fight infection. NOx also combines with VOCs to make ozone and with water vapor to form acid rain or acid fog.

Volatile Organic Compounds (VOCs) – Evaporated carbon compounds which react with NOx in sunlight to form ozone (photochemical smog). Ozone injures the lungs and makes breathing difficult, especially in children and exercising adults. NOx and VOCs also form particulate matter through reactions in the atmosphere.

Toxic Pollutants - Wood smoke also contains VOCs, which include toxic and or cancer-causing substances, such as benzene, formaldehyde and benzo-apyrene, a polycyclic aromatic hydrocarbon (PAH). Manufactured fireplace logs, for instance, are not recommended for burning because they produce toxic fumes, including PCBs (polychlorinated biphenyls).

Researchers are now studying these and other smoke products to learn more about their effects on human health. Particulate Matter less than 10 microns in diameter (PM10) are very small droplets of condensed organic vapors of wood tar and gases. These particles are a result of unburned fuel and have a diameter of 10 microns or smaller (the diameter of a human hair is about 50 to 100 microns), which allows them to be inhaled into the lungs. Exposure to PM10 aggravates a number of respiratory illnesses. PM10 includes a smaller group of particles called PM2.5, particles with

diameters of 2.5 microns and less. These finer particles pose an increased health risk because they can lodge deep in the lungs and contain substances that are particularly harmful to human health, contributing to lung diseases and cancer. Exposure to PM2.5 may even cause early death in people with existing heart and lung disease.

2.7 Health Challenges from the Use Firewood as Household Fuel

Three billion people in the world use biomass fuel for cooking and heating, 90% of them in rural households located mainly in developing countries (Boy et al., 2000; WHO, 2002; World Bank, 2011). In countries such as Bangladesh and India, 70% of the households use biomass fuel (Balakrishnan et al., 2004; Dasgupta et al., 2006a, b; Pandey and Chaubal, 2011).

The most significant health concern using firewood is the smoke, especially, when the burning happens indoors without proper ventilation or chimneys. Together with HIV/AIDS and diarrhea, it forms the primary cause of burden of disease in Africa. Smoke contains carcinogens and small particles, which damage the lungs and respiratory organs (WHO 2009). This indoor air pollution strongly increases the risk of pneumonia and chronic respiratory diseases. It also increases the exposure to lung cancer, cataracts and tuberculosis by weakening the condition of the respiratory organs. There has also been found tentative connections between indoor air pollution and low birth weight, or ischemic heart disease as well as nasopharyngeal and throat diseases (WHO 2005).

Traditional way of cooking with firewood produces lot of smoke (K. Zschauer 2010). The health effects of smoke are especially high in low-income countries. According to the World Health Organization (WHO) lower respiratory infections were the leading

cause of mortality in 2004, causing 2,9 million deaths (in high-income countries it caused 0,3 million deaths). Acute Respiratory Infections (ARI), mainly pneumonia, was also one of the main causes of death among children under five years in Africa (WHO 2008: 1–16, 43). Smoke is particularly harmful for children who are more vulnerable to hazardous pollutants and 56% of all indoor air pollution-attributable deaths occur among children under 5 years of age (WHO 2005).

Respiratory and other health problems caused by IAP may raise the overall burden of disease among the population, which could in turn affect the performance of health systems by demanding increased economic resources and medical personnel.

2.8 Health challenges on the eye

The use of firewood and charcoal is cumbersome, drudgery and can affect the health of humans through the inhaling of smoke in burning wood or it entering the eyes.

Cataract has long been linked to cigarette smoking, and, according to the United States Surgeon General, there is sufficient evidence to label smoking as a causal factor for cataract (USA Surgeon General report, 2004). Biomass smoke condensates also contain metal ions such as lead, and lead exposure is associated with protein aggregation diseases like cataract (Susaya et al., and Schaumberg et al.)

2.9 Health challenges on the heart

Firewood is subject to incomplete combustion (Smith et al., 2005), which emits toxic carbon monoxide and particulates (WHO, 2006). Burning solid fuels produces extremely high levels of IAP, which is associated with health problems such as a cough, acute respiratory infections, and chronic obstructive pulmonary disease

(COPD) (Smith et al., 2005; Duflo et al., 2008; Rahut and Behera, 2016; Lu et al., 2017), causing 1.6 million premature deaths annually (WHO, 2002; Junaid et al., 2018).

2.10 Health challenges on the Lungs

Amy Smith reports that acute respiratory infection from indoor cooking fires is the number one cause of death in children under five in the third world. This represents nearly two million deaths per year. In addition, carbon monoxide (CO3) is a combustion product which contributes to outside air pollution. This causes lungs and eye infection among women. Even though there is an interventional program dubbed 'a world fit for children' which aims at reducing by one-third the deaths of children due to acute respiratory infections by 2015, the use of solid fuel for cooking in our homes may defeat the objective if not discouraged.

Wood smoke is a mixture of solids, gases, and liquids. Much like cigarette smoke, wood smoke contains hundreds of air pollutants that can cause cancer and other health problems. One of these pollutants that is of most concern is fine particles. The particles in smoke are tiny bits of solids and liquids made of partially burned wood. When you breathe air with wood smoke in it, you inhale the fine particles deeply into your lungs. The particles contain toxic substances that can remain in your lungs for months, causing changes that lead to diseases and structural damage. Most wood smoke particles are 2.5 microns (μm) or less in size smaller in diameter than a human hair.

Smoke related to health effects may act as surrogate for many air pollution effects where very small less than a tenth of a micron distribute widely (NAAQS); go indoors adsorb and carry other toxic combustion products on their surface and deep into the

lung. Smoke as an airborne particle are a complex mixture of extremely small solids and liquid droplets fine and ultra-fine particles that behave like a gas penetrate indoors from outside air and penetrates deep into lungs when breathing. Scientists call these particles PM2.5, also known as “fine particles” (Delgado et al., 2005). These tiny particles are so small that they get past the respiratory tract’s defenses and reach the deepest areas of the lungs, the alveoli, which are tiny air sacs where oxygen enters the blood stream. These fine particles have greater aggregate surface area and the lungs adsorb these toxic combustion products, metals, atmospheric air toxics and carry them deep into the lung that are catalytic for respiratory diseases formation (Delgado et al., 2005).

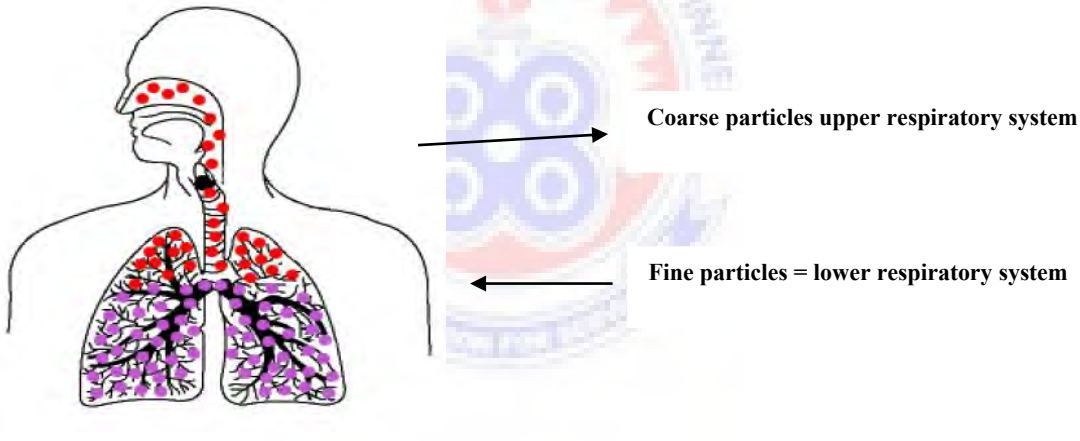

Figure 7. The lung showing how smoke particle droplets is distributed when inhaled

2.11 Health challenges on the skin

Smoke is the result of incomplete combustion, which produces tiny particles of carbon in the air. When deposited, these particulates are identified as soot (Scott, 2017). Typically, soot is representative of what has burned, but may include byproducts that at first seem unrelated to the original material (Scott, 2017). For

example, hydrogen cyanide is a byproduct of burning wool. When wood burns, it can produce manganese and benzene. As many products as there are in the world, there are equal number of byproducts produced in a fire and many are known carcinogens or extremely hazardous when inhaled or absorbed by the skin. However, the important point is that soot may be more than just a particulate hazard; it can potentially carry other chemical residues that are potentially harmful to the respiratory system of humans in the form of smoke.

2.12 Industrial challenges

Many diseases related to firewood consumption imply economic losses, specifically lost productivity for example, lost worked hours and medical expenses, which limit participation in household activities, labor markets, and school attendance, and adversely affect household development. Duflo et al. (2008) argue that problems caused by IAP can generate productivity losses, specifically through reductions in labor force participation and working hours.

Although they do not explicitly address the effects on labor variables of exposure to pollution from firewood, there are studies related to health status or health problems and their effects on labor issues such as labor force participation, hours worked, and earnings. One difficulty is that of correctly measuring people's health status, given endogen problems and misreporting in self-assessed health (Schultz and Tansel, 1997; Cai, 2010).

Using disability days as a health measure and correcting for the endogen issue using relative food prices and local health infrastructure, Schultz and Tansel (1997) found that disability days reduce wages in Ghana and the Ivory Coast by at least 10% and working hours by 3% or more. Tsafack and Zamo (2010) studied the effect of fertility

on health status and labor force participation for female workers in Cameroon. Using a simultaneous equations model and 2SLS, they found negative effects of fertility on (self-reported) health and in turn on labor force participation. Cai (2010) evaluated the relationship between health and labor force participation for Australia. Correcting for endogen due to measurement error, simultaneity, and unobserved heterogeneity by using a panel data simultaneous equations model, he found a positive effect of health on labor force participation while rejecting exogenous of the health measurements.

There is thus ample international evidence that bad health has negative labor market effects. For Mexico, however, the literature about the relation between health status and labor force participation is limited. Parker (1999) studied the effect of health on the wages of the elderly and found that those with bad health had reduced hourly earnings. Van Gameren (2008) found an increased probability of labor market participation for elderly persons in good health. Both studies used IV methods to correct for measurement error due to self-reporting of health status.

Direct evidence that fuel choice affects labor market outcomes is much more limited. Burke and Dundas (2015) studied female labor force participation and household dependency on biomass energy in 175 countries. They found that an increase in female labor force participation is associated with a reduction in the use of biomass fuels: if a household uses firewood, time is required to collect the firewood, a task that is generally carried out by women, reducing the possibility of their participation in activities outside the household. If households use less biomass fuel, women have more time, which can be used to participate in labor markets. Evidence that the pollution itself has a direct labor market effect is even scarcer, although

Hanna and Olivia (2015) explore the closure of a refinery in Mexico City, reporting a reduction in pollution and a rise in labor market participation and hours worked.

Health problems from exposure to the contaminants from burning firewood may cause difficulties in carrying out activities such as studying, domestic tasks, and participation in the labor market, which in turn can generate economic losses, specifically lost wages and increased medical expenses.

In addition to the indirect economic impacts through health, the use of biomass fuels can also directly affect the time availability particularly of women in rural areas of developing countries; the time required to collect firewood reduces their available time for activities such as paid labor outside the household (Burke & Dundas, 2015).

Hanna & Olivia (2015) also found that exposure to pollution in Mexico City resulted in reductions in labor force participation, and Zhang et al. (2009) found a negative effect of chronic disease on labor force participation in Australia.

CHAPTER THREE

METHODOLOGY

3.1 Study Area

The study was conducted in the Kwabre East Municipal area, which is located in Ashanti Region of Ghana. The Kwabre East Municipal is among the 275 Metropolitan, Municipal and District Assemblies (MMDAs) in Ghana and forms part of the 43 MMDAs in the Ashanti Region. Kwabre East Municipal, carved out of the former Kwabre Sekyere District in 1988, is located almost in the central portion of the Ashanti region.

The Municipal is bounded by Sekyere South District to the North; Kumasi Metropolis to the South; Ejisu Juaben District to the East and Afigya Kwabre District to the West. It has a population of 102,310 (GSS National Population Census, 2000) and it covers an area of approximately 148 square kilometers.

The Municipality has a total land area of 246.8 square kilometers constituting about 1.01% of the total land area of Ashanti Region. The administrative capital, Mamponteng, is approximately 14.5 kilometers from Kumasi to the north east. The Municipality is part of the greater Kumasi City Region, which is made up of Kumasi Metropolitan Area and the surrounding Districts. The population of the Municipality according to the 2010 Population and Housing Census stands at 115,556 with 55,106 males 60,450 females.

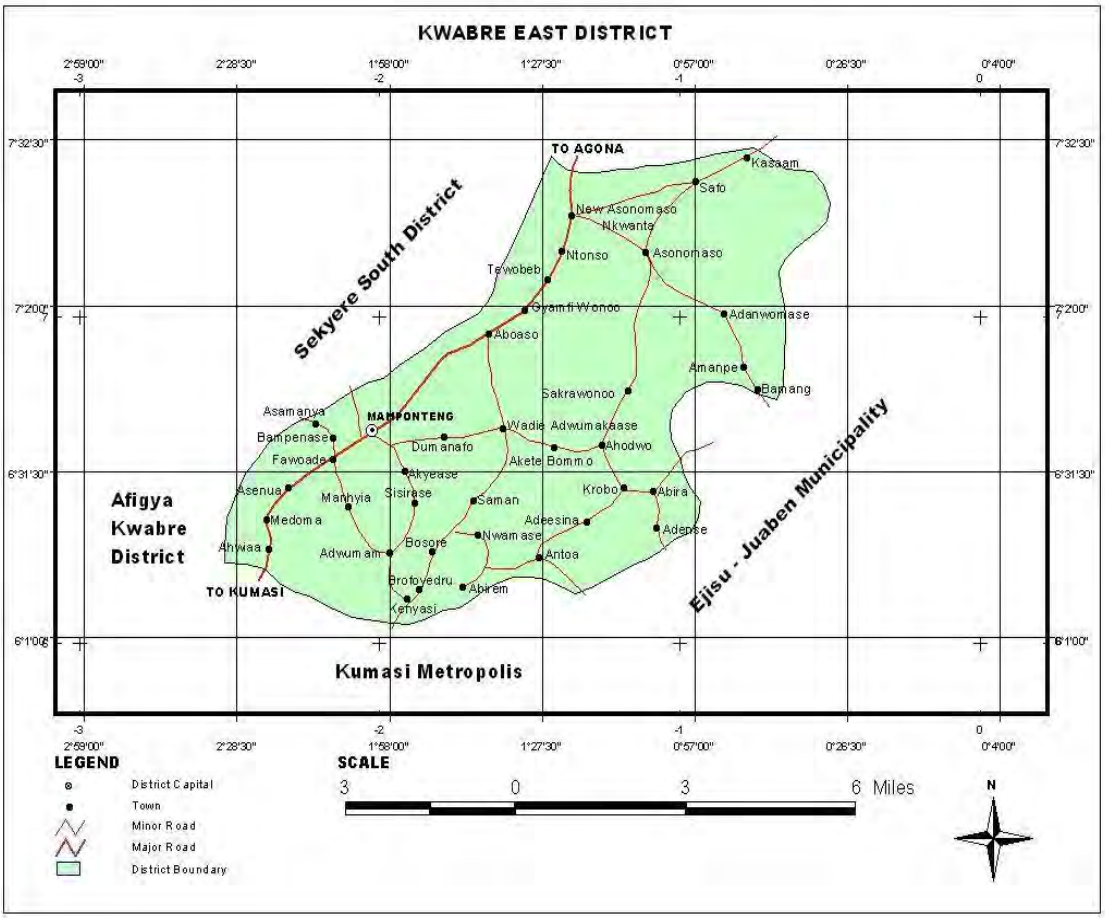

Figure 8 Kwabre East District map

Source: Ghana Statistical Service, GIS (2010)

3.2 Study Design

An important aspect of any research is the design. It is the logical sequence that connects the empirical data to the initial questions of the study and, ultimately, to its conclusions.

The study adopted the quantitative approach and a descriptive design which describes the status quo, the correlation study which investigates the relationship between variables. A descriptive design was therefore adopted because the study ultimately seeks to describe public perceptions and attitudes towards bamboo and rattan made furniture.

3.3 Study Population

The population for the study was (N=400), comprising of the household heads and other residents of the defined geographical landscape was used for the study. The population comprised 100 informants from each town namely; Mamponteng, Ntonso, Asonomaso,and Adanwomase in the Kwabre East Municipal.

3.4 Sampling Procedure and Sample Size

Simple random sampling technique was used to acquire a sample size of 250 respondents out of the population of 400. The 250-sample size comprises, 63 responses from Mamponteng, 63 responses from Ntonso, 62 responses from Asonomaso, and 62 responses from Adanwomase.

3.5 Instruments for Data Collection

Questionnaire was used to solicit data from households. The questionnaire contains a series of statements that attempt to collect information on a particular topic.

3.5.1 Pre-Test

The instrument for data collection were pre-tested with purposively sampled 20 household heads in Sunyani, because it also has similar shares certain socio-economic and ethnic characteristics with Kumasi. This was to serve as the preliminary testing of the research questions to provide insights into ideas not yet considered and problems unanticipated, which could challenge the data analysis. Furthermore, it helped to check and try the planned statistical tests of association between variables. Besides these, the pre-test enabled the researcher to revise the contents of the questionnaire,

thereby revising the instrument to achieve the reliability standards required in scientific research.

3.5.2 Ethical Issues

The research obtained a letter of introduction from the Technical and Vocational Department, of the University of Education, Winneba, Kumasi campus, which was shown to all respondents in order to establish the grounds that the research was for academic purposes only. This enabled the needed support and co-operation from the household heads. The researcher made sure to explain the purpose of the study to all participants and only included them in the study based on their informed consent. The respondents were assured of the confidentiality of their responses.

3.6 Fieldwork

The questionnaires were sent to target respondents in their homes during the evening hours, when most of them would have returned from work. The researcher paid subsequent visits to their houses until all the targeted respondents were acquired and responses were taken.

3.6.1 Field Challenges

A major challenge was getting sufficient number of the interview schedules completed within the time scheduled for the data collection. Another challenge was that most of the respondents were workers who only returned from work in the evening. These challenges prolonged the period for the data collection.

3.7 Data Analysis

Data was summarized and presented using frequency counts, percentages, and means involving tabulating and description of data. All quantitative analysis in the study used percentages. The tabulation of the questionnaire helped to determine if the instrument has followed uniformly and to ensure that all items has been responded to. The responses to the questionnaires were coded by assigning numbers to each category of the questionnaire for analysis purposes.

CHAPTER FOUR

DATA COLLECTIONS AND RESULTS

4.1 Demographic Data

A demographic data is the data collected about the characteristics such as age, gender, and income of the population.

4.1.1 Demographic of respondents

The demographic characteristics of the respondents as reported in Table 4.1 shows among the 250 randomly selected respondents for analysis after the data collection, a percentage of (35.2%) of the respondents were aged 41-50 years while (26.8%) were aged 51 years and above. Again those aging between 20-30 and 31-40 years represented (12.4%) and (25.6%) respectively as reflecting in the table.

Analysis on the level of education for the respondents showed that (38.8%) had no formal education followed by (26.0%) with Tertiary Education, Secondary Education (20.8%), and lastly Primary education tabulating (14.4%) of total respondents.

Table 4.1 Demographic of respondents

Characteristics	Respondents	Percentage
Age groups		
20 - 30	31	12.4%
31 – 40	64	25.6%
41 – 50	88	35.2 %
51 and above	67	26.8 %
Total	250	100%
Education Background		
No formal education	97	38.8%
Primary education	36	14.4%
Secondary Education/ Technical School	52	20.8%
Tertiary (polytechnic / University)	65	26.0%
Total	250	100%

Source: Field Data 2020

4.1.2 Household Records

The locality of the various houses used for the survey were categorized which saw respondents identifying their homes as either a traditional or modern based on the buildings set-up. From the responses (n=128, 51.2%) argued that they had traditional homes as against (n=122, 48.8%) insisting that they had modern homes set-up as reported in the Table 4.2.

Table 4.2 classification of house locality

Household type	respondents	Percentage
Traditional	128	51.2%
Modern	122	48.8%
Total	250	100%

Source: Field Data 2020

4.1.3 Household population

The various households' population was sought from various homes and the Table 4.3 reports. Household population of (n=70, 28.0%) was the highest data with household density of individuals between 1-5 stay in the house. Houses with individuals between 11-15 representing (n=62, 24.8%) was next and followed by 6-10 representing (n=53, 21.2%) and 16-20 representing (n=49, 19.6%). Household population between 21-25 and 26-30 recorded (n=16, 6.4%) and (n=0, 0.0%) respectively.

Table 4.3 household population

Item	Respondents	%
1-5	**70**	28.0
6-10	**53**	21.2
11-15	**62**	24.8
16-20	**49**	19.6
21-25	**16**	6.4
26-30	**0**	0.0
Total	250	100%

Source: Field Data 2020

4.2 Factors Influencing Choosing Firewood as Domestic Fuel

4.2.1 Primary type of energy or fuel used in homes

Selection of household primary fuel are preference of individuals in home especially as the heads in a home. Among fuel presented to respondents, firewood was highly preferred by respondents, which recorded ninety-two a percentage of thirty-six point eight followed by charcoal registering ninety-one a percentage of thirty-six point four. Liquefied Petroleum Gas recorded sixty-seven a percentage of twenty-six point eight and both kerosene and sawdust recorded zero each.

Table 4.4 primary fuel use in homes

Item	Respondents	%
Firewood	92	36.8
Charcoal	91	36.4
Liquid petroleum gas (LPG)	67	26.8
Kerosene	0	0.0
Sawdust	0	0.0
Total	250	100%

Source: Field Data 2020

4.2.2 Secondary type of energy or fuel used in homes

Individual resort to other source of fuel for domestic purposes when their primary source tends to fail them and in appreciating this heads of various homes responds was that in such instances charcoal representing more than half of respondents (n=134, 53.6%) proffered t use it. Firewood (n=74, 29.6%) was the next common secondary fuel used by respondents and liquified petroleum gas was third recording (n=42, 16.8%).

Table 4.5 secondary energy or fuel used in homes

Item	Respondents	%
Firewood	74	29.6
Charcoal	134	53.6
Liquid petroleum gas (LPG)	42	16.8
Kerosene	0	0.0
Sawdust	0	0.0
Total	250	100%

Source: Field Data 2020

4.2.3 Reasons for preferring firewood as domestic fuel

Among the reasons why respondents preferred firewood to other fuel for use in their homes the Table 4.6 shows some (n=172, 11.5%) taught is comparatively cheap and (n=169, 11%) deem that it cooks faster. Reasons being that respondents are custom to firewood usage which represented (n=166, 11.0%) and they can be gotten from around their area of aboard and they are readily available witness (n=163, 11.0%) each. Again (n=157, 10.5%) reported that they had been using it as the only source of energy whiles (n=147, 10%) recorded that they had been using firewood for a long time so they preferred it. The convenience in using firewood reflected (n=137, 9.0%) and (n=121, 8.0%) settled on firewood is safe and less risky to use. Lastly, (n=103, 7.0%) posited that firewood burns faster than other fuel.

Table 4.6 Firewood as domestic fuel preference

Item	Frequency	%
Can be gotten from around my area of aboard	163	11.0
I have been using it as the only source of energy	157	10.5
I'm custom to firewood usage	166	11.0
Cheap comparatively	172	11.5
Readily available	163	11.0
Burns more faster than other fuel	103	7.0
Have been using it for a long time	147	10.0
Safe and less risky	121	8.0
Convenience	137	9.0
Cooks faster	169	11.0

Source: Field Data 2020

4.2.4 Sourcing of firewood

How respondents obtained firewood was also consider. The Table 4.7 gives and account of their sourcing which included getting it from their farms representing a frequency of a hundred and ninety-five with a percentage of thirty-five. Buying from wood sellers came second with (=182, 32%) and was followed by off-cuts from sawmills and community woodlots accumulating (n= 97, 17 %) and (n=87, 16 %) accordingly.

Table 4.7 sourced of firewood

Item	Frequency	%
From your farm	195	**35**
Buy them from wood sellers	182	**32**
Community woodlots	87	**16**
Off cuts from sawmills	97	**17**

Source: Field Data 2020

4.2.5 Periodic sourcing of firewood

Frequency in restocking their firewood lot theses respondents reported that a majority of them does so twice in a week which represented (n=84, 30 %) and restocking once a week recorded (n=74, 26 %) and those who restock once every two weeks represented (n=47, 17 %) with those who replace as their stock gets finished recording (n=77, 27 %).

Table 4.8 periodic sourcing of firewood

Item	Frequency	%
Once a week	74	26
Twice a week	84	30
Once every two weeks	47	17
Once every month	0	0
More than four weeks	0	0
As stock gets finished	77	27

Source: Field Data 2020

4.2.6 Cost of firewood

Most of the respondents had to purchase their firewood used in their home, at various cost, and the monetary factor was not exceptional. The Table 4.9 shows that these respondents' payments varied. From the table (n=94,37.6 %) spends between GH₵ 10.00 to GH₵ 50.00 who were in the majority and those who spend GH₵ 50.00 and GH₵ 100.00 represented (n=84, 33.6 %) as against those who spends between GH₵ 100.00 and GH₵ 200.00 totaling (n=72, 28.8 %).

Table 4.9 cost of firewood

Item	Frequency	%
Between GH₵ 5.00 and GH₵ 10.00	0	0
Between GH₵ 10.00 and GH₵ 50.00	94	37.6
Between GH₵ 50.00 and GH₵ 100.00	84	33.6
Between GH₵ 100.00 and GH₵ 200.00	72	28.8

Source: Field Data 2020

4.3 Domestic Role of Firewood Usage in Homes

4.3.1 Firewood Consumption Pattern

How these respondents use firewood for domestic chores was also investigated. The Table 4.10 reflects how they put firewood to use. Those who use it for cooking specific food pulled (n=210, 84 %), those who used more firewood during the dry season recorded (n=177, 73 %), those who used it for boiling water for bathing represented (n=163, 65 %) and those who use firewood for all their cooking activities and for illumination recorded (n=94, 38 %) and (n=45, 18 %) respectively.

Table 4.10 firewood consumption usage in homes

Item	Yes	%	No	%
You use firewood for all your cooking activities	**94**	38	**156**	62
You use firewood for boiling water for bathing	**163**	65	**87**	13
At times you use firewood for illumination (lightening) in your house	**45**	18	**205**	82
You use more firewood during raining season than the dry season	**98**	39	**152**	61
You use more firewood during dry season than raining season	**177**	71	**73**	29
You keep firewood burning all night to keep warm	**0**	0	**250**	100
You use firewood for cooking specific food	**210**	84	**40**	16

Source: Field Data 2020

4.4 Health Consequences from the Use of Firewood Domestically

4.4.1 Cooking area

Concerning areas where cooking is done, a majority of the respondents sought to operate in an opened space area representing (n=162, 65 %) of total respondents as against those operating in a closed space area representing (n=88, 35 %) as presented in the Table 4.12.

Table 4.12 cooking area

Item	Frequency	%
Open space area	**162**	65
Closed space area	**88**	35
Total	250	100%

Source: Field Data 2020

Cooking devices used

According to the survey respondents who used three stones device for cooking as reporting in the Table 4.13 is (n= 147, 70%). This table also shows that (n=51, 24 %) used improved fire place and (n=12, 6 %) used ceramics built-up in the walls of the kitchen.

Table 4.13 cooking devices used

Item	Frequency	%
Improved fire place	51	24.0
Three stones	147	70.0
Ceramic built-up in the wall	12	6.0
Modified car tyre rim	0	0.0
Total	250	100%

Source: Field Data 2020

Nature of firewood used domestically

According to the Table 4.14 (n=147, 70 %) uses seasoned firewood for domestic purposes whiles (n=126, 60 %) uses unseasoned firewood for their domestics related chores. Almost all the respondents who used firewood had to split their firewood before using representing (n=210, 100%) and those who adherent used large size firewood showed (n=197, 46 %) as seen in the Table 4.14.

Table 4.14 Nature of firewood used domestically

Item	Yes	%	No	%
Seasoned firewood	**84**	40.0	**126**	60.0
Unseasoned firewood	**63**	30.0	**147**	70.0
Split firewood	**210**	100	**0**	0.0
Large size firewood	**197**	46.0	**113**	54

Source: Field Data 2020

4.4.2 Change in skin colour due to contact with firewood smoke

Some respondents believed that they noticed changes in their skin color after they interacted with firewood for their domestic chores as documented in the Table 4.15. The change in skin color affected (n=86, 34.4 %) of respondents and did not for (n=74, 29.6 %) whiles (n=90, 36 %) where not sure if their engagements with firewood had effects on the color of their skin.

Table 4.15 change in skin colour in relations to contact with firewood

Item	Frequency	%
Yes	**46**	22
No	**74**	35
Not sure	**90**	43
Total	250	100

Source: Field Data 2020

4.4.3 Knowledge about firewood smoke and its' negative health effects

From the Table 4.16 it was evident that theses respondents were aware of the health effects firewood smokes brings. They were aware that it can cause indoor air

pollution, death, respiratory tract infections, lung cancer, and cataract in the eyes and can affect the weight in babies.

Table 4.16 Knowledge on the negative health effects of firewood

ITEM	AWARE		UNAWARE	
	Fq	%	**Fq**	%
Firewood as cooking fuel used can cause injuries	**164**	15.0	**86**	4.50
Firewood as cooking fuel used can cause indoor air pollution	**157**	14.0	**93**	8.0
Firewood as cooking fuel used can cause death	**153**	14.0	**97**	8.50
Firewood as cooking fuel used can cause ill health	**250**	23.0	**0**	0.0
Firewood as cooking fuel used can cause respiratory tract infection	**121**	11.0	**130**	11.0
Children under the age of 5 years are more affected by type of cooking fuel used	**69**	6.0	**181**	16.0
Lung cancer could be caused by type of cooking fuel used	**93**	8.0	**157**	14.0
Firewood as cooking fuel used can cause cataract	**74**	7.0	**176**	15.0
Firewood as cooking fuel used can affect the birth weight of babies	**22**	2.0	**228**	20.0

Source: Field Data 2020

4.4.4 Ailment suffered because of using firewood as domestic fuel

From the Table 4.17 it is reflecting indications of various ailments suffered by respondents due to the usage of firewood as their domestic fuel. These ailments ranged from catarrh, eye irritation, cough, dry throat, nausea, sneezing leading to bleeding nose, shortness of breath, lungs issue asthma and reported headache.

Table 4.17 ailments suffered because of using firewood as domestic fuel

ITEM	YES		NO	
	Fq	%	**Fq**	%
Catarrh	**123**	49.0	**127**	51.0
Eye irritation	**192**	77.0	**55**	23.0
Cough	**145**	58.0	**105**	42.0
Dry throat	**112**	45.0	**138**	55.0
Nausea	**96**	38.0	**154**	62.0
Sneezing leading to bleeding nose	**22**	9.0	**228**	91.0
Shortness of breath	**44**	18.0	**206**	82.0
Lungs issue	**16**	6.0	**234**	94.0
Asthma reported	**146**	58.0	**104**	42.0
Headache	**196**	78.0	**54**	22.0

Source: Field Data 2020

Usage of firewood for domestic chores

In table 4.19, 178 (71.2%) respondents uses firewood as fuel for domestic chores while 72 (28.8%) do not.

Table 4.19 usage of firewood for domestic chores

ITEM	Yes		No	
	Fq	%	**Fq**	%
Do you use firewood for your domestic house chores	**76**	71.0	**31**	29.0

Source: Field Data 2020

4.4.5 Frequency in the usage of firewood

Enquiring on the frequent use of firewood in urban homes majority of them (n=108, 43.2 %) reported that they used it once awhile. From the table some too used it for specific chores which represented (n=76, 30.4 %) and those who used it always represented (n=66, 26.4 %) according to the Table 4.20.

Table 4.20 frequency in the usage of firewood

ITEM	Fq	%
Always	**66**	26.4
Once awhile	**108**	43.2
For specific chores	**76**	30.4

Source: Field Data 2020

4.4.6 Type of stove arrangement operated in your kitchen

The stoves used by these respondents in the urban area when it came to firewood as fuel for domestic purposes (n=68, 64 %) stated that they set up three stones whiles (n=29, 27 %) attached bricks to the wall and a hand full of (n=10, 9 %) did use metallic stoves.

Table 4.21 type of stove arrange operated

ITEM	Fq	%
Three stones	**117**	46.8
Metallic stove	**57**	22.8
Bricks attached to walls	**76**	30.4

Source: Field Data 2020

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter discusses the results of the questionnaire responded by survey participants. The objective this study is to investigate household usage of firewood and its challenges and effects on its users in the Kwabre East Municipality of the Ashanti region. The discussion purposes the headings linking to the research questions where systematically review to manifest collated data from respondents.

5.1 Summary of Findings

Findings from data analysis and discussion in chapter four have been outlined below;

- Most households in the Kwabre East Municipality use firewood as fuel for cooking due to its cheapness as compared to other sources. Out of the 250 sampled responses, 172 responses, being the highest number among all possible factors influencing their choice of fuel, posited that the cheap price of firewood had greatly influenced their decision to use it as fuel.
- One of the challenges of the usage of firewood was that cooking areas in various households were always smoky, full of ashes and there is excessive heat. Because of respondents' awareness about the smoke, ashes and excessive heat that come when using firewood, most of them opted to cook in an open space area.
- Headache was a common health complication among users of firewood as fuel for cooking. Out of the 250 sampled responses, 196 responses suffered headache resulting from the prolong use of firewood as fuel.
- One of the consequences of the usage of firewood is that users developed a smoky body scent as a result of constant exposure to the smoke from

firewood. Most respondents were found to using the old form of cooking (three stones) with firewood. Frequent exposure to the smoke caused unpleasant body smell.

- Another challenge of the usage of firewood as fuel was that smoke from firewood had an adverse influence on both taste and smell of food cooked with it. Due to the gaseous nature of the smoke from firewood, it was able to meddle the taste and smell of food in most cases.

5.2 Conclusion

- Most people in the Kwabre East Municipal mostly use firewood as source of fuel for cooking.
- Available evidence suggests that the general population used for the survey is exposed to a very high level of pollutants in the wood smoke from the use of firewood domestic cooking needs.
- This exposure is associated with a number of diseases such as eye problems and respiratory problems on users of firewood as fuel for cooking.

5.3 Recommendation

❖ Strategies and interventions aimed at reducing smoke emissions should therefore, be up and regulated.

❖ There is need for more vigorous campaigns on the dangers of wood smoke and the need for switching to clean fuels.

❖ There is also need for adequate education on ways to reduce exposures to these emissions especially among women and those with occupational exposure to wood smoke.

- Furthermore, government and international agencies should help by subsidizing the cost of clean fuels and making them available in rural areas and further research on the effect of exposure to wood smoke pollutants in other population groups, especially among the elderly.
- Again, large epidemiological studies, especially prospective cohort and case-control studies with improved measures of exposure to wood smoke for adequately estimate on health in this population.

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APPENDIX A

UNIVERSITY OF EDUCATION, WINNEBA

COLLEGE OF TECHNOLOGY EDUCATION, KUMASI CAMPUS

QUESTIONNAIRE FORM

Please I am**, Beatrice Boadi** a student at University of Education Winneba, Kumasi Campus. I am pursuing Bachelor of Science Education in catering and hospitality and need information from your company to enable me to: **Household usage of firewood and its challenges as fuel.**

I promise to treat any given information as confidential and your involvement is highly needed and would be appreciated. Please tick (√) / circle (o) where appropriate.

DEMOGRAPHIC DATA

1. What is your level of education?

(a) No formal education ☐

(b) Primary education (J. S. S) ☐

(c) Secondary education (S. S. S. / Technical School) ☐

(d) Tertiary education (Polytechnic / University) ☐

2. What is your age?

(e) Less than 20 ☐

(f) 20 – 30 ☐

(g) 31 – 40 ☐

(h) 41 – 50 ☐

(i) 51 and above > 60 ☐

3. Household type Tradition ☐ modern ☐

4. Household population .....

WHAT FACTORS INFLUENCE TO THE CHOICE OF FIREWOOD CONSUMED

5. Primary type of energy or fuel used for house use

Firewood ☐
Charcoal ☐
Liquid petroleum gas (LPG) ☐
Kerosene ☐
Sawdust ☐
Other …….

6. Secondary type of energy or fuel used for house use

Firewood ☐
Charcoal ☐
Liquid petroleum gas (LPG) ☐
Kerosene ☐
Sawdust ☐
Other …….

7. If your source of energy is firewood, why do you prefer firewood over other energy sources

Can be gotten from around my area of aboard ☐
I have been using it as the only source of energy ☐
I'm custom to firewood usage ☐
Cheap comparatively ☐
Readily available ☐
Burns more than other fuel ☐
Have been using it for a long time ☐
Safe and less risky ☐
Convenience ☐
Cooks faster ☐
Others (Specify) ……

8. Have you been introduced to another source of energy but you refused to adopt. Yes No

9. do you consider firewood as a convenient energy for cooking? Yes No

10. Do you see firewood as fast fuel energy for household use? Yes No

11. How do you get supplies of your fire wood?

From your farm ☐
Buy them from wood sellers ☐
Community woodlots ☐
Off cuts from sawmills ☐

12. Do you always get your supplies from this source as started above? ☐ Yes ☐ No

13. If you gets your supplies from sawmill off cuts or your farm what would be your average distance covered in Kilometers

0-1 km ☐
1.5-2 km ☐
2.5-3 km ☐
3.5-4 km ☐
4.5 and above ☐

14. How periodic do you get new stock of firewood?

Once a week ☐
Twice a week ☐

Once every two weeks

Once every month ☐

More than four weeks ☐

15. On the average how much do you spend within a month on purchasing firewood?

Between GH₵ 5.00 and GH₵ 10.00 ☐

Between GH₵ 10.00 and GH₵ 50.00 ☐

Between GH₵ 50.00 and GH₵ 100.00 ☐

Between GH₵ 100.00 and GH₵ 200.00 ☐

Other specify ……..

ROLE OF FIREWOOD USE IN THE LOCAL'S HOUSEHOLD ENERGY CONSUMPTION PATTERN?

Local household pattern

Thick that which applies to you.

NO	ITEM	YES	NO
16	You use firewood for all your cooking activities		
17	You use firewood for boiling water for bathing		
18	At times you use firewood for illumination (lightening) in your house		
19	You use more firewood during raining season than the dry season		
20	You use more firewood during dry season than raining season		
21	You keep firewood burning all night to keep warm		
22	You use firewood for cooking specific food		

23. What is the common type of wood usually supplied you for fuel wood?

Wawa ☐

Mahogany ☐

Sapele ☐

Odum ☐

Teak ☐

Framo ☐

Mango tree ☐

HEALTH CONSEQUENCES FROM THE USE OF THE FIREWOOD

24. Area reserve for cooking is in a

Open space ☐

Closed space ☐

25. How do you stock reserved fuel wood

In the open ☐

In the open but under a shed ☐

In a built up room ☐

Other (Specify)

……

……

26. What sought of cooking devices do you use?

Improved Fire Place ☐

Three stones ☐

Ceramic built-up ☐

Modified car tyre rim ☐

27. Do you always use

Dried firewood.	Yes	☐	No	☐
A few sticks	Yes	☐	No	☐
Split firewood.	Yes	☐	No	☐
Lid on the pot.	Yes	☐	No	☐

28. Does cooking area trapped smoke produced from fuel wood passes through a chimney.

Yes ☐ No ☐

29. Does the smoke from the fuel wood have direct contact with your skin?

Yes ☐ No ☐

30. If your answer to question 19 is yes, have you noticed any change in your complexion since working with fuel wood? ☐ Yes ☐ No

31. Do you have to use deodorant on your body to kill a peculiar scent?

Yes ☐ No ☐

32. Cooking is mostly done by Male ☐ Female ☐

32. Knowledge of the Effects of firewood as domestic Fuel on Health

ITEM	AWARE	UNAWARE
Firewood as cooking fuel used can cause injuries		
Firewood as cooking fuel used can cause indoor air pollution		
Firewood as cooking fuel used can cause death		
Firewood as cooking fuel used can cause ill health		
Firewood as cooking fuel used can cause respiratory tract infection		
Children under the age of 5 years are more affected by type of cooking fuel used		
Lung cancer could be caused by type of cooking fuel used		
Firewood as cooking fuel used can cause cataract		
Firewood as cooking fuel used can affect the birth weight of babies		

33. Are you suffering from or have been diagnosed of any of the following ailment?

ITEM	YES	NO
Catarrh		
Eye irritation		
Cough		
Dry throat		
Nausea		
Sneezing leading to bleeding nose		
Shortness of breath		
Lungs issue		
Asthma reported		
Headache		

HOUSEHOLD FIREWOOD USAGE PATTERN

34. How do you consider where you stay as? rural area ☐ urban area ☐

If you consider where you stay as urban, please answer the questions that follow.

35. Do you use firewood for domestic chores? Yes ☐ No ☐

36. If yes,

How frequently do you use it

Always ☐ Once awhile ☐ For specific chores ☐

37. How do you get your firewood?

From the market ☐ Pick them around yourself ☐ From my farm ☐

38. What form of kitchen do you have?

Enclosed area ☐ Only covered roof in an opened area ☐ in an total open area ☐

39. If your kitchen is enclosed, do you have a chimney for smoke outlet?

Yes ☐ No ☐

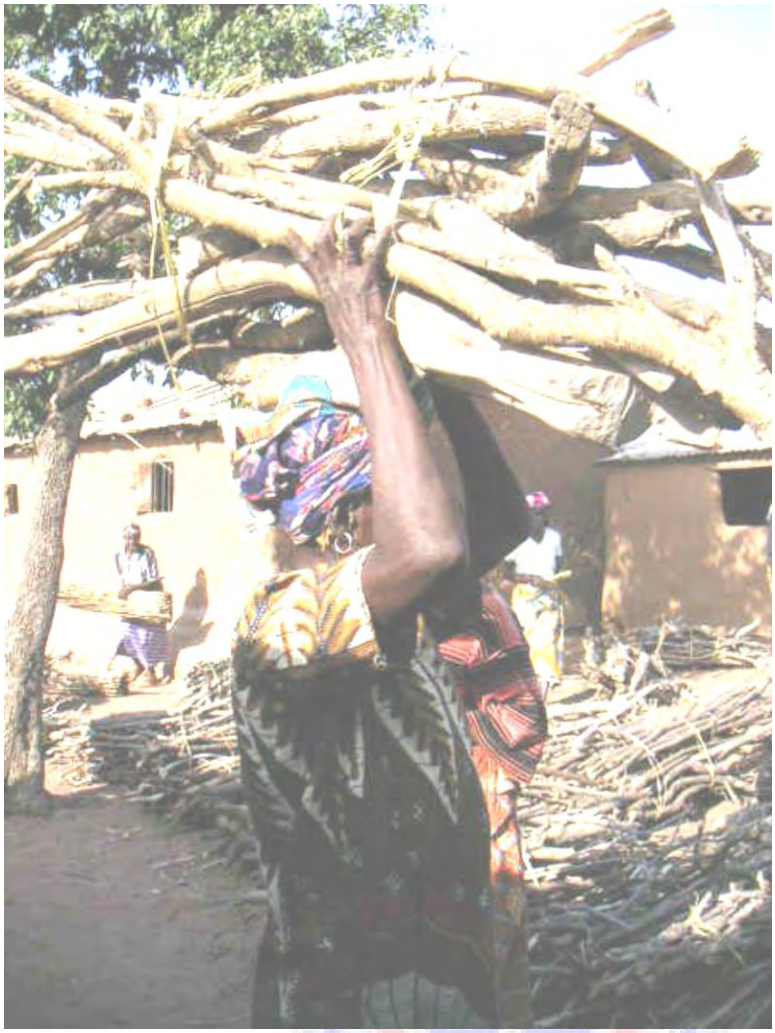
40. What form of stove arrangement do you operates when using firewood?

Three stones ☐ |Metal stove ☐ Bricks attached to the wall ☐

APPENDIX B

Wood sticks piled up in the open to season and be used as firewood for domestic purposes

Fireplace built-up attached to the kitchen wall



Purchased firewood transported on the head to residence

Purchased firewood transported by donkey on truck

Woman standing suffered right eye infection due to constant contact with firewood smoke