



Original Research Article

Gender assessment of hazard exposure, risk awareness and cultural perceptions associated with firewood usage: A case study of Mendakwe village in Cameroon

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Firewood has been a major source of energy for ages and is still a primary source of energy in rural households worldwide. Its mode of acquisition and usage disproportionately exposes different persons to physical burden, time trade-off and health hazards. This study assessed gender differences in firewood consumption in order to design strategies to protect disadvantaged groups. A structured questionnaire was used to obtain data from in 255 households randomly selected from 34 clusters about Hazard exposure, risk awareness and cultural perceptions concerning wood fetching, preparing and burning. The data was analyzed on SPSS and the results showed that, 42.2% males and 57.8% females engaged in wood consumption activity. 51.6% females and 7.7% males burned wood. 52.2% of all persons did not perceived a health risk while, 10.2% were ignorant of any consequences. 60.72% of persons had a strong cultural perception while 39.28% had a weak cultural perception of fuel wood consumption. Girls were 1.07 times more culturally inclined to firewood usage than boys and 6 times more exposed to related health hazards than boys. Girls were also 1.08 times more likely to be ignorant of the consequences associated with firewood usage than boys. Promotion of clean energy technologies through research, investment and education and sensitization programs should be promoted with emphasis on females. Current household cooking devices were to be redesigned and adapted to address cultural needs as well as reduce associated current health risks due to air pollution. Intervention strategies to prevent deforestation by discouraging wood sales were also recommended.

Key words: Gender, firewood, hazard, indoor air pollution, risk, exposure, Mendakwe, Cameroon.

INTRODUCTION

According to Broadhead et al. (2001), developing countries account for almost 90 percent of the world's firewood consumption with wood being the primary source of energy for cooking and heating. Access to clean household energy is imperative in the achievement of the Sustainable Development Goals (SDGs) amongst which include; Eradicate extreme poverty, Promote gender equality and empower women, Promote maternal and child health, and

Ensure environmental sustainability. Due to the increasing scarcity of firewood, households respond by substituting different fuels or by adopting fuel-saving technologies (Dovie et al., 2004) such as more efficient stoves and perhaps even two or three households cooking together (Deweese, 1989).

While energy poverty is a burden for all poor populations, women are disproportionately impacted since

their access to energy resources and benefits is further limited by gender disparities (Danielsen, 2012). The effects of energy poverty on women and girls are far reaching and include the physical and time effects of drudgery in travelling long distances to fetch firewood, health effects of indoor pollution, and decreased school attendance (Danielsen, 2012). Fordham (2003), affirmed that interventions which do not integrate hazards and development have a negative impact on the advancement and promotion of women in development. In another study Toonen (2009), found out that in order to build adaptive capacity to changes such as fuel switching, understanding the needs and problems of the users is critical. Maser and Navia (1997) and Hiemstra-van der Horst and Hovorka (2008), refuted the simplified model that people will 'naturally' use more modern cooking technologies if they have the means.

Women's high participation in subsistence production results in high social status (Sanday, 1973). The reduction and greater flexibility of occupational working time, and men's gradual realization that a gender-egalitarian dual role of occupational and of family work is in their own long-term interest (Agassi, 1989). Increasing risk awareness should lead to precautionary behavior (Becker, 1974; Rosenstock, 1974). Caution should be taken on a simplistic view of ethnicity, and researchers and policy makers should acknowledge the diversity of cultural reality (Durie, 1995).

Statement of the problem

Women in particular become victims of different health hazards such as uterine prolapses due to firewood scarcity and carrying heavy loads of wood soon after childbirth (Earth and Staphit, 2002; Nishimizu, 2001). Women and children are the ones most affected by the domestic air pollution due to low quality biomass burning (Dutta, 1997; Batliwala and Reddy, 1996). Acceptance of energy saving technologies is taken for granted without carefully analyzing the needs and priorities of women and rural energy needs for domestic, agricultural and small scale informal production activities, where women predominate, are given less priority (Skutsch, 1996). According to study by Toonen, (2009) in Burkina Faso it was concluded thus "most people are reluctant to change habits, changing cooking customs is not done easily," and Osei (1996) in a similar study determined that the transformation to modern technologies requires a change in socio-cultural systems – i.e. a change in people's attitudes and beliefs.

Women carry greater loads than men but have a lower intake of calories in cultures with gender-based food hierarchies (Dankelman, 2010; WHO, 2011). The physical burden involved in carrying out these responsibilities can pose a serious strain on women's health because carrying heavy loads over long periods can lead to early ageing of the vertebral column (WHO, 2011). Women's poor nutritional access in relation to their workload leads to increased prevalence of anemia, delivery problems, and increased rates of intrauterine growth retardation, low

birth weight, and perinatal mortality (WHO, 2011). Similarly, indoor pollution is a serious problem for women and girls due to inefficient burning of biomass indoors.

Improved access to clean energy for women can reduce health risks associated with some traditional fuels such as respiratory diseases and eye conditions, and with acquiring fuel by travelling long distances or through dangerous terrain. This can also allow for more time for other activities such as schooling or training (Heltberg, 2004). Cultural factors may play an important role in cooking fuel decision-making, and should not be overlooked (Toonen, 2009).

Literature review

Global estimates reveal that above two billion people worldwide depend on firewood as their main source of fuel (Kaygusuz, 2011). The usage of firewood as a major source of energy for cooking and heating, dates as far back as several thousand years and still remains a primary energy source worldwide (Soussan, 1988). Firewood is the leading biomass energy source for mainly poor people amongst the more than 2 billion people depending on it worldwide (Troncoso et al., 2007).

It is important to note that firewood is used for both domestic and industrial purposes in both rural and urban areas throughout much of the developing world (Dovie et al., 2004). Approximately 1.7 billion cubic meters of firewood and charcoal were produced in the world in 2004, out of which 0.7 billion cubic meters of firewood were produced in Developing countries (IEA, 2006). In developing countries, firewood accounts for 80% of all household energy consumption (Sharma and Banskota et al., 2005). In Asia, approximately 1,700 million people are expected to rely on firewood by 2030 (Arnold et al., 2006). In Africa, the number of people using firewood and other biomass fuels in Africa is projected to increase by 40% between 2000 and 2030 to about 700 million while in sub-Saharan Africa, mainly rural populations consume firewood, though towns and city dwellers also consume substantial amounts of firewood (FAO, 1997).

Health Implications

Good health is not merely the absence of disease, but a state of complete physical, mental and social well-being (WHO, 1981). Good health enables people to participate fully in society and provides the "means by which people can pursue their goals in life" (Seedhouse, 1993). Poverty has long been recognized as an important determinant of ill health (Calman, 1997). The extent of relative poverty is reflected in the degree of inequality in income and wealth distribution within a country. Recent research suggests that greater income inequality is associated with increased mortality (Kawachi and Kennedy, 1999).

There is also good evidence that unemployment is detrimental to both physical and mental health (Morrell, 1998). Educational attainment is strongly related to

subsequent occupation and income level, and poor social circumstances in early life are associated with significant chances of low educational achievement (Wadsworth, 1997). Educational achievement is not just a function of an individual's abilities and aspirations, but is influenced strongly by socioeconomic circumstances (Benzeval, 1995).

The high dependence of developing countries on firewood is a world concern due to its devastating environmental consequences such as forest degradation, soil erosion and the negative health effects of indoor air pollution resulting from the burning of wood (Bruce et al., 2000). Firewood and its mode of usage makes it a source of indoor air pollution leading to numerous health problems, which is the main cause of death among young rural children (Smith, 2000). Being the world's eighth largest health risk, indoor air pollution is a leading cause of death and disease, accounting for 2.7% of global losses of healthy life (WHO, 2003). In the combustion process, firewood releases particulates and harmful substances that increase indoor exposure above safety thresholds (Barnes, 2005). The result is acute bronchitis, obstructive pulmonary disease, eye problems etc. (Smith, 2002). Women, children, and the elderly are particularly exposed because they spend more time indoor and are more likely exposed to smoke when cooking. Even when smoke is vented through chimneys and windows, it contributes to outdoor air pollution, especially in densely populated areas (Heltberg, 2005).

Gender issues

In rural communities of most developing countries, energy is the primary responsibility of women and most of which is derived from traditional biomass fuels such as agricultural wastes, charcoal and firewood (Carr and Hartl, 2010). The physical burden associated with wood-fetching can pose a serious hazard on women's health due to carrying heavy loads persistently over long periods thus resulting into early ageing of the vertebral column (WHO, 2011). Women's poor nutritional access in relation to their workload leads to increased prevalence of anemia, delivery problems, and increased rates of intrauterine growth retardation, low birth weight and perinatal mortality (WHO, 2011). Similarly, indoor air pollution is a serious problem for women and girls. Inefficient burning of biomass indoors releases high levels of black carbon and accounts for nearly 2 million deaths per year, mainly of women and children in the poorest communities in the world (Parry, 2007).

Females spend a lot of time fetching firewood, cooking and performing other household chores, which introduce another gender-based dimension of poverty being time poverty. Women in rural areas are time poor due to the fact that their ability to undertake other productive activities like education is compromised by time spent on energy production activities like firewood-fetching (World Bank, 2006). Prove of this is found in the difference in literacy rates and school enrolment levels for males and females—

two third of all illiterate adults are females (UNESCO, 2012). Due to women's collection of firewood and water largely by foot, climate change-related scarcities of natural resources will increase women's time poverty (World Bank, 2009). Access to modern clean energy alternatives will not necessarily ensure greater gender equality in roles, but can potentially diminish most of the burdensome and unhealthy aspects of their daily lives and expand the development options available to women, families and communities" (ENERGIA, 2011).

Perceived Health Risk

According to the "Health Belief Model", increasing risk perceptions should lead to precautionary behavior (Becker and Rosenstock, 1974). The "Theory of Reasoned Action" holds that behavior is predicted to follow a behavioral intention, which in turn is based on an overall attitude (Ajzen and Fishbein, 1975). Theory of Planned Behavior suggests that perceived control is an independent construct that affects both intentions as well as future behavior (Ajzen, 1991). Perceived controllability has also been shown to affect people's perceptions of risk and intentions to seek assistance (Raghubir and Menon, 2005).

According to the protection motivation theory (PMT), people are more likely to protect themselves when they anticipate negative consequences, have the desire to avoid them, and feel they have the ability to take preventive measures (Becker and Maiman, 1975). Enhancing the elements of risk appraisal such as risk perception, and perceived severity, has a combined positive effect on changing intentions and behavior toward safety (Sheeran et al., 2013). According to the risk compensation or risk homeostasis theory, people tend to take more risks when they feel a greater sense of security (Wilde, 1994). Situated rationality theory makes the argument that it is erroneous to presume that safe behaviors are inherently rational and high-risk behaviors are inherently irrational (Cafri et al., 2008; Keating and Halpern-Felsher, 2008).

Habituated action theory argues that engaging in high-risk behaviour many times without a negative outcome often decreases the perceived risk associated with this behaviour. Those who repeatedly perform a high-risk action without an adverse consequence eventually become desensitized to the risk (Weyman and Kelly, 1999). Social action theory states that people take risks because of peer pressure or a general community perception that an activity is low risk. Individuals conform to group norms to avoid sanctions and start to identify with the group and accept group perceptions and behavior (Cooper et al., 2003). Social control theory states that connectedness to organizations promotes behavior conformity, which can reduce the probability of high-risk behavior (Hirschi, 1969).

Cultural perception

Caution should be taken on a simplistic view of ethnicity,

Table 1. Distribution of boys & girls in Household by Level of education Status

Level of Education		Number & percentage of boys in HHs	Number & percentage of girls in HHs	Proportion of Total boys/girls in HHs
1.	Low Education	429 (56.9%)	325 (43.1%)	754 (55.4%)
2.	High Education	151 (55.9)	119 (44.1%)	270 (19.8%)
3.	No Applicable Education	63 (18.7%)	274 (81.3%)	337 (24.8%)
Total		643	718	1361

Low Education =secondary school; High Education =high school and above; No applicable Education=primary school and below

and researchers and policy makers should acknowledge the diversity of cultural reality (Durie, 1995). fuel switching remains a challenge and is influenced by factors such as cooking customs and habits in addition to economic costs and Cultural factors may play an important role in cooking fuel decision-making and should not be overlooked (Toonen, 2009). cultural perceptions that food cooked on clay stoves tasted better than food cooked on other stoves affects switching from biomass to cleaner fuels (Wijayatunga and Attalage, 2003); Boadi and Kuitunen, 2006).

METHODOLOGY

The study design was a descriptive case study with a sample size of 271 households. The sample size was derived based on previous similar studies and choosing a hypothetical sample size of $n=240$ households, a value of $s=15.8$ for the sample standard deviation was calculated. Assuming a margin of error of 2 ($E=\pm 2$), with a 5% level of significance (95% confidence, $\alpha=0.05$, $Z=1.96$, power=0.08) and substituting the values in the sample size formula $n = \left(\frac{z \cdot s}{E}\right)^2$ yielded a sample size of 246 households. A Minimum sample size of 246 households was upwardly Adjustment by 10% ($246 + 10\%$ of 246) to carter for non responses or recording errors giving a total of 272 households. A random sampling technique was used to select 8 households per cluster from 34 clusters (34 residential quarters) that made up Mendankwe village, giving a total sample size of 272 households. The study used both primary data and secondary data to observe the nature of the problem under investigation. An average of 5 persons per household from 272 households was studied and gender aggregates were derived from individual responses and responses provided by household heads.

Primary data was generated from respondents using a structured questionnaire as well as summaries of responses obtained from focus group discussions and participant observation activities relevant to the study objectives. The questionnaire generated data on the following variables: firewood usage (i.e fetching, buying, preparing, and burning), risk awareness and cultural perceptions for boys and girls. Focus group technique provided in-depth information and clarity on the questionnaire design while

participant observation enabled the researchers to verify the consistency and accuracy of various survey responses. Secondary data was gathered from existing literature derived from the Delegation of Territorial Administration, The Delegation of Forestry, The local council and the Fon's Palace. These documents provided data on population demographics, number and names of residential areas as well as the cultural setting, background and geographic location of the study area. Secondary data also portrayed a schematic picture of the traditional and legal administrative set up, socioeconomics and basic wood consumption activities all of which played a vital role in the achieving of the study objectives. The generated data was analyzed on SPSS using descriptive and statistical methods.

RESULTS AND DISCUSSION

Education Status of Household Members by Gender

As shown in Table 1, 75.2% of household members, had one form of formal education or the other while 24.8%, did not have formal education. The findings approximately matched the National literacy values from National Institute of Statistics (NIS) 2011 estimated at 71.3% with minimum secondary education and 28.7% with no education level in Cameroon; the difference was 4%. This is consistent with a similar study by Toonen (2009) which showed that educational level was relevant in determining higher calculated opportunity costs for firewood collection which in turn motivates switching of fuel.

Distribution of Firewood usage by Gender

Table 2 showed that division of labor in firewood usage was gender-based with boys and girls disproportionately (42.2% versus 57.8%) involved in all activities related to firewood usage. These were consistent with the results of Danielson (2012) which revealed that women were disproportionately impacted by the burden of energy poverty due to gender disparities. Burning (cooking) revealed an even sharper disproportion for boys and girls (7.7% versus 51.6%) rendering girls most vulnerable to potential health hazards stemming from wood smoke exposure hus it has confirmed results from previous studies in which it was found out that Women and children were

Table 2. Distribution of Household Members by Gender and Firewood usage

Wood consumption activity	# of males involved in activity	# of females involved in activity	Total # of males & females involved in activity
Wood -fetching	233 (41.8%)	221 (29.0%)	454 (34.4%)
Wood -preparing	194 (34.8%)	82 (10.8%)	276 (20.9%)
Wood -buying	87 (15.6%)	66 (8.7%)	153 (11.6%)
Wood- based cooking	43 (7.7%)	393 (51.6%)	436 (33.1%)
Overall Wood- consumption Activity	557 (42.2%)	762 (57.8%)	1319 (100%)

Table 3. Hazard exposure status of boys and girls for firewood usage

Activity groups under risk comparison	Fuelwood consumption activity	Relative risk of potential hazard exposure (95% confidence interval)	Results
Males versus females	Wood-fetching	1.4	Males are 1.4 times more exposed to wood-fetching hazards than females
Males versus females	Wood-preparing	3.2	Males are 3.2 times more exposed to wood-preparing hazards than females
Males versus females	Wood-buying	1.8	Males are 1.8 times more exposed to wood-buying hazards than females
Females versus males	Wood-based cooking	6.7	females are 6.7 times more exposed to cooking hazards than males

Table 4. Distribution of Household Members by Gender and Risk Awareness Status of Firewood usage

Risk Awareness Status	# of males	# of females	Total # of males and females
Aware of Risks associated with firewood usage	302 (52.1%)	356 (52.3%)	658 (52.2%)
Not aware of Risks associated with firewood usage	221 (38.1%)	253 (37.2%)	474 (37.6%)
Ignorant of any consequences	57 (9.8%)	72 (10.6%)	129 (10.2%)
Total for all risk awareness categories	580 (46%)	681 (54%)	1261 (100%)

the ones most affected by the domestic air pollution due to low quality biomass burning (Dutta, 1997; Batliwala and Reddy 1996). Being the world's eighth largest health risk, indoor air pollution is a leading cause of death and disease, accounting for 2.7% of global losses of healthy life (WHO, 2003).

Hazard Exposure Status

Risk analysis shown on Table 3 revealed a difference in hazard exposure between males and females in wood-based cooking with females being 6 times more exposed to cooking hazards than males due to negative health effects of indoor air pollution resulting from the burning of wood (Bruce et al., 2000).

Risk Awareness Status of firewood usage

Table 4 showed that 10.2% were ignorant of any consequences, 52.2% perceived a health risk and 37.2% did

not perceive a health risk associated with firewood usage. This suggested that firewood usage was highly influenced by health risk perceptions thus underscoring the need for attitude and behavior-modifying strategies to be incorporated in interventions geared towards discouraging firewood usage. Studies in the "Health Belief Model", (Becker, 1974; Rosenstock, 1974), and "Theory of Reasoned Action", (Ajzen and Fishbein, 1975), supports this imperative. The results also revealed a contrast between the actual hazard posed by fuelwood consumption and the population health risk perception and the higher risk group (females) also exhibited a risk perception contrary to the actual hazards they were exposed to as well as a higher ignorance to consequences associated with firewood usage.

Gender distribution of risk awareness status

Results in Table 5 show that Boys and girls had equal likely chances of perceiving a Risk associated with firewood

Table 5. Distribution of risk awareness status amongst boys and girls

Gender	Risk awareness status for firewood consumption			
	Risk	No Risk	Ignorant	Total
boys	302	221	57	580
girls	356	253	72	681

Table 6. Population distribution of Cultural perception regarding firewood usage

Cultural perception of firewood usage	# of boys	# of girls	Total # of boys and girls
Strong cultural perception	320 (58.5%)	405 (62.6%)	725 (60.72%)
Weak cultural perception	227 (41.5%)	242 (37.4%)	469 (39.28%)
Total for all categories	547 (45.8%)	647 (54.2%)	1194 (100%)

Table 7. Distribution of cultural perception status amongst boys and girls

Gender	Cultural perception status for firewood usage		
	Strong	Weak	Total
boys	320	227	547
girls	405	242	647

usage while males were 1.02 times more likely to perceive *No risk* associated with fire usage than females. Females were 1.08 times more likely to be ignorant of any consequences of firewood usage than males.

The results in Table 6 showed that 60.72% of the overall population had a strong cultural perception of firewood usage while 39.28% had a weak cultural perception. This suggested that firewood usage was highly associated with cultural perceptions thus spelling out the need for cultural stereotypes-modifying strategies to be incorporated in interventions directed towards discouraging firewood usage. cultural perceptions that food cooked on clay stoves tasted better than food cooked on other stoves affects switching from biomass to cleaner fuels Wijayatunga and Attalage, (2003); Boadi and Kuitunen, (2006).fuel switching remains a challenge and is influenced by factors such as cooking customs and habits in addition to economic costs and Cultural factors may play an important role in cooking fuel decision-making and should not be overlooked (Toonen, 2009).

According to Table 6 girls were 1.07 times more culturally inclined to firewood usage than boys.

According to Table 7 Females were 1.07 times more culturally inclined to firewood usage than males. A slightly greater proportion of girls showed a stronger cultural inclination to firewood usage than boys.

Inferential deductions

According to Table 7 above firewood usage was associated with Risk Awareness (RA), Cultural Perception (CP) and gender. There was no association between wood-buying and RA and CP.

CONCLUSION AND RECOMMENDATION

Division of labor in the usage of firewood was strictly based on gender. Firewood usage was highly associated with negative health hazards and social consequences and females were the dominant group that was adversely affected being six times more exposed to cooking related hazards than males. A greater proportion of females than males had a low level of education, and was more ignorant of any consequences associated with firewood usage.

Females showed an overall stronger propensity to persist in firewood usage than males, in spite of their higher exposure to hazards and negative consequences and the main influencing factors were cultural perception and risk awareness. The government should design short and long term interventions geared towards implementing alternative clean household energy forms in poor rural communities. Education programs on risks associated with firewood usage and breaking of cultural stereotypes concerning division of labor and wood-based cooking should be incorporated in the national education curriculum with special focus on females. Where energy-switching is difficult, current cooking mechanism should be adapted to address

Cultural stereotypes and at the same time mitigate related hazards like the use of more efficient cook stoves.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

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