Assessing the Status of Improved Stove and its Contribution towards the Conservation of Forest Resources, Bulehora wordea, West Guji zone, Ethiopia

ABSTRACT

The study aimed to assess energy consumption patterns in Bule hora town, Ethiopia, focusing on the use of biomass energy and the impact on deforestation and land degradation. A total of 150 households were surveyed using a structured questionnaire that considered various socioeconomic variables. The findings revealed a high demand for fuel wood due to the prevalent use of traditional stoves for cooking. Despite financial constraints hindering the adoption of improved stoves, a majority of respondents expressed a strong preference for them. The multiple linear regression analysis showed that socioeconomic factors significantly influenced attitudes towards the use of improved stoves. It is crucial to raise awareness among local residents about the benefits of using improved stoves and for various stakeholders to collaborate in the distribution of these stoves. Government subsidies may also be necessary to facilitate the widespread adoption of energy-efficient technologies in Bule hora town, ultimately contributing to forest conservation efforts.

Keywords: Deforestation, Energy efficient; Fuel wood; Forest resources; Multiple linear regression

INTRODUCTION

Deforestation is a major environmental concern in Ethiopia, driven largely by the unsustainable use of biomass for cooking (Bezu *et al.,* 2018). In rural areas, traditional stoves are highly inefficient, requiring large quantities of firewood to cook meals. This dependence on firewood contributes to deforestation and land degradation, putting vital ecosystems at risk (Waktole *et al.*, 2020). Driven primarily by the unsustainable use of biomass for cooking, particularly in rural areas (Bezu *et al*., 2018), traditional stoves are highly inefficient, demanding vast quantities of firewood. This dependence not only depletes valuable forest resources but also contributes to land degradation, jeopardizing vital ecosystems and biodiversity (Waktole *et al.,* 2020). Studies estimate that over two-thirds of Ethiopia's population relies on traditional

biomass for cooking, highlighting the urgency of addressing this issue (Alemu *et al.,* 2019). Ethiopia grapples with a pressing environmental challenge: deforestation. Fuelwood dependence for cooking in rural areas, primarily due to inefficient traditional stoves, stands as a major culprit (Bezu *et al.,* 2018). These stoves require vast amounts of firewood, leading to unsustainable resource extraction and land degradation that threatens vital ecosystems (Waktole *et al.,* 2020). Studies estimate that over two-thirds of Ethiopians rely on traditional biomass for cooking, highlighting the urgency of addressing this issue (Alemu *et al.,* 2019). Fuel wood collection for cooking is the primary driver of forest degradation in these nations (Skutsch *et al.,* 2018), yet quantifying this phenomenon is difficult even with sophisticated approaches such as remote sensing (Herold *et al.,* 2019). Furthermore, indoor air pollution induced by traditional cooking poses a significant health risk (Johnson *et al*., 2020). As a result, measures to minimize fuel wood usage have the potential to alleviate the effects of climate change while both conserving forests and improving human livelihoods. To obtain energy for residential consumption, fuel demand dominates the forest product. For example, in 2021, Ethiopia's overall demand for domestic energy was estimated to be at 68 million m3 of wood equivalent, with fuel wood accounting for 45 million m3. This implies that wood fuel is the single most important source of household energy in the entire country. In 2021, Ethiopia's expected annual fuel wood consumption was around 45m3, whereas the estimated yearly additional output available for fuel wood was 12.4 m3 (EFAP, 2021). In this situation, fuel wood deficit was 32.5 million m^3 (GTZ, 2021). This suggests that the exploitation of forest resources has been making above its regeneration capacity which results in the decline of growing stock over the time period. This in turn has brought a serious and sever problem of deforestation, soil erosion, moisture stress, resource use conflicts, shortage of water supply for different purposes, poverty, and less conducive for health (Hagu, 2019). Over half of the world people still use solid biomass or coal fuels for basic cooking and heating (Smith *et al., 2022*). Increasing attention is being paid to the consumption of such fuels because of their role in producing damages at three distinct scales (Pant *et al*., 2018). At the household and village level, combustion of solid fuels produces pollution that is damaging to health and a large contributor to the global burden of disease (Ezzati and Kammen, 2018; Mehta and Shahpar, 2018) and imposes a high time burden on those collecting fuel wood, typically women and girls. At the community and national level, when fuel wood is harvested in unsustainable manner, its consumption contributes to the loss of forest and associated ecosystem services. Ethiopia has a severe shortage of fuel wood as a result of the inefficient use of traditional cooking methods. For example, most people utilize biomass energy for cooking and heating,

and the equipment they use is primarily the simplest stove type, three stone fires, which are created by arranging three stones in a triangle pattern around the fire. The main disadvantages of using three stones (traditional mud stoves) are their inconvenience, exposure to fire hazards, poor quality and high smoke caused by incomplete combustion of the fuel wood, low efficiencies due to excessive heat loss to the surroundings due to wind, and poor control over the fire. Improved cookstoves offer a transformative solution for combating deforestation and promoting sustainable resource management. These meticulously designed stoves achieve significantly higher fuel efficiency compared to their traditional counterparts. This translates to a reduced demand for firewood, mitigating pressure on dwindling forest resources (Gebremedhin *et al*., 2015). The benefits extend beyond environmental gains. Improved stoves contribute to improved indoor air quality, reduced respiratory health problems, and time savings associated with gathering less firewood (Sovani et al., 2022). These stoves are designed to burn fuel more efficiently, reducing the amount of firewood needed for cooking. By promoting the adoption of improved stoves, communities can lessen their reliance on forest resources and contribute to forest conservation efforts (Gebremedhin *et al.,* 2015). “Injera” is the staple flat bread for the majority of Ethiopians and also in most households in Bule hora town because it is used in daily meal. For example, baking “Injera” accounts for over half of all the household energy consumption in Ethiopia. As it requires quick and fast heat evenly distributed over energy under the traditional ceramic plate, but there is high dissipation of heat energy to the surrounding environment. This suggests that there is high fuel wood consumption at household level in Bule hora town. To meet such household energy demands, people spend more of their working time to collect fuel wood. Moreover, the usage of cow dung, leaves and crop residues as sources of fuel wood which otherwise could be used as organic fertilizer to boost agricultural productivity. In addition, to full fill their fuel wood needs, local people also cut trees from the forests which ultimately lead to the deterioration of the forest resources in the study site. The majority of residents of Bule hora town and its surroundings use traditional fuels such as wood, crop wastes, and animal dung to meet their households' energy demand. As a result, the town and its surrounds have suffered from environmental degradation caused mostly by the loss of plant cover, agriculture leftovers, and animal manure. The situation is exacerbated by the ever-increasing need for fuel wood caused by population growth. This is mostly due to a lack of research-based quantitative data on the alternate uses of upgraded stoves for cooking or as energy sources. This study delves into the current state of improved stoves within Bulehora woreda, located in the West Guji zone of Ethiopia. The primary goal is to assess the prevalence of improved stove usage among households and evaluate their

effectiveness in conserving forest resources. Through a well-designed household survey and interviews with local energy experts, the study aims to shed light on the factors influencing the adoption of improved stoves within the region. By identifying these factors, the study can contribute to the development of targeted strategies for promoting wider use of improved stoves and fostering a shift towards more sustainable cooking practices in Bulehora.

METHODOLOGY

Study site description

The study was conducted in Bule hora town. The details of the study site were as followed.

Location

Bule hora is a town found in Oromia Regional State, Ethiopia. It is situated in West Guji Zone about 467 kilometers south west of Addis Ababa on the highway to Moyale. The town is located at latitude and longitude of 9°41′N and 39°32′E, respectively. The average altitude of the town is about 2,840 meters

Climate

Bule hora town is one of the coolest towns which are found at subtropical zone of Ethiopia. For example, the average annual temperature of the town during day and night hours is 20.7 °C and 8.2 °C, respectively. The mean annual precipitation in the town is about 964mm.

Methods

Data collection

Initially, a preliminary survey was carried out in order to get better information about the study area and the types of data to be collected.

The household survey

The household survey was conducted by administering structured questionnaires, which included both closed- and open-ended questions, to households residing in two randomly selected kebeles within Bule hora town. These kebeles were chosen randomly using a lottery system based on their numbers. The survey aimed to gather primary data on various

socioeconomic variables such as gender, age, family size, occupation, livestock ownership, education level, length of residency, land ownership, annual income, accessibility to different energy sources, and use of improved stoves. A total of 150 households participated in the survey, with 75 households from each kebele. The data was collected through house-to-house interviews. In addition to the household survey, interviews were conducted with energy experts and other professionals working in the energy development sectors in the town to provide supplementary information. The data collection took place in May 2023.

Independent variables

Independent variables were derived from the following 21 questions: (i) sex, (ii) age, (iii) level of education, (iv) family size, (v) occupation type, (vi) annual income, (vii) livestock ownership, (viii) wanted to keep more livestock than had at present, (ix) length of residence in the area (in years), (x) history of settlement in the area, (xi) had the plan to stay in the area in the future, (xii) private land ownership, (xiii) had allocated land for woodlot plantations, (xiv) got enough supply of fuel wood throughout the year from their land with the existing trees, (xv) had a shortage of fuel wood, (xvi) the type stove that the respondents use for baking "injera", bread, etc., (xvii) the type stove that the respondents use for cooking stew, sauce and boiling purposes, (xviii) familiarity with improved stove, (xix) knowledge to use improved stove, (xx) knew about the contribution of improved stove to reduce the problem of fuel wood shortage and thereby contributing to the conservation of the forest resource, and (xxi) The fuel wood and energy consumption efficiencies of improved stove over traditional stove.

Dependent variable

The dependent variable, i.e. attitude towards ‘the use of improved stove over traditional stove’ derived from the statement “agree that the respondents had positive attitudes towards the use of improved stove over traditional stove.

Data analyses

Quantitative analysis methods were employed to analyze and interpret the data based on its nature. Descriptive statistics, including measures such as mean, standard deviation, and proportion, were utilized to examine household characteristics. Furthermore, a multiple linear regression model set at an alpha value of 0.05 was applied to analyze and predict the value of

the dependent variable, which is the attitude towards 'the use of improved stove over traditional stove'. These analyses were conducted using SPSS version 21.

RESULTS AND DISCUSSION

The survey encompassed 150 households, evenly distributed between Bule Hagala Kebele and Goro Gudina Kebele, each comprising 75 households. The gender distribution showed that 45% of respondents were male, while 55% were female. The average age of participants was 38.6 years, with a standard deviation of 13.2, and the average family size was reported as 4.32 persons with a standard deviation of 1.98. In terms of education, the respondents' levels varied, with 11% being illiterate, 12% literate, 19% having completed elementary education, 25% with secondary school education, 22% holding a diploma, 10% a degree, and 1% a master's degree. Notably, none of the respondents were engaged in crop cultivation or livestock rearing, with 17% involved in mixed farming and the remaining 83% in occupations such as student roles, daily employment, merchant activities, and government jobs. The average annual income was reported as 10,963.96 Ethiopian Birr, with a standard deviation of 13,170.01. Regarding livestock ownership, 28% of households reported owning livestock, while 72% did not. Of those surveyed, 21% expressed a desire to increase their livestock holdings, with reasons ranging from having enough grazing land (10%), using livestock as insurance during crop failure (7%), and for dairy production (2%), while 81% did not feel the need to keep more livestock than they currently had. The respondents had an average length of residence in the area of 30.35 years, with a standard deviation of 16.82. When asked about their history of settlement in the area, 22% inherited land, 4% settled out of personal interest, 28% were settled by the state, 24% bought land, and 22% fell under other categories (Table 1).

Table 1. Table showing socio-demographic characteristics of the respondents

Variable	Descriptive Results	Proportion (%)
Locality	Bule hagala Kebele (75 households)	50
	Goro gudina Kebele (75 households)	50
Total sample size (*n*)	150 households	

Sex	Male	45
	Female	55
Age	Mean = 38.6 years; SD = 13.2	
Family size	Mean = 4.32 persons; SD = 1.98	
Level of education	Illiterate	11
	Literate	12
	Elementary	19
	Secondary school	25
	Diploma	22
	Degree	10
	Masters	1
Occupation type	Crop cultivation	0
	Livestock rearing	0
	Mixed farming	17
	Others (e.g., student, daily employment, merchant and government jobs)	83
Annual income	Mean = 10,963.96 ETB; SD = 13,170.01	
Livestock ownership	Yes	28
	No	72
Wanted to keep more livestock than had at present	Yes	21
	No	79
Reason to keep more livestock	Enough grazing land	10
	Insurance during crop failure	7
	Dairy production	2
	No	81
Length of residence in the area (years)	Mean = 30.35; SD = 16.82	
History of settlement in the area	Inherited land from my ancestor	22
	Settled by my own interest	4
	Settled by the state	28
	Bought land	24
	Others	22

Table 2: Table showing attitude of the respondents towards the use of improved stove over traditional stove

Variable	Descriptive Results	Proportion (%)
Had the plan to stay in the area in the future	Yes	73
	Unsure	19
	No	8
Had private land ownership	Yes	53
	No	47
Had allocated land for woodlot plantations	Yes	23
	No	77
Purpose of planting trees	For fuel wood	23
	No planting tree	77
Get enough supply of fuel wood throughout the year from their land with the existing trees	Yes	21
	No	79
Had a shortage of fuel wood	Yes	75
	No	25
Method used to manage fuel wood shortage	Purchasing additional fuel wood	40
	Using electrification	29
	Collection of fuel wood	23
	Other	7
The main source of fuel wood for household consumption	Fuel wood	66
	Electrification	34
The type of stove that the respondents use for baking "injera", bread, etc.	Traditional enclosed mud stove	41
	Mirit or improved injera baking stove	28
	Electric based “injera” baking stove	31

As shown in table 2, the survey findings revealed that a significant majority of respondents, approximately 73%, had plans to stay in the area in the future, while 19% were unsure and 8% did not intend to remain. Regarding private land ownership, 53% of respondents reported owning land, while 47% did not. Only 23% of respondents had allocated land for woodlot plantations, with the majority, 77%, not having done so. Among those who planted trees, 23% did so for fuel wood purposes, while 77% did not plant trees at all. When asked if they could obtain a sufficient supply of fuel wood throughout the year from their existing trees, only 21% responded affirmatively, while 79% indicated otherwise, suggesting a shortage of fuel wood. To address this shortage, 40% of respondents managed by purchasing additional fuel wood,

29% used electrification, 23% collected fuel wood, and 7% employed other methods. Fuel wood was reported as the main source for household consumption by 66% of respondents, while 34% relied on electrification. In terms of stoves used for baking injera, bread, and other purposes, 41% preferred traditional enclosed mud stoves, 28% used Mirit or improved injera baking stoves, and 31% utilized electric-based injera baking stoves.

Table 3: Table showing knowledge of respondents

Variable	**Descriptive Results**	**Proportion (%)**
The type stove that the respondents use for cooking stew, sauce and boiling purposes	Modern stove	51
	Open fire	8
	Enclosed clay/mud	15
	Traditional metal tri-pond stove	31
Familiarity with improved stove	Yes	61
	Unsure	6
	No	33
Knew to use improved stove	Yes	61
	No	39
The main reason that restrained the respondents not to use the improved stove	Income constraint	25.3
	Too expensive	11.3
	No supply	3.3
	Lack of interest	1.3
	others	59
Knew about the contribution of improved stove to reduce the problem of fuel wood shortage and thereby contributing to the conservation of the forest resource	Yes	78
	Unsure	7
	No	15

The fuel wood and energy consumption efficiencies of improved stove over traditional stove	High efficiency	65
	Low efficiency	7
	Unsure	19
	No idea	9

As shown in the table 3, the survey data indicated that for cooking stew, sauce, and boiling purposes, respondents predominantly used modern stoves (51%), followed by traditional metal tri-pond stoves (31%), enclosed clay/mud stoves (15%), and open fires (8%). In terms of familiarity with improved stoves, 61% of respondents reported being aware of them, while 6% were unsure, and 33% had no knowledge of them. Similarly, 61% of respondents knew how to use improved stoves, while 39% did not. Among those who did not use improved stoves, the

main reasons cited were income constraints (25.3%), costliness (11.3%), lack of supply (3.3%), lack of interest (1.3%), and other reasons (59%). A significant majority of respondents (78%) acknowledged the potential of improved stoves in reducing fuel wood scarcity and contributing to forest conservation. When asked about the fuel wood and energy consumption efficiencies of improved stoves compared to traditional stoves, 65% perceived improved stoves as highly efficient, while 7% viewed them as less efficient. Additionally, 19% were unsure about the efficiency levels, and 9% had no idea about the comparative efficiency of the stoves.

Belief statements of the respondents

Belief of the respondents regarding usefulness of the improved stoves over traditional ones was assessed using Likert scale (Fig 1). *Scale values (Strongly agree = 5 through Strongly disagree = 1) were used to calculate mean (*M*) and standard deviation (*SD*) values, where higher values indicate more positive attitudes towards the use of improved stove over traditional stove.

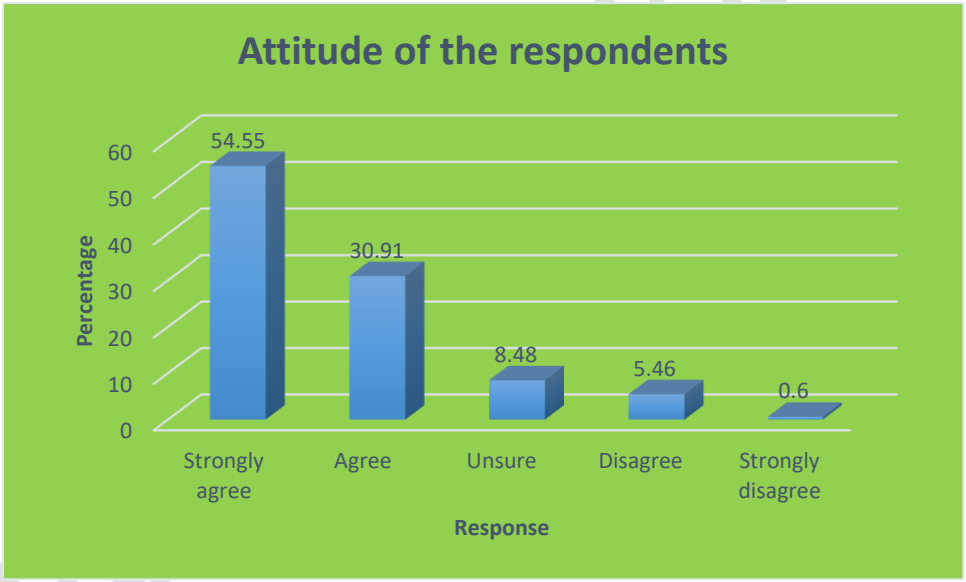

Figure 1: Figure showing Belief statements of the respondents

As shown in figure 1, the data on belief statements regarding attitudes towards the use of improved stoves over traditional stoves revealed that 54.55% of respondents strongly agreed, while 30.91% agreed with the statement. Additionally, 8.48% were unsure, 5.46% disagreed, and only 0.60% strongly disagreed with the idea of preferring improved stoves over traditional stoves. The mean agreement score was 4.35, with a standard deviation of 0.87, indicating a relatively high level of agreement among respondents towards the positive attitudes regarding the use of improved stoves compared to traditional stoves.

Multiple linear regression model to predict attitudes of the respondents

As shown in table 4, the regression analysis results examining the factors influencing attitudes towards the use of improved stoves over traditional stoves revealed several significant findings. Among the demographic variables, the level of education had a positive influence on attitudes, with a coefficient of 0.12 and a statistically significant t-value of 1.71 ($p = 0.040$). This indicates that individuals with higher levels of education were more likely to have positive attitudes towards using improved stoves. Livestock ownership also played a significant role, with a negative coefficient of -0.17 and a t-value of -2.58 ($p = 0.011$), suggesting that respondents without livestock were more inclined towards positive attitudes regarding improved stove usage. Furthermore, familiarity with improved stoves ($ß = 0.17$, $t = 2.34$, $p = 0.021$), knowledge of how to use improved stoves ($ß = 0.25$, $t = 3.47$, $p = 0.001$), and awareness of the benefits of improved stoves in reducing fuel wood shortage and forest conservation ($ß = 0.32$, $t = 3.76$, $p = 0.001$) were all significantly associated with more positive attitudes towards their adoption. Additionally, beliefs about the fuel wood and energy consumption efficiencies of improved stoves compared to traditional stoves had the strongest influence, with a coefficient of 0.62, a high t-value of 5.56, and a very low p-value of 0.0001, indicating a robust impact on attitudes. On the other hand, the type of stove used for cooking stew, sauce, and boiling purposes showed a negative association with positive attitudes ($ß = -0.25$, $t = -3.43$, $p = 0.001$), suggesting that those using traditional stoves for these cooking activities were less likely to have favorable attitudes towards improved stoves. Overall, the results highlight the importance of education, familiarity with, and knowledge of improved stoves, as well as perceived efficiency gains, in shaping positive attitudes towards their adoption. Addressing these factors through targeted awareness campaigns and educational programs could help promote the uptake of improved stoves and contribute to sustainable energy practices in the community.

Table 4. Multiple linear regression model to predict attitudes towards 'the use of improved stove over traditional stove'. + indicates a positive change in attitude and - a negative change in attitude.

Variable	**Attitude towards** 'the use of improved stove over traditional stove'		
	ß	***t***	***P* value**

Intercept	+ 5.16	48.08	-
Sex (Male = 1; Female = 2)	0.03	0.50	0.622
Age	0.09	1.22	0.225
Level of education	0.12	1.71*	0.040
Family size	-0.08	-1.20	0.232
Occupation type	-0.05	-0.70	0.486
Annual income	0.06	0.86	0.392
Livestock ownership (Yes = 1; No = 2)	-0.17	-2.58*	0.011
Wanted to keep more livestock than had at present (Yes = 1; No = 2)	0.07	0.98	0.328
Length of residence in the area (in years)	0.05	0.66	0.513
History of settlement in the area	-0.10	-1.44	0.151
Had the plan to stay in the area in the future (Yes = 1; No = 2; Unsure = 3)	-0.03	-0.37	0.715
Private land ownership (Yes = 1; No = 2)	0.05	0.69	0.491
Had allocated land for woodlot plantations (Yes = 1; No = 2)	0.02	0.33	0.741
Get enough supply of fuel wood throughout the year from their land with the existing trees	-0.01	-0.10	0.920
Had a shortage of fuel-wood (Yes = 1; No = 2)	-0.04	-0.65	0.518
The type stove that the respondents use for baking "injera", bread, etc.	0.11	1.56	0.121
The type stove that the respondents use for cooking stew, sauce and boiling purposes	-0.25	-3.43*	0.001
Familiarity with improved stove	0.17	2.34*	0.021
Knowledge to use improved stove	0.25	3.47*	0.001
Knew about the contribution of improved stove to reduce the problem of fuel wood shortage and thereby contributing to the conservation of the forest resource	0.32	3.76*	0.001
The fuel wood and energy consumption efficiencies of improved stove over traditional stove	0.62	5.56*	0.0001

Standardized coefficients were reported; *represents significance at the 95% confidence level; [b]Adj. $R^2 = 0.34$, df = 20; $F = 75.55$, overall $P < 0.0001$.

DISCUSSION

The study suggested that the local people in the study site preferred to use biomass as a source of energy for household consumption. One of the possible reasons could be the ease of accessing the biomass energy source in the surrounding environment. For example, previous studies noted that many rural people living in several sub-Saharan countries including Ethiopia rely on biomass fuel to satisfy the household energy demands (Gurung and Oh, 2020; Bekele, 2020). Moreover, as compared to the modern source of energy (e.g. electricity), the market price of biomass fuel is affordable by many poor people in the developing countries like Ethiopia (Girma, 2019). This study is the first attempt that tried to quantitatively evaluate the attitudes of local people towards 'the use of improved stove over traditional stove in bule hora town. Generally, the study demonstrated that a greater percentage of respondents had positive (71.4%) rather than negative (28.6%) attitudes towards 'the use of improved stove over traditional stove'. This could be attributed by the knowledge of the respondents about the contribution of improved stove to reduce the problem of fuel wood shortage and thereby contributing to the conservation of the forest resources in the study site. For example, as compared to traditional stoves, about 65% of the respondents confidently noted that the fuel wood and energy consumption efficiencies of improved stoves are relatively higher (Table 1). Moreover, majority of the respondents (about 78%) knew about the contribution of improved stove to reduce the problem of fuel wood shortage and thereby contributing to the conservation of the forest resources in the study site. The study also revealed that knowledge of the local people was powerful and consistent predictor of the attitudes towards 'the use of improved stove over traditional stove'. For example, the multiple linear regression model revealed that socioeconomic variables had significant effects on the attitudes towards 'the use of improved stove over traditional stove' (34% variance explained) (Table 3). Previous studies noted that attitudes of the respondents towards the use of improved stove can be positively influenced by increasing their knowledge about its use and contribution towards forest resources conservation (Seid, 2003). Informing the local communities about the use and importance of improved stove can help raise the positive attitudes, and thereby increase the support of local people in forest conservation. This is because creating public awareness will increase the understanding of the local people on the usage of improved stove over traditional stove. For example, the usage of improved stoves has various benefits to the local communities including saving time for cooking, increasing fuel wood and energy usage efficiencies, reducing the number of labor and time required to collect fuel woods (e.g. the time could be used for other activities including farming), reducing indoor house pollution and thereby reducing the negative impacts of emitted smoke on the health of the residents in the households (Johnson *et al.* 2020).

CONCLUSIONS

The study indicated that a majority of respondents in the study site favored using traditional enclosed mud stoves for baking "injera" and bread, highlighting a significant reliance on local fuel wood consumption in the area. Instead of utilizing modern energy sources like electricity, respondents predominantly used fuel wood, cow dung, leaves, and crop residues for cooking and heating, citing unreliable access to modern energy sources and the high cost of electricity as key factors driving this dependency. The affordability of modern energy sources, particularly for urban poor households, was a major concern, with income levels and family size influencing the choice to use local energy sources due to the financial constraints associated with modern energy alternatives. The study suggested that the high reliance on local energy sources, particularly fuel wood, by economically disadvantaged and less educated individuals contributes to increased deforestation rates in the study site. Conversely, more educated and economically affluent individuals tend to opt for modern energy sources like electrification for their household energy needs. This disparity in energy usage patterns may have influenced the development of positive attitudes towards the use of improved stoves over traditional stoves in Bule Hora. Encouraging women's involvement in initiatives aimed at reducing fuel wood shortages and deforestation through the promotion of improved stove technologies is crucial for future sustainability efforts. While some respondents reported using improved stoves, many cited financial constraints as a barrier to purchasing these technologies. The introduction and distribution of improved stoves, such as the "merit" stove technology, offer a promising solution to address energy efficiency, fuel wood conservation, cost savings, and indoor air pollution reduction, ultimately benefiting people's health and well-being. By promoting the adoption of improved stove technologies over inefficient traditional stoves, the community can achieve more efficient energy use, contribute to socioeconomic development, and conserve natural resources. This shift towards sustainable energy practices aligns with broader goals of poverty reduction in Ethiopia and underscores the importance of addressing energy access challenges through innovative solutions that benefit both the community and the environment.

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