



Distribution of Sheep Fattening Practices and Marketing Systems in the Sagnarigu Municipality in Northern Ghana

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was conducted in the Sagnarigu Municipality in Northern Ghana to assess sheep fattening practices and marketing systems. Eighty respondents were selected and questionnaires administered to them. Data was summarized and analysed using SPSS version 20. Majority of the fatteners were within the ages 21-30 years. Sheep fatteners were not equally distributed across the different age groups. Most of the farmers had at least primary education while majority (30.0%) of them had tertiary education. The sheep fattening enterprise in the area was male and Muslim dominant activity. Majority of respondents were engaged in specialized skill work as their main occupation with self-financing as the main source of income for the sheep fattening business.

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Majority had at most 5 years fattening experience. Semi-intensive system of management was mainly practiced. Farmers use wide range of feed stuff alternatively and supplied from multiple sources. Mature animals (≥ 6 months) sourced from farmers' own flock were mostly used in fattening. Generating cash was the primary motivation for fattening sheep, with a convenient market for the fattened sheep. Customers of fattened sheep were mainly butchers, mostly at local markets (50%). Price determination for the fattened sheep was bargaining. The major constraints of sheep fatteners were diseases and mortality and lack of capital/financial. It was concluded that sheep fattening practices and marketing system was a business in the Sagnarigu municipality, nevertheless, it was not well organized and developed. To create a lucrative sheep fattening industry, government and non-governmental organizations should promote sheep fattening by providing financial and training support for the fatteners and the teaming youth in Ghana to venture into the business. This could contribute to enhancing livelihood of rural resource poor farmers, unemployment and poverty reduction as well as women empowerment in the country.

Keywords: Fattening practices; income; feedlots; sheep; own flock.

1. INTRODUCTION

One of the most important aspects of Ghanaian agriculture is the livestock industry, which includes poultry. Without a doubt, this industry contributes in a variety of ways to supporting smallholder livestock farmers' livelihoods, especially for the rural populace [1]. The industry supports the country's economy by providing jobs, a means of generating income, a buffer against crop failure, food and nutritional security, financial stability, and improved rural livelihoods [2,3,1]

Sheep farming contributes to fulfilling cultural commitments. Chiefs of the North, for instance, sit on skin. Some people make religious sacrifices and prayers using skin. For the people working on the production, it serves as a source of income. Sheep manure is a useful fertilizer for fish ponds and soil [4]. Additionally, bio-gas for household consumption can be produced with it. You may make food out of the bones and blood to feed other animals. People from a variety of social and cultural backgrounds can easily accept their meat [5]. They can be produced without the need for pricey infrastructure or machinery [6].

Sheep have many prospects and are important, but there are obstacles to their increased productivity and production. These difficulties include inadequate feed availability, sluggish growth, and significant mortality from nutrient deficiencies [3]. Poor management of feed supplies, nutrition, health, and breeding are some more [7]. Cattle and small ruminants rely primarily on grazing natural pastures and rangelands found in Savannah woods, as well as unimproved pastures and bush fallow, which vary

greatly in quantity and quality throughout the year [7]. If the right feed packages and feed management are implemented, sheep fattening may prove to be a financially sustainable method [8]. These restrictions prevent the sheep sector from being fully utilized to satisfy the nation's rising need for animal protein.

A significant amount of meat and dairy products are imported annually to meet the rising demand for livestock products [9]. This is most likely a result of the local sources of animal protein not providing enough.

Therefore, one of the most important areas that requires careful attention to boost the output per individual animal without necessarily increasing their numbers is fattening. This is due to the fact that most of the feed used in the large-scale production systems is deficient in nutrients, making productivity unacceptable. Therefore, in these systems, supplemental nutrition is essential [7]. Particularly during the dry season, ruminant cattle are given supplemental meals in the form of crop waste and cut forages.

Additional feed inputs including wheat, maize, and rice bran are fed to ruminant cattle to increase their fat content during festive times when sales opportunities present themselves. The process of "fattening" involves feeding a carcass with a high-nutrient diet in order to accelerate growth and cause the desired amount of fat to be deposited [10]. This goes after the regional markets where there is a big market for fatty animals. Sheep may readily adapt to an intense production system in feed lots, therefore such systems can be used with them Pasha [11]. When compared to systems where animals are

housed for extended periods of time and have corresponding cycles in weight gain, this approach might be more financially feasible. It has been acknowledged that fattening sheep can be a lucrative endeavor that enhances small-holder farmers' income.

Numerous aspects, such as body condition, castration, age, color, health, and weight, influence the cost of fattened sheep [12,13]. Seasons and celebrations have an impact as well [12]. Despite the potential for sheep production in northern Ghana, there is a lack of accurate and comprehensive data regarding the area's marketing strategies and methods for fattening sheep. Thus, the purpose of this study was to evaluate the Sagnarigu municipality's sheep feeding procedures and marketing schemes.

2. MATERIALS AND METHODS

2.1 The Study Area

The Sagnarigu Municipal District is located in the northwest part of Northern Region and has Sagnarigu as its district capital. Geographically, the Municipality lies between latitudes 9°16' and 9° 34' North and longitudes 0° 36' and 0° 57' West with Sagnarigu as its Administrative capital and covers a total land size of 454 km². The Municipality shares boundaries with the Savelugu Municipal to the north, Tamale Metropolis to the south and east, Tolon District to the west and Kumbungu District to the north-west. The population of the Municipality according to 2021 population and housing census stands at 341,711 with 170,199 males and 171,512 females [14].

Farming is the major economic activity with many engaged in formal service such as teaching, as well as trade activities. The people are also engaged in sheanut and rice processing, small and large ruminant production and butchering. The dominant ethnic group is Dagbamba with Dagbani being a widely spoken local language. About 70% of the population is Muslim [15, 14].

The municipal experiences one rainy season from May to October, and this period naturally coincides with the farming activities in the municipal. Annual rainfall average ranges from 600mm to 1100mm, with the peak being usually between July and August. Daily temperature varies from season to season. During the rainy

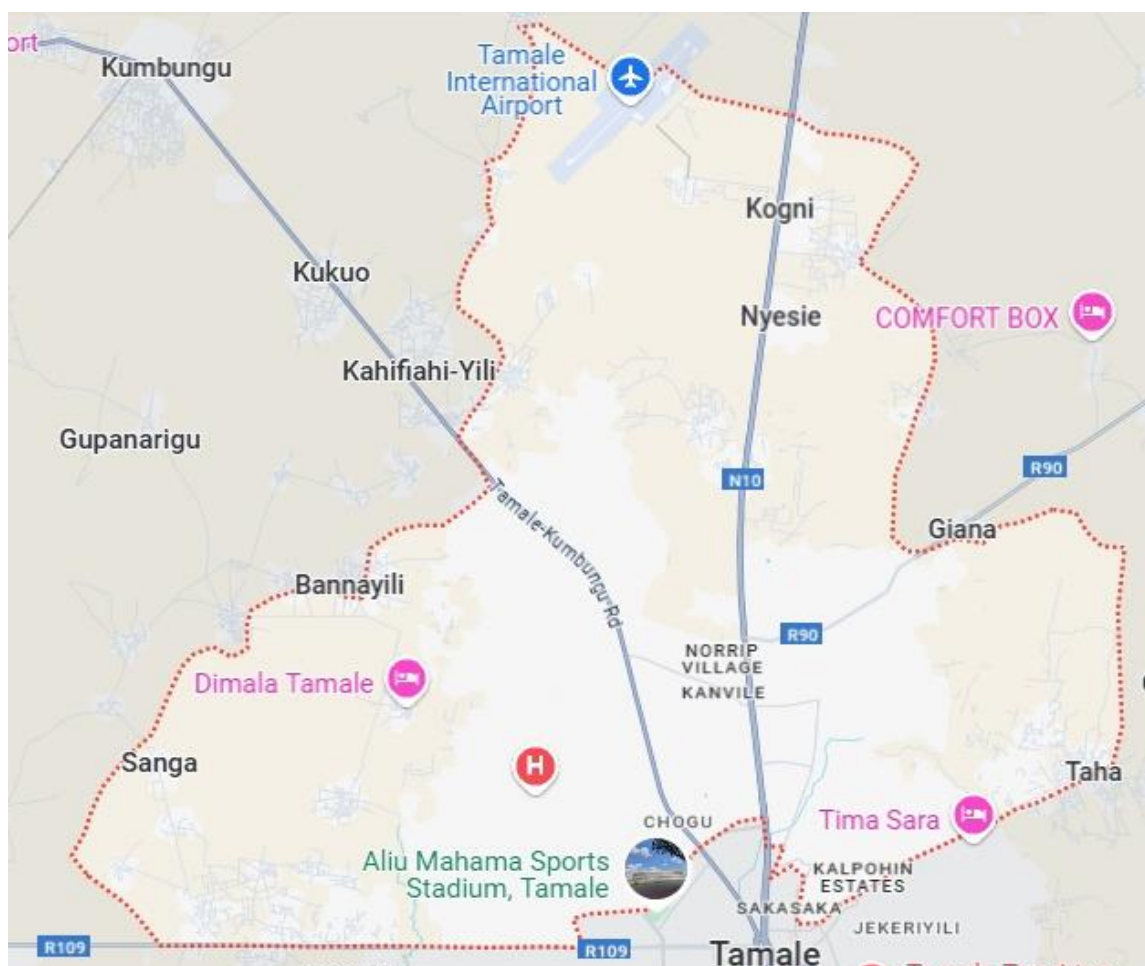
season, there is high humidity with relatively less sunshine and heavy thunderstorms. The mean day temperatures range from 28°C (December-mid-April) to about 38°C (April-June) while the mean night temperature ranges from 18°C (December) to 25°C (February and March). The dry season (November-March) is characterized by the dry Harmattan winds: the Harmattan season presents two extreme weather conditions, the extreme dry cold temperature of the early dawns and mornings and the very warm afternoon [14-16].

2.2 Field Survey

The study employed a combination of purposive and random sampling techniques to get study participants. The Sagnarigu municipality's twelve (12) settlements were selected for the investigation. Sheshigu, Sagnarigu-Kukoo, Kpalsi, Choggu Mmanaayili, Gbalo, Kumbuyili, Gurugu, Zagyuri, Kanvilli, Tuunaayili, Wayamba, and Sagnarigu were the communities examined. These locations were specifically picked based on a preliminary assessment that indicated the accessibility and existence of fatteners in those localities. Eighty (80) sheep fatteners participated in the data collection process using a semi-structured questionnaire. Prior to being used, questionnaires underwent validity and reliability pretests. One of the main methods for gathering data was observation as well. Personal observation and interactions were made through field visits alongside the administration of questionnaires. Questionnaire tools obtain information on fattening practices, marketing systems, general management of animals, feeding, watering, health care and demographic characteristics. Early morning, between 6:00am to 7:00am and evening between 4:00pm to 5:00pm, visits were made to the sheep fatteners selected in each community to identify the actual management and fattening practices carried out.

2.3 Data Analysis

Version 20.0 of the Statistical Package for Social Sciences (SPSS) was used to analyze the data [17]. To ascertain the distribution of the qualitative features, the data were exposed to the Non-parametric Test of Chi-Square. Descriptive was selected under the option, and asymptotic only was picked under the exact.



Picture 1. Map of Sagnarigu Municipal

3. RESULTS AND DISCUSSION

3.1 Socio- Demographic Characteristics of Respondents

According to the survey, the age group of 20–30 years old accounted for 40% of sheep fatteners, followed by 51–60 years old while those under 20 years old made up the least proportion (Table 1). The results of the chi-square test ($X^2 = 14.30$, $P = 0.006$) indicated that the distribution of sheep fatteners varied among the various age groups. This indicates that the company was run by young, vibrant individuals who are part of the nation's active labor force, which bodes well for the company's future. This might be because of the high unemployment rate, which forces young people to start their own businesses in order to make ends meet. It could also be explained by the observation that young people view the sheep fattening industry as a lucrative and profitable aspect of agriculture, particularly in light of the government's flagship agriculture

project and program, which is raising sheep for food and jobs, as well as the youth's strong advocacy for the development of entrepreneurship. This supports the findings of researchers [18,19], who found similar things for sheep fatteners in Ghana and Ethiopia, respectively. The majority of livestock farmers are young, according to previous publications [20, 21]. This finding confirms those findings. However, the involvement of more ageing (50+ years) confirms the assertion that traditionally in Africa, men initially concentrate more on crop farming during their youthful stage, but turn to engage seriously in livestock farming when old age approaches them. Majority (30.0%) of the respondents had tertiary education. Approximately 73% of the sheep fatteners had at least secondary/high education with only 23.7% of them being illiterates or had no formal education. Further classification of respondents into educated (those with at least middle school or JHS) and uneducated (those with no formal education and those with at most primary

education) indicated there is unequal distribution of educated and uneducated fatteners in the area ($X^2 = 8.533$, $df = 1$, $p = 0.003$). Thus more educated people are attracted to sheep fattening in the area probably due to the fact that they have acquired knowledge in basic business principles to aid their profit maximization in the fattening. In order to maximize business profit, fatteners are therefore seeing a positive trend in the access and suitable application of livestock technologies [22]. These results conflict with those of Adam et al [3, 23], who found that the majority of Ghanaian ruminant farmers lacked literacy. The likely cause of the discrepancies is that the ruminant farming activities that [3, 23] reported on may be very different from the fattening operations under investigation. The latest data, however, supports a 2005 analysis by Eсену that found that only 24.7% of livestock producers reported having no formal education,

while the majority (75%) had completed at least an elementary school.

All (100%) of the sheep fatteners in the Sagnarigu municipality were males and Muslims as well. This revelation suggests that sheep fattening in the Sagnarigu municipality is hardly practiced by women. This confirms the assertions that women, unlike men were more likely to manage only goat than both sheep and goat animals [3]. In support of this finding, Dossa et al [24] reported that female farmers were more inclined to raising goat alone compared with other livestock species in southern Benin. Thus, women would likely be marginalized from some efforts towards poverty reduction involving sheep fattening, since the business is a potential poverty reduction venture [18]. Another explanation would have to do with sub-Saharan

Table 1. Socio-demographic characteristics of respondents

Parameter	Frequency	Percentage	Chi-square	P - Value
Age group (years) (N = 80)				
< 20	5	6.3	14.3	0.006
21-30	32	40.0		
31-40	8	10.0		
41-50	8	10.0		
51-60	27	33.7		
Education				
No Formal Education	19	23.7	6.67	0.155
Primary	3	3.7		
Middle School/JHS	13	16.3		
SHS	21	26.3		
Tertiary	24	30.0		
Sheep fattening as a secondary occupation (N = 80)				
Yes	64	80	10.8	0.001
No	16	20		
Major occupation of respondents (N = 64)				
Formal service	6	9.4	9.33	0.053
Crop farming	16	25.0		
Trading/Business	10	15.6		
Specialized Skilled Work	26	41.0		
Others	6	9.4		
Sheep fattening experience (in years) (N = 80)				
≤ 5	39	48.8	21.28	0.001
6 – 10	25	31.2		
11 – 15	8	10		
16 – 20	5	6.3		
> 20	3	3.7		
Source of finance (N = 80)				
Self	72	90	43.4	< 0.0001
Family	5	6.3		
Loans	3	3.7		

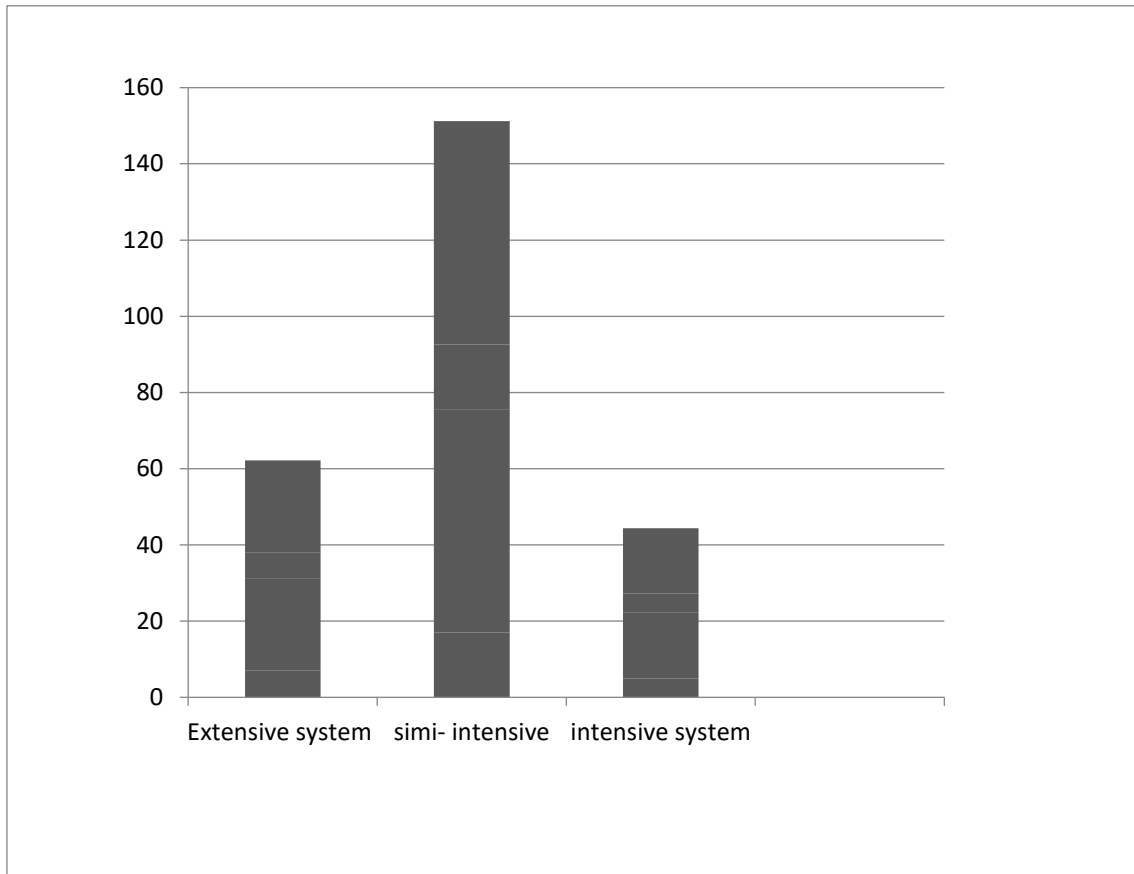


Fig. 1. Management systems by the respondents

African cultural norms and conventions, which assign men the role of managing the productive assets of the home [25]. Furthermore, since women were not involved in the fattening of sheep in this study, it is possible that their male partners still expressed ownership over the (female) farm animals, preventing them from fully participating in the sheep fattening industry. Previous research on the production and fattening of sheep in Africa [19, 26] revealed a similar male dominance. Since men make up the majority of decision-makers in most African civilizations [27], their dominance in the study area's sheep fattening industry is essential for the easy adoption of novel concepts and cutting-edge technologies to enhance the fattening industry. In sub-Saharan Africa, earlier studies [27-29] have reported comparable findings. The predominant Muslim population in Ghana's northern area may be the cause of the Christians' lack of interest in the business [14, 15]. Another explanation would be that the kind of cattle to raise depends on the cultural context of the household, which includes factors like religion and ethnicity in the majority of African countries [30, 31]. It is well known that

Muslims celebrate Eid-ul Adha by killing sheep, or rams [28].

A Chi-square test ($p < 0.001$) showed that the proportion of respondents who fattened sheep as a secondary occupation was about four times the proportion of those who did it as primary occupation. The study found that 80% of the respondents were having major occupations with sheep fattening as a secondary occupation. Only 20% were engaged in sheep fattening as their main occupation, probably due to the high unemployment rate in the country. The study further revealed that respondents were not equally distributed across the major occupations based on the chi-square test ($X^2 = 9.33, p = 0.05$). Majority (41.0%) of respondents were engaged in specialized skilled work as their main occupation besides sheep fattening in the Sagnarigu Municipality (Table 1). Few respondents were relying on formal service (teaching, nursing, lecturing, etc) (8.3%) and others (at least two occupations practiced alternatively as major) (8.3%) were the other main occupations besides sheep fattening in the Sagnarigu Municipality.

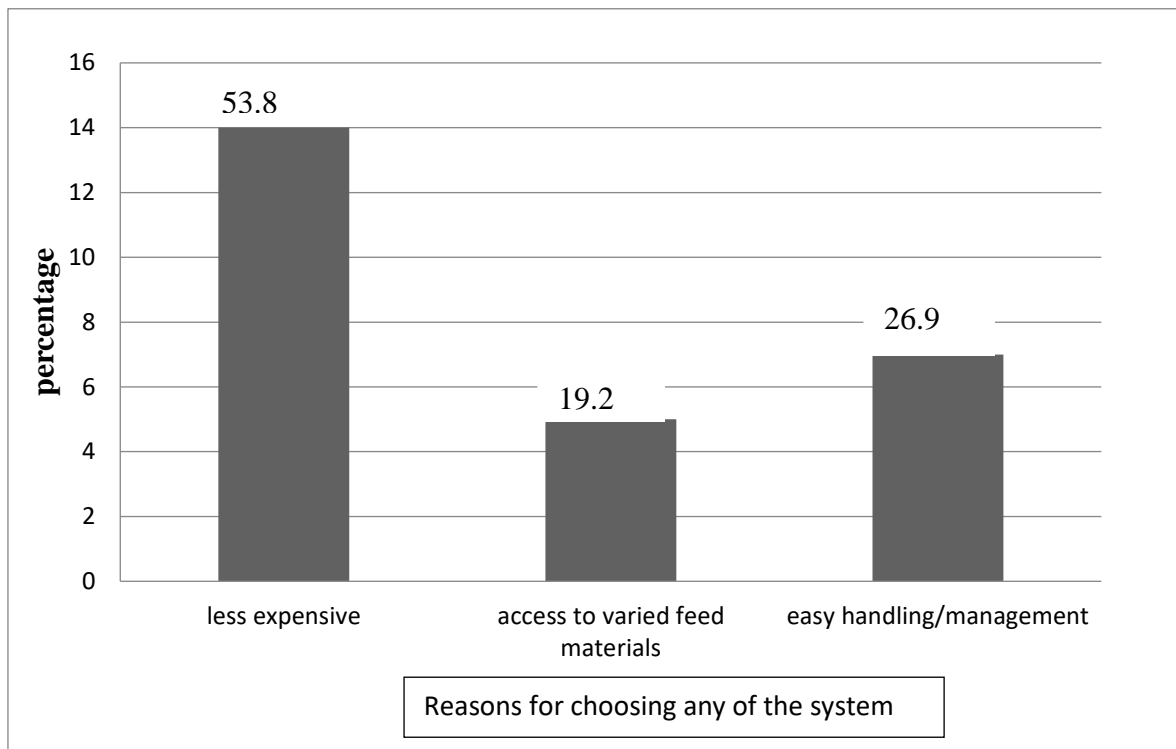


Fig. 2. Reasons for the choice of any of the management system

3.2 Management Systems Used in Sheep Fattening by the Farmers

The study found that three main systems of livestock management were found in the study area. They were intensive system (Zero-grazing/stall feeding), semi-intensive (grazing with stall feeding) and extensive system (grazing with regular supplementation) of management. Majority (58.6%) of the fatteners employed semi-intensive system of management as reported by Taylor [29], with the least practiced system being intensive (Fig. 1). Explanations of these systems have been provided by Husein et al [13]. With regards to the reasons given for the choice of a system, majority (53.8%) of the fatteners indicated that they chose their system because it is less expensive to practice (Fig. 2) [30,31]. This may explain why most of them were practicing grazing with stall feeding as against Zero-grazing. This result is in support of earlier reports such as Schuetterle and Coulibaly [18, 32]. It however differs from report by [19] who found more sheep fatteners practicing feedlot system of production management. Extensive system characterized by utilization of Horro sheep breeds on free grazing and seldom supplemented with the locally available feed types was the sole method of sheep fattening in Genji, Ethiopia [33].

3.3 Sheep Fattening Practices

3.3.1 Feeding and feed stuff/materials

The study found that in the Sagnarigu municipality, fatteners feed their animals with varied feed stuff. Most (83.7%) of them were using these wide range of feed stuff alternatively depending on their availability as far as the effect of seasons on their availability is concerned (Table 2). About 86.7% of fatteners stated that they provide salt lick for their animals while the rest (13.3%) do not supply salt lick to their animals. This finding agrees with Diriba et al[34] who reported that the type of concentrates used for sheep fattening varies depending on availability, accessibility and cost of the ingredients. Access to oilseed cakes and cereal bran vary from place to place depending on the availability of food processing factories [34]. Many researchers [12,35,36] observed similar outcomes in their studies.

All the sheep fatteners in the Sagnarigu municipality indicated that they feed/supplement their animals two times daily, three times daily and/or *ad libitum*. More than half (80%) of the sheep fatteners were feeding their animals two times daily (morning and evening) and the least (3.3%) of the sheep fatteners feed their animals

three times daily (morning, afternoon and evening) (Fig. 3). The best feeding option for the sheep is grazing with supplement feeding high energy concentrate ration [36]. Sheep fattening is a common practice in different parts of Africa, though the degree of fattening and resource base differs markedly [36].

3.3.2 Water supply to fattening sheep

All (100%) the sheep fatteners in the study area indicated that they supply water to their animals in either water troughs or suitable containers. The water is usually obtained from different sources as indicated in (Fig. 4). Most (71.4%) of the fatteners obtain water from multiple sources (tap, dam, river, lakes, lagoon, etc) alternatively, depending on availability of the water in any of the sources. This was attributed to seasonal fluctuations and drying of the water from some of the sources especially during the dry season. They assert that their search for water in the rainy season is lessen by less intake of the water by the animals and harvested rain water. Animals' body water was augmented by water in

fresh grass and feed. This finding agrees with [36] who reported that water intake of fatten animals depends on environmental temperature, the temperature of the drinking water itself and the moisture content of the feed fed per day [36]. When cold drinking water consumed in large volumes, the temperature of the rumen may decrease which reduces the activity of the rumen microorganism and which affect fattening operation [36].

3.3.3 Health care

All (100%) the sheep fatteners stated that they pay good attention to their animals by providing regular and proper medication for the animals. The type of medication is either orthodox or ethno-veterinary care, though they rely more on the orthodox medication. The important environmental challenge as a part of fattening animal health program is control of the internal and external parasites. So, any effective animal health controls program aims to control both internal and external parasites and prevention of other contagious diseases [36].

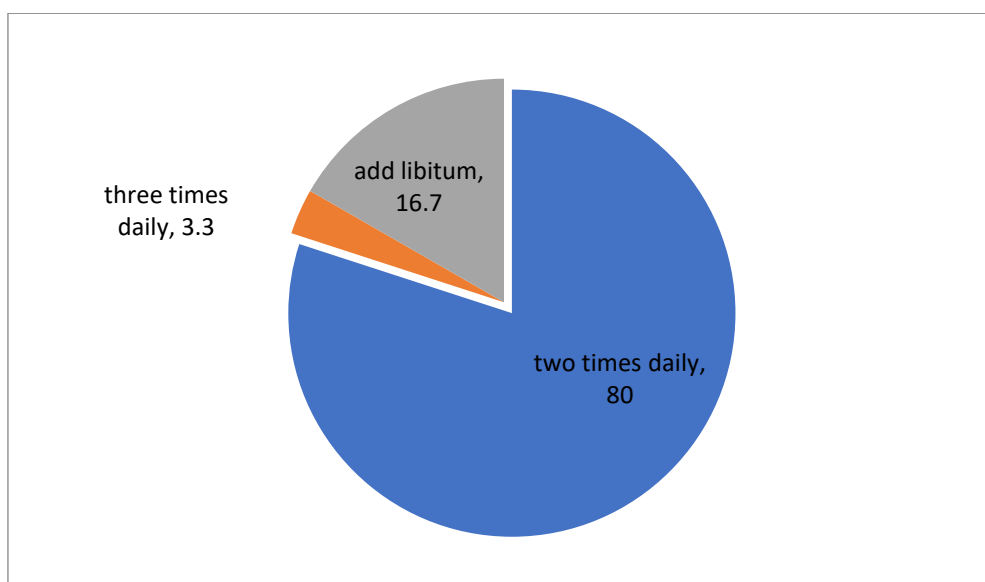


Fig. 3. Feeding regime by the Sheep fatteners

Table 2. Supplementary feed ingredients used by sheep fatteners

Feed staff	Frequency	Percentage
Agro-industrial by-product	3	3.8
Grass and legumes	3	3.8
Concentrates	7	8.8
Grass, legumes, agro and industrial by-products, concentrates, kitchen waste	67	83.7

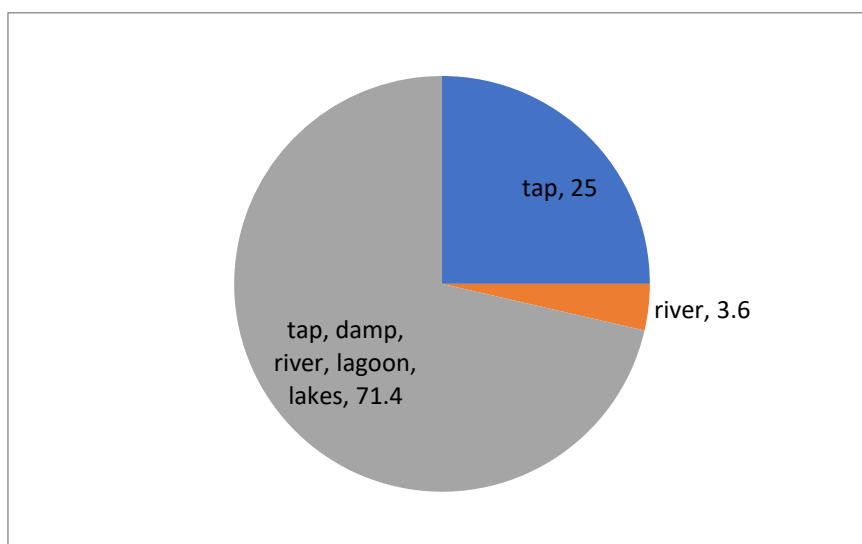


Fig. 4. Sources of water for fattening sheep.

Table 3. Types of identification used by Farmers

Types of identification used	Frequency	Percentage
Permanent identification	10	52.6
Semi-permanent identification	4	21.1
Temporal identification	5	26.3

Table 4. Criterion for selecting sheep for fattening

Parameter	Frequency	Percentage (%)	Chi-square	P - Value
Sex				
Male sheep	5	6.3	22.53	<0.001
Both male and female sheep	75	93.7		
Breeds				
Djallonke	14	17.5	8.448	0.133
Sahel	11	13.8		
Crosses	9	11.3		
Mixed pure breeds	25	31.2		
Mixed pure breeds and crosses	21	26.2		
Age				
Younger (< 6 months)	19	23.8	21.79	<0.001
Matured (≥ 6 months)	61	76.2		

Table 5. Sources of sheep for fattening and other species of animals being fattened with sheep

Parameter	Frequency	Percentage (%)	Chi-square	P - Value
Sources of sheep for fattening (N = 80)				
Exchange/ purchase from colleague farmers	6	7.5	18.80	<0.001
Purchase from market	21	26.3		
Gift/inheritance from family	8	10		
Own flock	45	56.3		
Other species of animals being fattened alongside sheep (N = 80)				
Cattle	4	33.3	3.0	0.556
Goats	16	25		
Poultry	6	16.6		
Cattle, goats, poultry	8	25		

Table 6. Sheep fattened per fattening cycle and period used to fatten a batch in the area

Parameter	Frequency (N = 80)	Percentage (%)	Chi-square	P - Value
< 5 animals	21	26.25	48.67	<0.001
5 – 10 animals	43	53.75		
> 10 animals	16	20		
Fattening duration or period used to fatten a batch (N = 80)				
< 6 months	33	41.25	26.00	<0.001
6 – 12 months	36	45		
1 – 2 years	6S	7.5		
> 2 years	5	6.25		

3.3.4 Identification used to identify animals by the farmers

From the survey, it was found that more than half (63.3%) of the fatteners were using identification marks on their sheep while 36.7% were not using any sort of identification. Out of those who use identification, majority (52.6%) of them were using permanent identification (Table 3). Similar findings have been reported by other researchers in their studies on sheep fattening [18, 36].

3.3.5 Selection criteria of sheep for fattening

Generally, males/rams were preferred for fattening as against females/ewes in this study because they grow faster [13]. But most of the farmers (93.7%) were involve in fattening both sexes, with the reason that they fatten spent females when the need arises though their main focus is on rams. This could be the explanation for why the bulk of fatteners use their own flock to provide the animals for fattening. They usually go buy guys instead of girls with the intention of making them overweight. The sex of the sheep utilized for fattening differed significantly, according to the chi-square test ($X^2 = 22.53$, $P < 0.001$) (Table 4). Farmers stated that while rams born within their herd are their primary supply, they also readily fatten exhausted and ineffective female sheep. This backs up the claim that fattening rams is their primary purpose [12,13,19], even if fattening also occurs in culled, spent, and unproductive females. Since it goes against what Islam demands of a ram intended for sacrifice, all (100%) respondents do not castrate their rams intended for fattening. Due to their use of the fattened sheep for religious purposes, Muslims make up the majority of the fatteners' clientele in Muslim-dominated regions such as the Northern area [14]. In contrast, castration of rams meant for fattening is practiced in many places within Ethiopia with the

intention of making the animals docile, grow faster and fatter [12].

The breed of sheep does not used for fattening do not differ significantly based on the Chi-square test ($X^2 = 8.448$, $P < 0.133$). This suggests that there were no preference for any particular breed for fattening in the study area. This supports the findings of Animut and Wamatu [12] analysis, which found that no breed is favored nationally due to its higher production value, superior quality features, or ability for fattening in Ethiopia. Despite the fact that the breeds used were identical, the majority of respondents (31.2%) chose to fatten mixed pure breeds, which are pure Djallonke rams mixed with pure Sahel rams. This was followed by mixed pure breeds and crosses (26.2%) between the long-leg Sahel and the local Djallonke breed, most likely due to heterosis. Thus, is important that the farmers see interesting and admirable traits in the Djallonke, Sahel and their crosses for fattening. This means that the farmers will always have enough animals available to choose for their fattening activities.

The age of the animal was an influential factor considered in selection of animals for fattening in the area. Majority (76.2%) of the respondents indicated that they selected animals that were at least 6 months old for fattening (Table 4). The majority of sheep fatteners preferred to purchase or use mature sheep, particularly those that were one year old [12, 13]. This might be done to prevent the high manufacturing costs that would otherwise arise from extending the fattening period, so boosting their profit margin. Some researchers [12, 19] have also reported findings that are similar. This may be to some extent influenced by the Muslim religion due to the significance of the sheep in the Muslim religion [3], and such, only sheep of at least 6 months old are due for sacrifice in Eidul-Adha [28]. In agreement with the results of the current study,

[33,37,38] indicated that younger animals at finishing may have tender carcasses and greater market demand than fattened older animals. The results differed slightly from the Ethiopian report of [12], which stated that sheep begin fattening between four and six months of age. As a result, there is no set weight at which a sheep can become overweight. According to almost all sheep fatteners [12, 13], they did not have a target weight at which to place animals for fattening.

3.4 Sources of Sheep for Fattening

The proportionate sources of sheep used for fattening differed significantly, according to the results of the Chi-square test ($X^2 = 18.80$, $P < 0.001$) (Table 5). More than half of the respondents (56.3) source their fattening flock from their own flock. This has the potential to increase their profit margins compared to purchasing from other sources. The present finding is in agreement with previous reports that home born sheep were the major source of fattening in Tamale Metropolis [13], south-western Ethiopia [39], Western Tigray [40] and Genji [33]. However, some fatteners, especially those who do not participate in the sheep production, buy sheep from market when interested in starting fattening. Similar to the findings of the current study, it was suggested that market is an important source of the flock in starting sheep fattening foundation stock [37]. About 10% of the respondents in the study area reported to have obtained animals for fattening from gifts/inheritance. This result is in support with that of [41], who indicated that gifts from different sources and inheritances from family were reported as important ways of building sheep flock for fattening.

3.4.1 Number of sheep fattened per fattening cycle and fattening duration per batch in the Sagnarigu Municipality

Of the 80 sheep fatteners in the research area, the majority (53.75%) reported fattening 5 to 10 sheep per cycle, whereas only 20% fattened more than 10 sheep in a single cycle (Table 6). The quantity of fattened sheep every cycle varied significantly ($X^2 = 48.67$; $P < 0.001$) throughout the communities in the research area. The lower percentage of respondents that fatten more than ten animals in a cycle may be due to financial limitations that prevent them from expanding their fattening operations. This supported the finding of Husein et al [13] that, as a result of

budgetary limitations, 70% of fatteners in the Tamale Metropolis fatten fewer than five sheep per cycle. According to Adams and Ohene-Yankyera [33], in Ethiopia, there are 49.4% of sheep for every 2-3 sheep every fattening cycle, 37.3% of animals for every 4-6 animals per fattening cycle, and 13.3% for more than 6 sheep per fattening cycle. In the Fogera district, farmers fatten three sheep on average during each fattening session, according to Tesfaye [42]. The main causes of this low animal fattening rate are typically inadequate feed supplies, a lack of funds, land, disease, inadequate market infrastructure, a lack of marketing support services, a lack of market knowledge, and so forth. As a result, sheep fatteners in the research area were unable to fully engage in the activity of fattening sheep [43].

The majority of respondents (45%) fatten a batch in a fattening cycle in 6–12 months, while the least number of respondents (6.25%) fatten a batch for more than 2 years (Table 7). This could explain why farmers select adult sheep for fattening. Therefore, employing mature sheep for fattening could shorten the fattening period, boosting their profit margins and preventing needless costs associated with keeping animals for unnecessarily lengthy periods of time. It might possibly be because Muslims need rams that are at least six months old for sacrifices during celebrations like Eidul-Adha and naming ceremonies [28].

3.5 Reasons for Fattening Sheep in the Study Area

The study found that farmers have a lot of reasons for going in to sheep fattening business. Majority (56.7%) of the farmers were fattening sheep for income generation, while only (3.3%) of them fatten sheep for at least two of reasons as indicated in Fig. 5. This result supports the assertion that the lower risks associated with sheep production are gearing rural farmers as well as peri-urban and urban dwellers to get involved in sheep production as a sideline income generation activity [12,37, 44,45] argue that the main driver of sheep fattening is the business's apparent profitability.

3.6 Marketing of Fattened Sheep

The percentage of respondents who said they enjoyed the ready market year-round was around four times higher than the percentage who said they did not (Table 7), according to a Chi-square

test ($X^2 = 10.80$, $P < 0.001$). According to Table 7, the majority of sheep fatteners (80%) indicated that there is a ready market whenever they wish to sell their fattened sheep. This suggests that there is a year-round high demand for fattened sheep in the research area. This suggests that the area's sheep fattening industry may present a chance to combat poverty. Twenty percent of respondents said the market is seasonal. The Chi-square test ($X^2 = 18.00$, $P < 0.001$) revealed how much of a good market is accessible to farmers at any given time of year. The majority (43.7%) of respondents who stated that the market is seasonal stated that the market is ready and favorable for the sales of their sheep during both Christian and Islamic festivities. Islamic festivities, particularly EIDUL ADHA when rams are needed for sacrifices, were followed by Islamic festivities (31.2%), and the rainy season and cultural functions (6.3% each) were the least popular responses (Table 7). About 12.5% of respondents said that there is an easy market for their animals (fattened sheep) throughout the long, dry season, which is the driest part of the year. throughout this time, feed is scarce and requires time for all animals to gain weight, leaving emaciated animals with low markets. This however creates good market for their animals since they are well fed to put up weight. Demand for their animals also increases during this period as a result of cultural practices such as funerals during the dry season which compel many people to buy sheep for these purposes. This research supports the findings of other researchers [12, 28, 45], who reported that because buyers were more willing to pay higher prices for the animals during religious and social occasions, fatteners preferred to sell their animals during these times of the year.

Fattened sheep were not equally distributed to customers who buy them from the farmers ($X^2 = 14.97$, $P = 0.001$). Just 3.8% of sheep fatteners sell to individuals for events like weddings, naming ceremonies, funerals, etc., whereas the majority (62.5%) sell to butchers. None of the producers sell to meat processing factories, unlike the report by [13] (Table 7). However, about 33.7% of the fatteners sell alternatively to all these customers identified (that is, butchers and individuals) implying that they sell to whoever needs their animals and had the money and at good price. This finding confirms the report by Husein et al [13] in Tamale Metropolis, Ghana and [12] from Ethiopia. Unlike the findings of Husein et al [13], the majority of fatteners (50%) sell their fattened sheep at local markets

(like Guu-Naa Yili, a well-known animals market in the capital of the northern region), while the remaining 10% sell their sheep at other locations (such as wayside grazing areas, abattoirs, et cetera). Table 7 revealed a significant difference in the proportion of sites of sales of fattened sheep based on the Chi-square test ($X^2 = 19.87$, $P < 0.001$). It is evident that many African farmers sell their animals at farm gates, with local markets serving as the animals' primary destination [12, 13, 32].

A Chi-square test ($X^2 = 10.80$, $P = 0.013$) indicated that the method by which prices of fattened sheep were determined varied considerably (Table 7). The results showed that, as reported by Husein et al [13], the majority of farmers (46.3%) set the price for their fattened sheep by bartering (bargaining) based on certain criteria. This suggests that while buying and selling sheep, farmers and producers estimate the weight and physical condition visually [46]. In addition to thinking that visual assessment and estimating will result in a better pricing than using a weighing scale, they also thought that this method would save them time and effort. A small percentage (7.4%) of them use many methods, such as those alternately listed in Table 7, to calculate the price of their animals, while thirty percent base their decision on the breed and age of the animal. For them, the price determination preferred by their buyers easily influences their choice, provided they do not feel cheated.

3.7 Challenges of Sheep Fattening

The limitations faced by sheep fatteners in the Sagnarigu Municipality are illustrated in Table 8 below. The sheep fatteners listed lack of capital/financial to operate and grow the business (30%) and health, diseases, and mortality (30%) as the main obstacles. The research area's least restrictive factors, with 3.3% of each, were theft, deferred payments, credit purchases, and cheap price/poor market. Conversely, a few farmers reported that they frequently or occasionally experience at least two of the limitations listed in Table 8. Previous studies [13] reported similar difficulties with sheep fattening in the Tamale Metropolis. This may result in decreased output and a decline in the fatteners' profit margins. This result contrasts with that of Schuetterle and Coulibaly [32], who claimed that it is challenging to supply feed in Ghana's northern Tamale Metropolis.

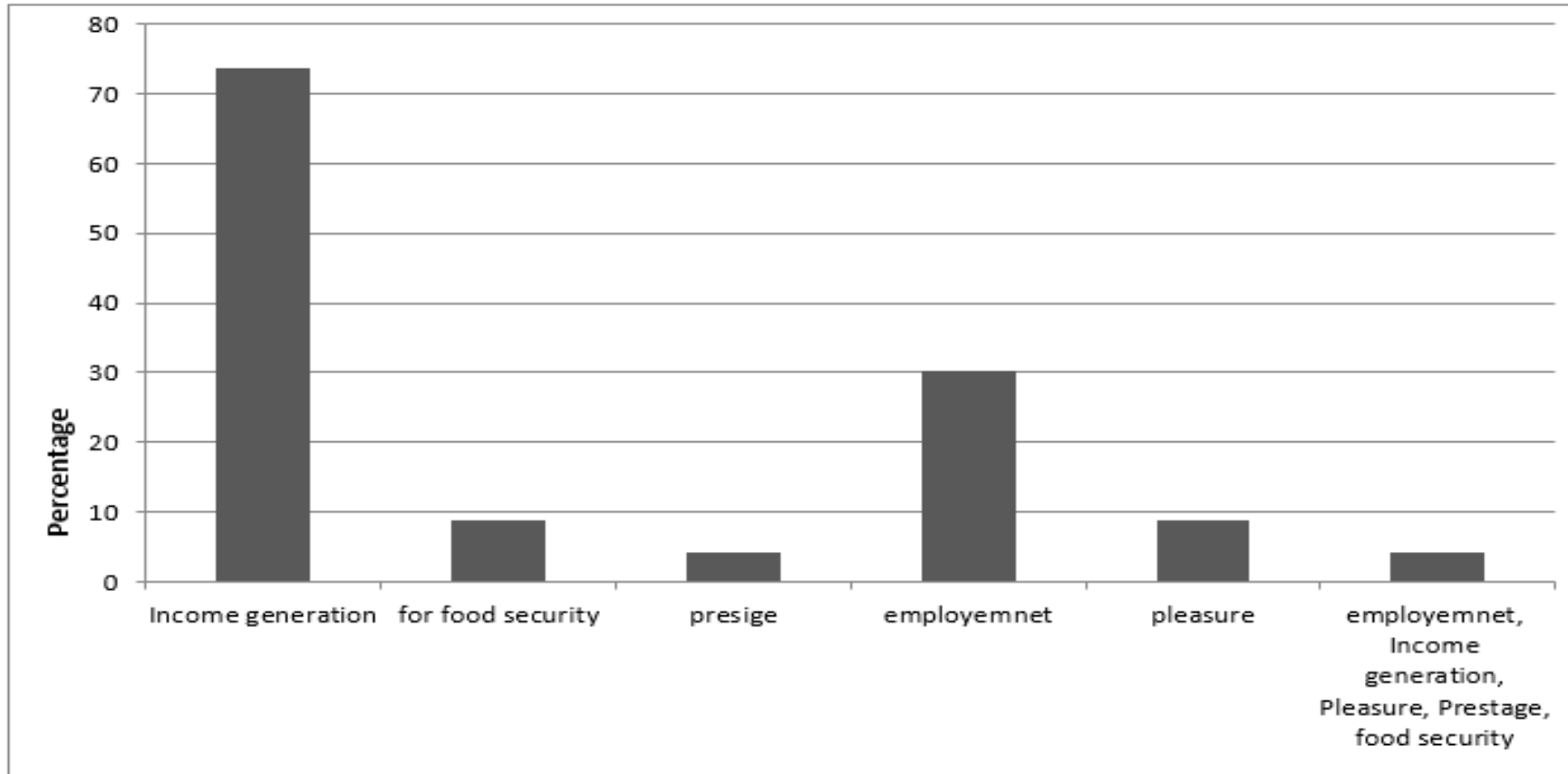


Fig. 5. Reasons for sheep fattening

Table 7. Marketing characteristics of fattened sheep in Sagnarigu Municipality

Parameter	Frequency	Percentage (%)	Chi-square	P - Value
Ready market available all year round for fattened sheep (N = 80)				
Yes	64	80	10.8	0.001
No, seasonal	16	20		
Time or season good market is available for fattened sheep (N =16)				
Dry season	2	12.5	18.00	0.001
Rainy season	1	6.3		
Islamic festivities	5	31.2		
Islamic and Christian festivals	7	43.7		
Cultural functions e.g funerals, weddings	1	6.3		
Buyers of fattened sheep (N = 80)				
Butchers	50	62.5	14.97	0.001
Individuals	3	3.8		
Both butchers and Individuals	27	33.7		
Place of sales of sheep (N = 80)				
At home	32	40	19.87	<0.001
Local markets	40	50		
Others	8	10		
Price determination of fattened sheep (N = 80)				
Weighing	13	16.3	10.80	0.013
Bargaining	37	46.3		
Age and breed	24	30.0		
Others	6	7.4		
Mode of off-take of fattened sheep				
All out all in	26	32.5	2.64	0.267
All in all out	17	21.25		
Culling with replacement	37	46.25		

Table 8. Challenges of Sheep Fattening

Challenge	Frequency	Percentage (%)
Feed and water scarcity	3	10
Health, disease and mortality	9	30
Stray or missing of animals/theft	1	3.3
Defer payments	1	3.3
Lack capital or finances	9	30
Low or poor market	1	3.3
Two or more of the above problems	6	20
Total	29	100

The most crucial aspects of fattening sheep are the restriction of movement and provision of feed and water to the animals. This reduces the amount of time the sheep must spend searching for feed, and may lead to faster rate of fattening and increasing revenue through the provision of high-quality feed, water access, veterinary care, and fully functional livestock markets [21, 36]. A sufficient supply of health services and an improved service delivery system are required to reduce the risks associated with disease. It is necessary to design and implement appropriate vaccination programs and strategic deforming.

Appropriate shelter can reduce the risks of theft and predators [12].

4. CONCLUSION AND RECOMMENDATION

Sheep fattening is an important business practiced by educated males in the Sagnarigu Municipality. There is good market and high demand for the fattened sheep, due to their relevance in Islamic religion. Sheep fattening is unquestionably a possible activity to reduce poverty in the area, despite the industry's

obstacles, which include mortality, scarce feed and water, theft, and infections. To create a lucrative sheep fattening industry, government and non-governmental organizations should promote sheep fattening by providing financial and training support for the fatteners and the teaming youth in Ghana to venture into the business. This could enhance livelihood of rural resource poor farmers and even empower women if extended to them. Further research should be carried out to assess the sheep fattening practices and marketing and its potentials in poverty reduction in the country as a whole. Further research should be carried out to explore effective marketing strategies or interventions to mitigate the sheep fattening challenges.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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