CHARACTERIZATION OF THE INDIGENOUS GOAT PRODUCTION SYSTEM IN ASOSSA ZONE, BENISHANGUL GUMUZ REGION, ETHIOPIA

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ABSTRACT

Most of the livestock population in Asossa zone is comprised of indigenous goats, which have remarkable socioeconomic relevance to the society. This study aimed to generate information on the production system and production constraints of goats in the study area. The study was conducted based on a household survey in which 192 households were purposively sampled. The households were located in Sherkole, Kurmuk and Menge districts that have a high goat population in Asossa zone. Data were recorded in MS Excel data sheet and analyzed using SAS. A chi-square and GLM procedure of SAS was used to test significant differences among categorical and quantitative variables. The primary reason for keeping goats was for cash income with an index value of 0.46, 0.34 and 0.31 for Sherkole Kurmuk and Menge districts, respectively. Milk was the second purpose for rearing goats, with a ranking index value of 0.29, 0.30 and 0.30 for Sherkole, Kurmuk, and Menge districts, respectively. Grazing on natural pasture was the major feed source for goat production in the three districts (with an index of 0.86, 0.91 and 0.0.87 for Sherkole, Kurmuk and Menge districts, respectively). Although the majority of households (59 %, 75% and 62.5% in Sherkole, Kurmuk, and Menge districts, respectively) used yard type of housing, the number of households that used this type of housing was significantly different ($p<0.05$) among the three districts. Majority of goat owners used an uncontrolled type of mating that accounts 92.2%, 89.1% and 85.9% in Sherkole, Kurmuk, and Menge districts, respectively. Feed shortage (with ranking index value of 0.30, 0.34 and 0.28 in Sherkole Kurmuk and Menge districts, respectively) and water shortage (with ranking index value 0.21, 0.23 and 0.22 in Sherkole Kurmuk and Menge districts, respectively) were the first and second goat production constraints. Age at sexual maturity was 7.52 months for males and 7.84 months for female goats in this region. Goats play a multi-functional role for the community by adapting to the different constraints that need intervention mechanisms from responsible bodies to boost the productivity of the sector.

Key words: constraints, Ethiopia, feed, housing, indigenous goats, reproductive performance, production system, water

INTRODUCTION

Ethiopia holds huge and diverse goat populations that play an important role in the livelihood of resource-poor farmers. According to the Central Statistical Agency (CSA) [1], there are about 24.06 million goats in Ethiopia. Out of these, 71.06% are female and the remaining are male goats. Almost all the goats are indigenous breeds, which accounts for 99.99% of the total population [2]. Sale of goats and goat products (meat, skin, and milk) by farming communities is the major economic source for their subsistence. In addition, goats are raised mostly to safeguard against crop failure and unfavorable crop prices in intensive cropping areas [3, 4].

In Ethiopia, goats are managed under extensive traditional system and their production is the lowest compared to the other sub-Saharan African countries [5]. Though the purpose of keeping goats vary from area to area due to economic, cultural and ecological factors [4], they are mainly maintained for fulfilling multiple roles, ranging from multi-cultural purpose (such as dowry and slaughtering different color goats for different ceremonial activities), to providing meat, milk and manure [5]. Mismanagement (poor feeding, watering), poor hygiene and precarious housing conditions contribute to the incidence of disease, high mortality and low productivity of goats in Ethiopia [6].

Poor management of rangelands, inappropriate grazing management, rangeland fires, and seasonal droughts, limit the availability of fodder in the communal areas [7]. The quality and availability of natural pastures are highly variable in the tropics with crude protein dropping below 8% in dry mature tropical grasses, especially during the dry season [8].

Sheep and goats are generally trekked long distances for marketing, often without adequate water and feed. They also trek long distances in search for feed and water. There are very limited market centers and stock routes with the necessary facilities such as feeding and watering points. Highly variable and erratic climatic conditions, drought, exploitation of the natural resources, loss of grazing lands are constraints the goat and other livestock production systems face in Ethiopia [9]. Diseases and parasites are major constraints to communal goat production and safe utilization of goat products. These diseases and parasites are endemic in many regions of Africa [10]. Poor housing negatively impacts on goat productivity as goats are exposed to extreme weather conditions. Van Wyk *et al.* [11] attributed the incidence of disease and high mortality to poor hygiene and precarious housing conditions.

An in-depth production system characterization work has not been carried out on the indigenous goat breed in Benshangul Gumuz region in general, and Asossa zone in particular. Furthermore, updating the previous results is vital since genetic resources and production systems are not static, routine inventories and on-going monitoring is needed [12]. Therefore, this study was designed to investigate the production system of indigenous goats and to identify the production constraints in the study area.

STUDY METHODOLOGY

Description of the study area

Benishangul Gumuz region is located in North-Western Ethiopia. It is divided by the Blue Nile into two parts. The Northern part, Metekel Zone, comprises an area of 26,560 km^2 while the Southern part, Asossa Zone, Kemashi Zone, and Mao-Komo Special district, occupies a total area of 23,820 km^2. The region's climate is grouped into three zones: Lowland, Midland, and Highland. The major part of the region (about 75%) is lowlands with an altitude below 1500 meters above the sea-level. The mean annual temperature is above 27.5^{0}C while the mean annual rainfall is about 500-1,800mm. The Midland zone accounts for 24% of the region with an altitude of 1,500- 2,500 meters above sea-level, while the Highland zone accounts for only 1 % of the area of the region and lies at an altitude above 2,500 meters above sea level [1].

Sampling technique

Before commencing of the actual research work, a reconnaissance study was conducted. Discussions were held with experts in the agricultural development offices about the production system, present conditions, and concentration of goats in Asossa zone.

Multi-stage sampling technique was employed where the first stage was zone selection. The zone was selected purposively based on goat population. In the second stage, the districts in the zone were selected purposively based on goat population and access to the road in the rural peasant association (PAs) of the district. Accordingly, three districts were selected. Then two peasant associations from each district were selected with the same sampling method which makes the total number of six peasant associations. Thirty-two households from each peasant association were selected purposively based on goat possessions (that is, those who have at least three mature goats) and they were interviewed on the issues such as the purpose of goat keeping, management practice, constraints of goat production and related issues on goat production. As a result, a total of 192 households were interviewed.

Data collection procedures

Data were collected by administrating a semi-structured questionnaire which was adopted from a questionnaire developed by the International Livestock Research Institute (ILRI) for individual interview, employing field measurement, observations, and organized group discussion; and from secondary sources in the district's agricultural offices, about the potential districts and peasant associations in goat population and the goat production trends in the study area. A rapid survey with an animal production expert in the districts and focus group discussions were held with key informants after designing checklists of issues to be covered with the experts. A semi-structured questionnaire was prepared in a way to address the aim of the research. Participatory methods, such as focus group discussions, semi-structured questionnaire interviews, and observations of goats, were used to generate information at household and community level.

Questionnaire and group discussion

The questionnaire was used to collect information on general socio-economic household characteristics, flock structure, breeding management, feeds and feeding management,

diseases prevalence, and production constraints. The questionnaire was re-arranged and corrected in accordance with respondents' perceptions. Then it was administered to the randomly selected household heads or representatives by a team of enumerators recruited and trained for the purpose, with close supervision by the researcher.

A total of six focus group discussions (one in each peasant association) were held with elderly farmers, women goat owners, village leaders and socially respected farmers who are known to have better knowledge on the present and past social and economic status of the study areas, to substantiate the information collected through individual household interview.

Statistical analysis
Descriptive statistics were employed to summarize and describe categorical variables. Qualitative data from individual and observation were analyzed following the frequency procedures of Statistical Analysis System (SAS) [13]. Chi-square test was employed to test the assumption of equal proportion between the categorical variables in the districts. The General Linear Model (GLM) procedure of SAS was employed to analyze quantitative variables to determine the effects of class variables (district) using the Duncan new multiple range test. The effects of class variables were expressed as Least Significant Means (LSM) ± SE. The ranking index was made for data including, the purpose of sheep keeping, feed resource and constraints of goat production in the study area.

RESULTS AND DISCUSSION

Household characteristics
The majority (83.3 %) of households in the study districts were male-headed and it was not significantly different (P>0.05) among the study districts. Similar to this study Tesfaye [14] noted that in Metema district among the household heads, 97 % were male-headed while only 3 % were female-headed. Most of the respondents in this study (84.9%) were uneducated and the remaining respondents were educated. Similar to this study, Grum [15] stated that the illiteracy level was higher in Dire Dawa (79.4%). Some of the respondents who can read and write are accustomed from informal education in religious schools (mosques and churches). The majority of respondents were uneducated and this may have limited their capacity to follow new technologies in management and husbandry practice of livestock in general and goats in particular.

Purpose of keeping goats
Ranking of the goat production objectives by the respondents in the study districts are shown in Table 1. Knowledge of reasons for keeping animals is a prerequisite for deriving outfitted breeding goals [16]. The primary reason for rearing goats among owners in the three districts was for income generation (immediate cash earning) with a ranking value of 0.46, 0.34 and 0.31 for Sherkole, Kurmuk, and Menge districts, respectively. Milk production was the second purpose of goat rearing with a ranking index value of 0.29, 0.30 and 0.30 for Sherkole, Kurmuk, and Menge districts, respectively. Similar cultures within the three districts might have resulted in similarities in reasons for producing goats. Wealth (using goats as saving capital) also had a high-

ranking index value next to income generation and milk, especially in Kurmuk and Menge districts.

Functions like dowry and sacrifice received relatively low ranking among the reasons for keeping goats in the three districts which might be due to the cultural beliefs of the study community. The results of this survey revealed that goats play multi-functional roles in the three districts with similar production objectives. The present finding is in line with the results of Demissie *et al.* [17], where goats in Enebse Sar Midir district were primarily raised for generating income followed by milk. In this study respondents mention that, they use goats in various social circumstances (to confer social identity and status; as well as ceremonial uses). Similar to this finding, small ruminants are reared in many parts of the country mainly as a means of generating income [18].

Goat feed resources and availability
The feed resource availability in the study area is shown in Table 2. According to the respondents in the study area, the main feed source for goats was natural pasture with an index of 0.86, 0.91 and 0.87 for Sherkole, Kurmuk and Menge districts, respectively. Natural pasture has greater index value and all of the goat owners in this study used communal natural pastures as a source of feed for their goat. Almost all of the goat owners in this study districts used the natural pasture as the first source of feed for their goat.

The ranking index value of grain was 0.08, 0.07 and 0.09 for Sherkole, Kurmuk, and Menge districts, respectively. Crop by-product was also not common in the study districts, indicating there was no trend of crop production by the study communities. Similar to this result, a study in Enebse Sar Midir district indicated that natural pastures were the main feed resources during the dry and wet season for goats [17]. In line with the result of this study; Tesfaye and Belete [19, 20] indicated similar feed sources for sheep and goats.

All of the goat owners indicated that they faced feed shortage problems during the dry season, and they would send their animals to a distant area in search of feed and return back to their home range when natural pastures are rejuvenated. This needs the intervention of governmental and non-governmental organizations to do pasture development strategy in the study districts.

Water sources and availability
The study revealed that the main water source in the three districts was rivers which accounted for 75.3% water sources and the remaining water sources were boreholes and ponds. The amount of water in the dry season decreased and was sometimes totally absent in some parts of the study districts. Often, the goat owners have to travel to distant areas to find new sources of water, especially during the dry season. In Dale district of Sidama zone, ponds were the main water source during the wet season, while in dry seasons rivers were most common [21]. Watering frequency was once in two days 53.1%, 65.7% and 70.3% during the dry seasons in Sherkole, Kurmuk, and Menge districts, respectively. This was due to a shortage of water in these seasons, and most of the goat owners fetch water from distant water sources using their donkeys. The

frequency of watering increased during wet seasons due to water being more available. In wet and dry seasons, watering frequency was not significantly different (p>0.05) among the three study districts.

Goat housing

The type of housing, housing materials and goat groups which are separately housed in this study are shown in table 3. This study showed that the majority of the households use yard type of housing; 59%, 75% and 62.5% for Sherkole, Kurmuk, and Menge districts, respectively. The type of housing was significantly different (p<0.05) among the three districts. This result also contradicts the result of Mahilet [22] that indicated the proportion of farmers practicing housing of goats in the family house as significantly higher when compared to separated houses. In this study, the majority of goat owners indicated the reason for housing in the yard and corral type of housing as due to high temperature in the three districts.

This study also showed that great majority of goat owners use bush (71.9%, 87.5%, and 65.6% for Sherkole, Kurmuk and Menge districts respectively) and the remaining goat owners use wood and grass for corral and yard preparation. The type of material used is significantly different (p<0.05) among the three districts, possibly due to the difference in the availability of housing materials. Goats were housed alone (76.6%), while the remaining were housed with sheep (15.6%) or cattle (7.8%). This is in contrast with the result of Seifemichael [23] who indicated that goats were housed together with sheep in the open corral.

Goat fattening practice

Goat fattening practice in this study is shown in Table 4. The study revealed that most of the respondents in this study area did not practice fattening (81.2%, 73.4% and 76.6% for Sherkole, Kurmuk, and Menge districts, respectively), while the remaining goat owners practiced informal fattening. The fattening practice was significantly (p<0.05) different among the three districts. This result is in contrast with Demissie *et al.* [17] who found that the majority of respondents (76.85%) in Enebse Sar Midir district castrated their goats to fatten. In the study area, most respondents did not practice fattening because there was a lack of feed, water, and market access. For those goat owners who carried out fattening activity, young male and castrates were commonly used for fattening in the three districts because these animals are to be culled. Category of goats used for fattening was significantly (p<0.05) different among the three districts. None of the respondents in this study preferred female goats for fattening purpose.

The type of feed resources used for fattening by goat owners was natural pasture 91.7%, 88.2% and 93.3% for Sherkole, Kurmuk, and Menge districts, respectively. Those farmers practicing fattening in the study area were fattening their goats within 3 to 8 months. According to Mahilet [22], most farmers in Meta, Babbile, and Gurawa district were fattening their goats in the range between 6 months and 12 months.

Goat breeding practice

Mating method and source of buck for mating in the study area are shown in Table 5. Most goat owners use an uncontrolled type of mating which accounts to 92.2%, 89.1%

and 85.9 in Sherkole, Kurmuk, and Menge districts, respectively. Mating methods in this study were significantly different (p<0.05) among the three districts. Grazing goats of more than one household together in the natural grazing land allowed the mating to be uncontrolled. In contrast to this result, 77.3 % of the respondents in Enebse Sar Midir reported practicing selection of breeding male and female goats by allowing mating of does with whichever buck is around when the doe showed signs of heat [17].

Almost 10% of the respondents used a semi-controlled type of mating and they did not permit mating their does by any buck from the mixed flock. Among the reasons for this, the color of the buck was the major consideration by the goat owners in the study area. Culturally a buck with black coat color type was not allowed to mate their does. The goat owners did not prefer goat with black coat color due to the fact the study community culturally distaste a black coat color and use it as culling criteria.

Majority of the goat owners in this study area responded that source of buck is from unknown sources (92.2%, 89.1%and 85.9% for Sherkole, Kurmuk and Menge districts, receptively); which is also the indicator for uncontrolled breeding. The remaining buck sources for mating in the study area were an owner's own buck and neighboring bucks respectively in the three study districts. Source of buck in this study was significantly (p<0.05) different among the three districts.

Major constraints to goat production
Prioritizing the constraints of goat production is important to identify and solve the problems of goat productivity. The major constraints challenging goat production in the study area are presented in table 6. Feed shortage was the first ranked major constraint in the three study districts which have an index value of 0.30, 0.34 and 0.28 in Sherkole, Kurmuk and Menge districts, respectively. Water shortage was the second goat production constraint in the three districts with an index value of 0.21, 0.23 and 0.22 in Sherkole, Kurmuk and Menge districts, respectively. The occurrence of diseases was the third constraints in Kurmuk and Menge districts; whereas drought was the third goat production constraint in Sherkole district. Predators were another goat production constraint in the three study districts, with foxes, hyenas, and wild dogs being most common. The predators attack goats when they are browsing in natural grazing land in the daytime as well as in open yard during the night time. This result is in line with Grum [15], who reported water shortage as the second frequently mentioned constraint at Jeldesa and Mudianeno districts next to feed shortage.

Reproductive performances of goat
Age at sexual maturity was 8.01 months and 7.91 months for males and female goats respectively in Sherkole district. Age at sexual maturity is 7.12 and 7.82 for male and female goat's respectively in Kurmuk district and the corresponding figures are 7.42 and 7.75 in Menge district. According to Yoseph [24], not only is information scarce on age at puberty for tropical goat breeds but whatever information is available in the literature is not consistent (7.42 and 7.75 for male and female goats). Age at sexual maturity of goats is significantly (p<0.05) different in Sherkole and the other two districts for male goats.

Age at first kidding is a good indicator of sexual maturity in does. Age at first kidding in these study districts was significantly (p<0.05) different from Sherkole and the other two districts for male goats. This result is in agreement with the result reported by Tesfaye [14] for Metema goats that have the mean ages at first kidding of 13.6 months. Age at first kidding (AFK) of 15 months is reported for local goats found in central Tigray [25]. These reproductive characteristics including age at first kidding are influenced by many factors such as the genetic makeup of individual goat, physical environment, nutrition and time of birth [26]. Kidding interval (KI) is 7.86, 7.75 and 7.65 for Sherkole, Kurmuk and Menge districts. The report of Adugna and Aster [27] revealed that 8 months of KI for some indigenous goat breeds in Ethiopia. The kidding interval for Afar goats in Gewane district was 7.59 months [23].

CONCLUSION

The study revealed that the goat owners kept their goat to generate income as the primary purpose in all sampled districts and they mainly relied on natural pasture as a source of feed. Therefore, uncontrolled grazing was a common practice among the majority of the farmers. Goat fattening was not common in the majority of the households due to lack of awareness about the modern goat husbandry practice; alternative feed resource and seasonal fluctuation of market price. Feed shortage, water shortage, and the different predators were the main constraints that hinder the production and productivity of the goat. Extension service providers are expected to train goat owners in practices that improve forage establishment programs to alleviate feed shortage, developing water sources (groundwater and pond) to reduce long movement of goat and their herders are suggested. Extension of animal health service by strengthening community-based animal health workers is required to reduce the loss of goat productivity caused by major diseases.

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Table 1: Purpose of goat keeping in the study area

Purpose of keeping	Skerkole		Kurmuk		Menge	
	N	Index	N	Index	N	Index
Income	37	0.46	31	0.34	36	0.31
Milk	36	0.29	33	0.30	36	0.30
Wealth	38	0.13	37	0.29	41	0.25
Dowry	19	0.12	6	0.04	11	0.08
Sacrifice	0	0	4	0.03	8	0.06

Index = sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for particular purpose divided by sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all purpose; N=the sum of rank one, rank two and rank three for each particular purpose

Table 2: Goat feed sources in the study area

Feed sources	Skerkole		Kurmuk		Menge	
	N	Index	N	Index	N	Index
Natural pasture	64	0.86	64	0.91	64	0.87
Grain	10	0.08	7	0.07	10	0.09
House residue	8	0.06	3	0.02	7	0.04

Index = sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for particular purpose divided by sum of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all purpose; N=the sum of rank one, rank two and rank three for each particular purpose

Table 3: Reported housing systems for goat in the study area

Housing of goat	Sherkole		Kurmuk		Menge		Overall		X^2	P value
	N	%	N	%	N	%	N	%		
Type of house									18.56	0.001
Yard	38	59.4	48	75.0	40	62.5	126	65.6		
Kraal	26	40.6	16	25.0	24	37.5	66	34.4		
Material for housing										
Bush /grass	46	71.9	56	87.5	42	65.6	144	75.0	19.03	0.008
Wood	10	15.6	3	4.7	20	31.3	33	17.2		
Earth and grass	8	12.5	5	7.8	2	3.1	15	7.8		
Goats housed with										
Cattle	2	3.1	8	12.6	5	7.8	15	7.8	3.96	0.411
Sheep	10	15.6	10	15.6	10	15.6	30	15.6		
Alone	52	81.3	46	71.8	49	76.6	147	76.6		

X^2=chi-square value, N=number of respondents in the districts

Table 4: Goat fattening practice in the study area

Housing of goat	Sherkole		Kurmuk		Menge		Overall		X²	P value
	N	%	N	%	N	%	N	%		
Practice fattening										
Yes	12	18.8	17	26.6	15	23.4	44	22.9	52.21	0.001
No	52	81.2	47	73.4	49	76.6	148	77.1		
Category of goat to be fattened										
Young male	3	25.0	5	29.4	4	26.7	12	27.3	8.48	0.014
Castrates	9	75.0	12	70.6	11	73.3	32	72.7		

Table 5: Goat breeding management

Breeding management	Sherkole		Kurmuk		Menge		Overall		X²	P value
	N	%	N	%	N	%	N	%		
Mating method										
Semi-controlled	5	7.8	7	10.9	9	14.1	21	10.9	61.13	0.003
Uncontrolled	59	92.2	57	89.1	55	85.9	171	89.1		
Source of buck										
Own buck	4	6.2	5	7.8	2	3.1	11	5.7	7.61	0.106
Neighbor buck	1	1.6	2	3.1	7	10.9	10	5.2		
Unknown buck	59	92.2	57	89.1	55	85.9	171	89.1		

X²=chi-square value, N=number of respondents

Table 6: Constraints of goat production in the study area

Constraints	Sherkole		Kurmuk		Menge	
	N	Index	N	Index	N	Index
Disease	2	0.01	31	0.13	41	0.17
feed shortage	46	0.30	49	0.34	44	0.28
water shortage	37	0.21	44	0.23	38	0.22
Drought	44	0.20	17	0.07	11	0.06
Predator	33	0.13	28	0.12	31	0.14
lack of technology	19	0.11	16	0.06	21	0.08
Market access	7	0.04	5	0.05	5	0.04

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