Husbandry and Breeding Practices of Indigenous Sheep in Bensa District of Sidama Zone, Southern Region

Hizkel Kenfo[1*], Yoseph Mekasha[2], and Yosef Tadesse[3]

[1]Southern Agricultural Research Institute (SARI), P. O. Box 6, Hawassa, Ethiopia
[2]International Livestock Research Institute (ILRI), LIVES, Hawassa, Ethiopia
[3]Haramaya University (HU), School of Animal and Range Sciences, P. O. Box 138, Dire Dawa, Ethiopia

Abstract: The study was carried out in the highland and mid-land of Bensa district of Sidama Zone, southern Ethiopia. The objectives of the study were to assess the husbandry and breeding practices of indigenous sheep. A total of 128 households from four *kebeles* were selected randomly from the purposively selected areas based on sheep population and accessibility. Data was gathered through semi structured questionnaire, focus group discussions and key informants interview. In addition, secondary information was collected from the Livestock and Fishery development offices. The primary reason of keeping sheep was for cash income, saving, and meat production in both agro-ecologies. Docking of fat tail of ewe lambs is a common practice in the highland agro-ecology. Selection was practiced both for male and female sheep mainly focusing on growth rate, appearance and coat color traits. In the highland area, appearance, growth rate, coat color, and tail type were the most frequently used traits for breeding rams. Twining ability, appearance, coat color, and lamb growth rate were mentioned as traits they give due emphasis in choosing future breeding ewes across the two agro-ecologies. It was concluded that considering producers objective traits identified in the current study would help in designing sheep genetic improvement in the study area.

Keywords: *Breeding practices, Highland, Husbandry practices, Midland, Sheep*

Introduction

Ethiopia has large farm animal diversity since its geographic location is near the historic entry point of many livestock population from Asia. Despite its diverse topographic and climatic conditions, its resources are not much described (Solomon, 2008). Detailed information on the population and its husbandry and breeding practices need to be available to design an effective community-based breeding strategy. Unfortunately, information available on Ethiopian sheep breeds is scanty (Solomon, 2008). Available information so far have been based on on-station managed flocks and measurements like body weight were the main focus. Looking at a population from this perspective alone does not consider the keeper's priorities (Yohannes *et al*., 2017). Institutionalized and centralized sheep genetic improvement efforts were made for the last six decades in Ethiopia and have often failed to yield significant impacts at the farm level. Among the many reasons, dependence on imported technological packages, absence of structured breeding plans, acute shortage of technical proficiency, and limited involvement of relevant stakeholders particularly smallholder farmers/pastoralists in the planning and implementation of sheep improvement endeavors contributed to such failures (Gemeda *et al*., 2010).

Indigenous sheep in Ethiopia have multipurpose roles for smallholder farmers as sources of income, meat, skin, manure, and coarse wool or long hairy fleece. They are also a means of risk avoidance during crop failure. Thus, increasing the current level of productivity of sheep is essential to meet the demand for these services by the ever-increasing human population, increase earnings from sheep export and income of the small scale sheep producers. The study of Tadelle (2010) showed that strong selection and short use of rams for breeding were the preferred options to improve sheep productivity in the small holder farmers.

Designing of community-based breeding strategies basically needs detailed understanding of the community's indigenous knowledge of farm animals regarding husbandry and breeding practices (Tadelle, 2010). Understanding of breeding objectives and selection criteria with the participation of the community and identification of husbandry and breeding practices are vital for improvement, utilization, and conservation of the sheep population, and for designing breeding strategies in the study area. However, information on husbandry and breeding practices of sheep population of the study area under smallholder management system is not available. Hence, the objective of the study was to characterize husbandry and breeding practices of indigenous sheep in Bensa district of southern region of Ethiopia.

Materials and Methods

Description of the Study Area

The study was conducted in Bensa district of Sidama Zone in Southern Nations Nationalities and Peoples' Region (SNNPR) of Ethiopia. Bensa district is one of the 19 districts in Sidama Zone. Bensa district is bordered on the South and North by Oromia Regional sate, with Bona Zuria on the west, Arbegona district on the North West, Chere district on the East, and

*Corresponding Author. E-mail: hizkel2001@gmail.com

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Aroresa district on the South east. Daye, the capital of Bensa district, is located at 420 kms south east of Addis Ababa and 135kms north east of Hawassa, the capital city of SNNPR.

The study area is located at an altitude that ranges from 1452 to 3129 meters above sea level. The area experiences bimodal type of rainfall. The two rainy seasons are the *belg* (short rainy season), which covers from late February to May, and the *kremt* (main rainy season), which occur from late June to early October. The annual average rainfall of the area is about 1206mm. The average temperature of the district is estimated at 19^{o}C. The district has 3 major agro-ecologies where about 50% is moist *weyna dega* (mid-altitude), 36% *moist dega* (highland) and 14% *moist kola* (lowland) (LIVES, 2012). According to the Bensa district Livestock and Fishery Office (BDLFO) the total human population size of the district is 342,545, of which 147,471 are men and 195,074 are women and the livestock population consists of 377, 867 cattle, 124,021 sheep, 25, 852 goats, 231, 081 chickens, 12, 377 horses, 2,474 donkeys, and 870 mules(BDLFO, 2015).

Sampling Techniques

Bensa district was selected purposively based on information from the Livestock and Irrigation Value-chains for Ethiopian Smallholders (LIVES) project (www.lives-ethiopia.org) for its huge sheep population and scarcity of information on breeding and husbandry practices. Before deciding on the target *kebeles* (smallest administrative units within a district), discussions were held with the district experts, development agents and the farmers' representatives about the local sheep types and the current production systems of the study area. The district was stratified into two based on sheep dominant and non-sheep dominant agro-ecologies. From each agro-ecology, two *kebeles* were selected based on the size of sheep population and accessibility. Households having a minimum of two ewes and has prior experience in sheep production were identified from residents list obtained from the respective *kebeles*. This was followed by identification of 32 households from each rural *kebele* randomly. A total of 128 households were randomly selected for the current study.

Data Collection

Data were collected by administering a semi-structured questionnaire via individual interview, group discussions with key informant, and from secondary sources obtained from the district Livestock and Fishery Office. The questionnaire was pre-tested before administration and some re-arrangements, reframing and correction were made based on outputs from the pre-tests.

Data Management and Analysis

The data was coded and entered into a spreadsheet in computer. Data was described and analyzed using SPSS (2009). Indices were calculated to provide ranking of the reasons of keeping sheep, trait preferences and selection according to the following formula: Index = Σ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] given for particular qualitative variables divided by Σ of [3 for rank 1 + 2 for rank 2 + 1 for rank 3] for all qualitative variables considered (Kosegy, 2004). Effective population size for randomly mated population was calculated according to Falconer and Mackay (1996) as: $Ne = (4Nm\ Nf) / (Nm + Nf)$ Where, Ne = effective population size, Nm = number of breeding males, and Nf =number of breeding females. The rate of inbreeding coefficient (ΔF) was calculated from Ne as $\Delta F = 1/2Ne$. The mean of these parameters was also computed.

Results and Discussion

Purpose of Keeping Sheep

The purposes of sheep keeping in the study area are presented in Table 1. The results of this survey revealed that sheep play multi-functional roles in both agro-ecologies with similar production goals. The results indicated the relative importance of tangible benefits of sheep keeping and they are primarily kept as source of income followed by saving and meat consumption purposes in both agro-ecologies. Functions like ceremony, wealth status and manure received relatively low ranking indicating that farmers keep sheep for monitory earning and source of food than other services. Highland farmers use sheep milk, but none of the respondents of the mid-altitude mentioned utilization of sheep milk. Dejene (2010) also reported that sheep are reared to provide a versatile function to the keepers in the southern highlands of Ethiopia. Diverse functions are particularly important under subsistence production system and the value of indigenous livestock breeds under low input system in this respect was well documented (Marsoner *et al.*, 2018).

Grazing Practices

The grazing practice in the study area depends on season (Table 2). During the wet season, majority of the respondents use tethering in order to prevent sheep from grazing on cultivated annual food crops and for optimal usage of family labor, protection from predators, and unwanted breeding. During the dry season, majority of the respondents practice free grazing, followed by tethered grazing, and herding in highland area. Similarly, during rainy season, majority of the farmers in Kaffa (72.7%) and in Bench-Maji (77.8%) Zone practiced tethering where as in dry season sheep are left to graze freely in Kaffa (78.6%) and in Bench-Maji (70.6%) Zones (Dejen, 2010).

Table 1. Ranked purpose of keeping sheep as indicated by respondents

Purpose of keeping	Highland				Mid-altitude			
	Rank 1	Rank 2	Rank 3	Index	Rank1	Rank2	Rank 3	Index
Meat	4.7	0	56.2	0.11	12.5	4.7	46.9	0.15
Milk	0	0	21.9	0.04	0	0	0	0.00
Ceremony	0	0	7.8	0.01	0	0	10.9	0.02
Wealth status	0	0	6.2	0.01	0	0	12.5	0.02
Manure	0	0	26.6	0.04	0	0	23.4	0.04
Saving	35.9	62.5	0	0.37	20.3	73.4	0	0.33
Income	62.5	34.4	3.1	0.42	78.1	21.9	0	0.44

Table 2. Major grazing practice of sheep as reported by respondents

Grazing management	Highland		Mid-altitude	
	Rainy season (%)	Dry season (%)	Rainy season (%)	Dry season (%)
Free grazing	3.1	59.5	21	93.8
Tethered grazing	71.9	10.9	79	6.2
Herding	17.2	6.2	-	-
Rotational grazing	7.8	23.4	-	-

Herding Practices

A good understanding of the community's herding practices is crucial to bring sustainable improvement in the smallholders flock through community-based strategies (Sölkner-Rollefson, 2003). The results indicated that all classes of the sheep were herded together during day time though new born lambs were kept separately for few days near the houses (Table 3). In highland and mid-altitude 100 and 75% of the households, respectively keep sheep as a flock. Because of their feeding habit, farmers prefer to herd sheep separately but shortage of labor forced them to keep them with cattle and equines. The result is similar with Tassaw (2012) who noted herding sheep separately was rarely practiced in Habru and Gubalafto districts.

Table 3. Sheep herding practices in the study area

Sheep herding practices	Agro-climate			
	Highland		Mid-altitude	
	N	%	N	%
Sheep flock is herded				
Together with cattle and equine	50	78.1	52	81.2
Sheep herded separately	14	22.9	12	18.8
Way of herding				
Sheep of a household run as a flock	64	100	48	75
Sheep of more than one household run as a flock	-	-	16	25

Fattening Practices

The majority of farmers in highland (71.9%) and mid-altitude (78.1%) do not fatten sheep (Table 4). Zewdu (2008) also reported that the majority of Bonga sheep (89.5%) and Horro sheep (53.3%) farmers did not practice fattening of sheep. Low level of fattening practice could be lack of awareness on value addition through fattening and seasonality of markets for fattened sheep. In this regard, the study of Montossi *et al.* (2013) showed that preference of lamb by consumers is affected by cultural aspects or consumption habits, consumer attitudes and beliefs. Although fattening is less common, the major classes of sheep used for fattening were young males followed by old females and older males. Crop residues, enset (*Ensete ventricosum*) leaves, salt, grain, and household leftovers were commonly supplemented to fatten the sheep.

Milk Production and Weaning

According to the group discussions, sheep milk consumption was common in highland agro-ecology (Table 5). Producers in the study area milk sheep for different purposes after giving priority to the lambs. Lambs were allowed to suckle freely for about a week to ensure their survival. When lambs are in a good condition (after about a month) and started to nibble on grasses and consume "supplementary feeds", farmers start partial milking for consumption, mainly for coffee whitening, and consumption by children and old people. According to focus group discussants, some farmers prefer sheep milk for butter making due to the perceived higher fat content. Sheep milk contains higher fat (6.8 to 8.5%) compared to goat (3.4 to 4.5), cattle (3.4 to 5.5), and camel (5.0 to 5.5) (Degen, 2007). According to the group discussants sheep milk was not marketed because of cultural reasons. On average 476ml of milk was produced per ewe per day and milking is performed once a day in the

morning. Ewes produce milk for up to 3 months after lambing. The producers were reluctant to disclose that they milk sheep though they consume the milk at home. Frequency of milking and milk yield per ewe per day were different between the rainy and dry seasons, but on average 2.82 cups/day was produced from Afar sheep (Tadelle, 2010). Sheep milking was not practiced in mid-altitude agro-ecology of the study area.

Weaning is a crucial period which influence both dam and lamb productivity (Gbangboche *et al*., 2006). In the study area, lambs wean naturally without owner intervention. The overall reported average weaning ages for both sexes was 4.4 months. It was a little bit longer than 3 months reported for indigenous sheep breeds such as Sekota, Horro, and Menz sheep of Ethiopia (Kassahun, 2000; Markos, 2006; Aemero *et al*., 2012). The present finding was similar with that reported for the thin tailed Gumuz sheep (3.95 ± 0.9 months) (Solomon, 2007).

Table 4. Sheep fattening practices in the study area

Fattening practices	Agro-climate					
	Highland		Mid-altitude		Overall	
	N	%	N	%	N	%
Do you practice fattening of sheep?						
Yes	18	28.1	14	21.9	32	25
No	46	71.9	50	78.1	96	75
Classes of fattening sheep						
Young males	12	66.7	10	71.4	22	69
Older males	2	11.1	1	7.1	3	9.1
Older females	4	22.2	3	21.5	7	22

Table 5. Sheep milk production, lamb weaning practices, and average flock size

Parameter	Highland		Mid-altitude	
	N	Mean ± SE	N	Mean ± SE
Average daily milk yield of sheep (ml)	55	476±0.15	-	-
Frequency of milking	55	1.1±0.14	-	-
Lactation length of sheep (month)	55	3.5±1.2	-	-
Lamb weaning age (month)	64	4.2±0.16	64	4.6±0.17
Average flock size	64	4.6±0.08	64	4.3±0.07

Castration

According to the group discussants, castration of sheep was not a common practice in the study areas. Some of the well to do farmers, however, castrate and fatten one to two rams for one year period for home consumption as well as for market. The method of castration is traditional through repeatedly crushing the spermatic cord using a smooth sharp stone usually found in the river and wood. Although the age of the animals at the time of castration is not fixed, farmers suggested that it should be after eruption of one pair of permanent teeth. In this regard ESGPIP (2008) reported that castration should take place at the youngest age possible since the stress of castration can adversely affect growth in older animals. Training should be given by appropriate stakeholders for the farmers to create awareness on castration of the inferior rams for fattening purpose and select superior rams with better management to be parents of the next generation.

Docking

Docking of female sheep was a common practice undertaken by sheep producers in highland agro-ecology of the study area. Accordingly, about 60.9% of the respondents practice docking in the highland while in mid-altitude docking was not common. The major reason for docking female sheep was for ease of mating. Moreover, the focus group discussants reported that docking females improves body weight and condition, appearance, ease hygiene during delivery, and widen the tail. Gemeda (2010) described that tail type is the important attribute for Bonga ewes, which they usually associate with beauty (physical attractiveness) and better body condition. For this purpose, farmers cut female lambs' tail tip a week or two after birth with a hot sharp knife. Unlike females, males are not docked since such males are not preferred at the market. Even though there is no standardized specific site of tail cutting in female sheep, most producers involved in the focus group discussion estimated that it is at about 5cm from the tip.

Sheep Breeding Practices

The dominant sheep breeding practice in the study area was uncontrolled mating system (Table 6). Similarly, the study conducted by Zewdu *et al*. (2012) showed that sheep mating was predominantly uncontrolled and no respondents reported controlled breeding in Adiyo Kaka and Horro districts in Ethiopia. About 39.1% of the respondents have no breeding ram of their own and they said that they use rams from neighborhood or borrow males from other areas. Most of the respondent had one ram running with the flock throughout the year; as a result respondents easily identify the sire of the lamb. Majority of the respondents do not give additional feeds for breeding

rams. Rams were kept for mating (64.1%), saving, and socio-cultural purposes. The majority of the males used for breeding were born within the flock (82.1%) and the remaining were purchased and managed privately. This implies that the animals within the flock are very closely related and have narrow relationship which leads to inbreeding (Jaitner *et al.*, 2001). Similar scenario was reported in Menz and Afar sheep (Tesfaye, 2008).

The majority of the respondents (65.6%) said they identify the sire of the new born lamb by relating the color of the lamb with the color of its sire while some know the sire of a lamb. Although the disadvantage of inbreeding was not clear for farmers in the study area, some of them reported that they heard about the negative effects.

Table 6. Breeding practices of sheep

Items	№ of respondents	%
Mating system		
Uncontrolled	116	90.6
Controlled	12	9.4
Having breeding ram		
Yes	78	60.9
No	50	39.1
Purpose of keeping ram		
Mating	50	64.1
Social	6	7.7
Saving	22	28.21
Source of ram		
Born in the flock	64	82.05
Purchase	14	17.95
Could you able to identify the sire of a lamb		
Yes	84	65.62
No	44	34.38
Docking		
Yes	39	60.94
No	25	39.06

Effective Population Size and Level of Inbreeding

The study revealed that utilization of breeding rams born within the flock, uncontrolled mating, lack of awareness about inbreeding, and small flock size may lead to accumulation of inbreeding and decreased genetic diversity (Falconer and Mackay, 1996; Kosgey, 2004). Effective population size is a measure of genetic variability within a population. A large value of Ne indicates more variability, while small values indicate less genetic variability (Maiwashe *et al.*, 2006). In the present study, the estimate of Ne was 97.7 when a household flock is herded alone (Table 7). Under random mating when the sheep flock of a household was not mixing, the rate of inbreeding was 0.005. This value is lower than the values reported by Amelmal (2011) for Tocha (0.17), Mareka (0.2), and Konta sheep (0.18) and Tesfaye (2008) for Menz (0.079 and Afar sheep (0.2). Rate of inbreeding in the study area is within minimum acceptable level (0.063) (Armstrong, 2006), which is an attribute of optimum effective population size and acceptable proportion of breeding ram in the study area. But, this acceptable level of rate of inbreeding would be affected in the successive generation because of small effective population size and small number of breeding rams per household. Hence, mixing flocks of different households may reduce rate of inbreeding. A study by Tesfaye (2008) indicated that mixing of flocks reduced ΔF by about 78% to 86%.

Table 7. Effective population size and level of inbreeding

Nm	Nf	Ne	ΔF
28	191	97.68	0.005

Ne= Effective population size; ⊿F= Coefficient of inbreeding; Nm= Number of breeding male; Nf= Number of breeding female.

Trait Preference

Knowing the potential of local sheep population and trait preferences are useful to make better informed decisions in developing interventions to improve the contribution of sheep to livelihoods of their keepers (Tassaw, 2012). In the study area, appearance/size, growth rate, coat color, meat quality, tail type and fertility were among the reported preferred traits in both agro-ecologies. In the highland, appearance/size, coat color, fast growth rate, and meat quality were among the reported preferred traits in their order of importance (Table 8), while in mid-altitude fast growth rate, appearance/size, coat color, tail type, and fertility were among the traits considered for improvement interventions. The most preferred color was red, light red, white patch and white, while unwanted color was black because of lower market value. Similarly, Zewdu (2008) indicted that traits like body appearance and coat color were the most considered characters in Adiyo Kaka and Horro rams.

Table 8. Ranking of sheep trait preference of farmers

Trait	Agro-ecology							
	Highland				Mid-altitude			
	1st	2nd	3rd	Index	1st	2nd	3rd	Index
Size	45.3	23.4	12.5	0.30	23.4	20.3	20.6	0.21
Color	17.2	26.6	23.4	0.19	17.2	17.2	17.2	0.17
Character	3.1	10.5	4.7	0.05	0	0	3.1	0.01
Meat quality	9.4	12.5	37.5	0.14	7.8	3.1	17	0.08
Growth rate	15.6	32.8	7.8	0.18	23.4	39.1	7.8	0.25
Fertility	4.7	0	3.1	0.03	15.6	7.8	10.9	0.12
Disease tolerance	12.5	3.1	3.1	0.07	1.6	3.1	12.5	0.04
Tail type	3.1	4.7	7.8	0.04	15.6	3.2	20.3	0.12

Table 9. Selection criteria for selecting breeding ram

Characters	High land				Mid-altitude			
	Rank1	*Rank2*	*Rank3*	*Index*	*Rank1*	*Rank2*	*Rank3*	*Index*
Appearance/size	37.5	31.2	15.6	0.32	39.1	25	10.9	0.32
Color	10.9	35.9	37.5	0.24	7.8	7.8	65.6	0.19
Behavior	0	9.4	0	0.03	0	0	1.6	0.00
Adaptability	0	0	12.5	0.02	0	1.6	0	0.01
Growth rate	51.6	17.2	21.9	0.36	29.7	21.9	7.8	0.25
Age	0	6.2	0	0.02	0	15.6	12.5	0.08
Tail length	0	0	4.7	0.01	23.4	4.7	1.6	0.15

Table 10. Selection criteria for selecting breeding ewe

Characters	High land				Mid-altitude			
	Rank1	*Rank2*	*Rank3*	*Index*	*Rank1*	*Rank2*	*Rank3*	*Index*
Appearance/size	31.2	26.6	42.2	0.27	29.7	6.2	51.6	0.25
Color	15.6	39.1	34.4	0.23	0	40.6	15.6	0.16
Lamb survival	0	0	0	0	3.2	0	7.8	0.02
Lamb growth	3.1	29.7	12.5	0.12	7.8	25	9.4	0.14
Age at first sexual maturity	0	0	0	0	0	7.8	14.1	0.05
Lambing interval	6.2	0	0	0.03	0	1.6	0	0.01
Twining ability	59.4	28.1	6.2	0.35	60.9	18.8	1.6	0.37

In both agro-ecologies, group discussants and key informants reported that the tendencies of farmers to rear local sheep have become high. According to them, they liked these local sheep type for their large body size, attractive coat color, fast growths, and good body conformation. They also mentioned that such type of sheep can fetch high premium price when sold. For this reason, it was observed that some farmers practice selective breeding of rams and ewes. The proportions of red /light red and white sheep are increasing and that of black sheep is decreasing over time. This is strongly supported by the preference of farmers for white and red/light red colors against the black color for which the farmers are exercising some kind of selection for the preferred ones. The results indicated that any sheep breed improvement interventions should take into account the needs of the producer trait preferences and market demands.

Selection Criteria

Selection criteria are characteristics that allow farmers to achieve the breeding objectives and select replacement animals (Philipson *et al*., 2006). Solomon *et al.* (2010) showed that the overall appearance of sheep is an important economic trait that influences value, particularly in the traditional markets of Ethiopia. In the study area, selection of breeding rams and ewes were practiced by the farmers, although they do not have specific age of selection. Farmers select rams/ewes when they need to cull some for market and save the others. In selecting a breeding ram, fast growth was ranked first in highland while appearance/size conformation was ranked first in mid-altitude agro-ecology (Tables 9 and 10). In the highland, appearance/size and coat color were ranked second and third. In mid-altitude, fast growth rate, color, and tail length were ranked second, third, and fourth. Bosenu *et al.* (2014) noted that coat color and tail size are the 1st and 2nd ranked traits preferred by farmers in Selale area.

In selecting a breeding ewe, twining ability was ranked first both in the highland and mid-altitude agro-ecology. In highland, appearance/size, coat color, and lamb growth were ranked as second, third and fourth while in mid-altitude appearance/size, coat color and lamb growth were ranked second, third, and fourth, respectively.

Conclusion

The natural uncontrolled mating with small flock size is predominant in the study area. The study revealed presence of selection for some economically important traits. Moreover, sheep fattening and castration are not common practice. Appearance, growth rate, and coat color are the most preferred traits by producers for defining breeding objectives in both agro-ecologies. The present study showed that sheep producers dispose fast growing animals at younger age through sale. Therefore, community based selective breeding program is needed in order to control negative selection and improve the performance and productivity of sheep, particularly males.

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Conflict of Interests

The authors declare that they have no competing interests.

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