

Breeding practice, trait preferences and flock structure of local sheep in selected districts of Hadiya zone, Southern Ethiopia

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Abstract

The present study was designed to identify breeding practices, trait preference and flock composition of local sheep in Duna and Misha districts of Hadiya Zone, Southern Ethiopia. A total of 180 respondents were interviewed using structured questionnaire to collect desired data. Group discussions were held in each district to articulate rank of traits of interest. Index values and descriptive statistics were employed to describe collected data. Mating practice was mostly uncontrolled (83%) and aims of sheep production were revenue generation, asset building and meat production with index values of 0.54, 0.36 and 0.10, respectively. Body size was ranked as primary selection criteria for ewe and ram with index values of 0.35 and 0.33, respectively. Considering/giving more weight for mothering ability could make a better genetic advantage due to its good correlation with growth and pre-weaning lamb survival. Therefore, designing breeding program ought to be based on full involvement local farmers.

Key words: Breeding objectives; Flock composition; native sheep; Mating system; Selection criteria

Introduction

Ethiopia has a huge and diverse sheep population and this genetic diversity is vital for the present and future livelihoods of the large rural poor farmers (Abegaz *et al*, 2010). Sheep afford valuable influences through income generation, direct food sources, non-food services and various socio-cultural privileges (Getachew *et al*, 2010). Particularly at time of crop farming is less reliable due to drought or other factors, sheep are usually used to alleviate adverse effects, for instance, related to food shortage at the smallholder level (Gatenby, 2002). Also sheep production is considered to be advantageous compared to other class of livestock, due to their short generation interval, high fertility, adaptation in harsh environment and their ability to produce in limited feed resource (Tsedeke, 2007). According to Shigdaf *et al.* (2013) sheep have multipurpose functions that provide meat, manure and as source of income. Sheep husbandry plays an important role in rural economics of underdeveloped or developing world viz. Chiapas, Mexico (Rebello-Morales *et al.*, 2021), Algeria (Merrouchi *et al.*, 2021), steppe (Inal *et al.*, 2021) and North Caucasus (Gogav *et al.*, 2021).

Sheep in Ethiopia is produced under an extensive low input subsistence system. Similar to other tropical countries, studies noted that productivity of indigenous sheep in Ethiopia has been limited by poor genetic potential (Markos, 2006; Taye *et al*, 2010; Getahun, 2008). Among the various factors, absence of planned genetic improvement programs is one of the causes for losing their competitive advantage. Moreover, lack of adequate information on indigenous genetic resources, breeding practices, trait preferences and selection criteria has been recognized to be a serious constraint to effective prioritization and planning of sustainable breeding strategies and breed conservation measures in Hadiya Zone. Improving sheep productivity through proper breeding, conservation and sustainable utilization to meet the protein demand by the ever increasing human population and to advance the livelihoods of poor livestock keepers and alleviate poverty among the rural poor dwellers. Presently, for sustainable genetic improvement and conservation of sheep genetic resources, assessing breeding system and farmers selection criteria are basic for development of community-based strategies which take into consideration the need, knowledge and aspiration of local community are being advocated. Disregard of such components will led to low success in sheep genetic improvement attempts (Duguma *et al*, 2010).

Designing and implementation of community based breeding packages require a good understanding of the production system, the alternative importance of the different constraints in the system, clear understanding of breeding practices and objectives supported by the farmers. Therefore, the present study is designed with the following objectives:

- a) To assess breeding practices and breeding objectives of local sheep in selected districts of Hadiya Zone
- b) To identify trait preference and flock structure of local sheep of smallholder farmers in the study area.

Material and methods

Description of Study Area

The study was conducted in Duna and Misha districts of Hadiya Zone of the Southern Nation, Nationalities and People Region, located in the Southern Ethiopia. Duna district has a geographic coordinates of latitude and longitude of 7°20'07 N and 37°39'09.42 E and Misha district situated at 7°3'19 N and 37°23'14 E at latitude and longitude, respectively. The districts were selected because they have greater potentials for sheep production, compared to other districts of the zone. Moreover, a primary assessment prior to the present study has identified the two districts as niche areas for local sheep breed, in which implementing and designing a breeding program is under concern. The agricultural practice in these areas is mixed (crop-livestock) farming, where livestock play vital roles for crop production and the livelihood of smallholder farmers.

Sampling Procedure

Duna and Misha districts of Hadiya Zone were used for the present study. The districts were selected based on sheep population and production potential in the zone. From each district three potential kebeles were chosen in systematic simple random sampling technique. Before deciding on target *kebeles*, a preliminary survey discussion was held with respective districts livestock and fishery production office about sheep population. In such a way top 10 kebeles were identified first and then three kebeles were selected in lottery method. Then after, list of households with minimum of two sheep and had prior experience in sheep production were obtained from authorities of *kebeles* in each district. From the list of households, respondents were selected using simple random sampling technique.

For focus-group discussion, three smallholder farmers who are regarded as knowledgeable in sheep production were further identified by help of livestock development agents and administrative leaders of each *kebele*. For each district, a separate focus-group discussion was held by involving total of 9 experienced farmers, livestock expert and the researchers. Traits that farmers consider during ram and ewe selection were identified during discussion. To rank traits, each member of focused group was asked to rank the traits based on

their indigenous knowledge. Finally, the ranks from the three districts were combined and analyzed to identify the most preferable traits of rams and ewes for selection.

Sample Size

Total households included in the study was determined according to the formula given by Arsham (2005), 3.73% of standard error (SE) with 95% confidence level, 180 households were included in the study.

$$N = 0.25/SE^2$$

Where, N= Sample size, SE= Standard error

Study Approach

Approach-1: Socio-economic characteristics, sheep breeding practices, breeding objectives, flock structure and composition, constraints of production, mating system and related data were collected through in-person interviews, using a semi-structured questionnaire. The questionnaire was organized following Haile *et al.* (2013) who suggested the types of information that need to be collected regarding sheep breeding practices and breeding objectives for the purpose of designing a community-based breeding program.

Approach-2: Sheep trait preferences were identified by means of a separate choice experiment according to Hensher *et al.* (2005). The choice experiment method was designed to identify and prioritize sheep traits during focus-group discussions. By help of the focused discussion respective traits of ram and ewe were arranged.

Data Collection

Field observation, semi-structured questionnaires together with a focused group discussion was employed to dig up the required information. The questionnaire was pre-tested and modified before the commencement of actual administration, to check its clarity to respondents and appropriateness of the questions. Data collectors were trained about approach way to respondents, asking and recording of data. Socio-demographic characteristics of the households (age, gender, educational background, family size, sex), livestock holding, flock structure (number and composition), purpose of keeping, feeding, breeding practices and other related data were included in the questionnaire.

Statistical Analysis

The SPSS statistical computer software (version 24 software) was used to analyze the data. Collected data were also presented in the form of descriptive tabular summaries in proportion and F-test was carried out to assess statistical significance or for comparisons. Data on sheep production objectives, purpose of keeping, ram and ewe selection criteria were arranged using index method of ranking which was recommended by Musa *et al.*, (2006).

$$\text{Index} = \frac{R_n * C_1 + R_{n-1} * C_2 \dots + R_1 * C_n}{\sum R_n * C_1 + R_{n-1} * C_2 \dots + R_1 * C_n}$$

Where, R_n = value given for the least ranked level (example if the least rank is 4th, then $R_n=4$, $R_{n-1}=3$, $R_1=1$).
 C_n = Counts of the least ranked level (in the above example, the count of the 4th rank = C_n , and the count of the 1st rank = C_1)

Results and discussion

Feed resource of sheep in the study areas

Available feed resources of sheep in the study districts are discussed in Table 1. The main feed resources for sheep across the study districts were grazing on natural pasture (private grazing, communal grazing land and road side grazing, riverside and indigenous browser), *enset* root, crop residues, home wastes, coffee residue (*attella*) and supplements. The importance and contribution of the feeds is differs between seasons. Among all feed types natural pasture was the most vital feedstuff throughout a year. Contribution of *enset* root is very high during dry season when natural pasture is richly threatened. Feed shortage is mostly happen during the dry season (April to May). During this period, farmers use supplements (wheat bran, crop residues, *Attela* (by-product of coffee) and leaves of different trees as feed resource of sheep.

Purposes of Sheep Production

The purpose of sheep production across the study districts are shown in Table 2. Calculated value of index (0.54) was highest for revenue generation than the other purposes. Therefore, this indicates that, the primary purpose of sheep rearing in the study districts is for income generation. Asset building, meat and skin production were ranked as second, third and fourth aims of sheep production, respectively. Similar reports have stated by different scholars as the principal objective of sheep production is to generate income in different parts of Ethiopia (Abebe *et al.*, 2020, Getachew *et al.*, 2010 and Dagnaw *et al.*, 2017).

Sheep Flock Size and Composition

The average flock size and composition of sheep under each district are presented in Table 3. The overall mean for sheep flock size was 8.34 ± 1.30 . Sheep population was not significantly different in the study districts ($p > 0.05$). Among sheep compositions, breeding ewes were higher than the others in the flocks, which account 31.62% of the total flock. However, castrated male was the least which accounts 7.74% of the flock in the districts. Therefore, ratio of ram to ewe was 1:2.5 in Misha district and 1:3.17 in Duna district. The current study shown that sheep flock size per farmer is generally small. The present result is to some extent lower than Abebe *et al.* (2020) report who noted that an average flock size of sheep in the northwest highlands of Ethiopia was 10.21. Edea *et al.* (2012) stated that flock size of sheep is 8 to 11 in a mixed (crop-livestock) production system; whereas Nigussie *et al.* (2015) noted an average flock size of about 97 and 72 sheep in Pastoral and agro-pastoral production systems, respectively. Therefore, reason for low flock size in the present study might be due to difference in production system to aforementioned reports, since as already known sheep population per household is depends on production systems.

Selection criteria for breeding ewes and rams

About 90% of respondents have practice of selection of breeding ewes and rams in the districts. Farmer's practice of selection of the animals during buying and mating times based on the outlined criteria's in table below. Body size was the first ranked trait followed by coat color and mothering ability for ewe selection. Likewise body size, coat color, tail type and horn shape were first, second, third and fourth important selection criteria's of ram in the study areas. In the study districts, tail type was more important for rams than ewes. Therefore, smallholder farmers select breeding stock (ewes and rams) mainly based on body size and coat color. The present study is similar with finding of Abebe *et al.* (2020) who found that body size and coat color were two of the most important selection criteria for both breeding rams and ewe in northwest highland of Ethiopia. Appreciating indigenous knowledge is vital to confirm the sustainability of a breeding program intended to be realized at the community level, since applying selection based on body size have linear relation with growth rate.

Sheep breeding management in the areas

About 84.44% and 81.12% of respondents in Duna and Misha districts, respectively use uncontrolled mating with year round lambing. Overall average of 72.77% of smallholder farmers have no their own breeding rams, they get ram service from neighbour and by taking sheep to nearby markets where ram is accessible. On the other hand 27.22% of the farmers across the districts have their own ram of which 86.95% and 80.77% were born in the flock in Duna and Misha districts, respectively. The farmers often keep breeding ewes for longer periods and there is high tendency of inbreeding, since rams have free access to detect heat and mating during field grazing. The matter of inbreeding at smallholder levels has been also reported in southwest Ethiopia by Edea *et al.* (2012). Therefore, farmers ought to be aware of to use rams for a short period to minimize inbreeding within the sheep population.

Culling criteria for rams and ewes

Farmers cull ewes that are infertile, black coat color, poor in mothering ability (locally called *shif jora*) and poor in weight gain. Rams with limbs problems, black coat color and poor in weight gain culled from flocks. Respondents' measure mothering ability of the females based on lambs' growth performance. Similarly, ewes that not give twins birth also not favoured for breeding. About 84% of the respondents across the study districts cull ewes that give only one young per lambing and remaining 16% even need single birth per lambing due to feed shortage. Additionally, the farmers also cull when the animals are get aged too. Even though the farmers have not known the exact age of culling for ewes, they remove ewes after fourth to fifth lambing, whereas, rams with any unpleasant condition left out from flocks at younger age than ewes. Similar traits were also reported by Gebreyohens (2016) to cull refused sheep at smallholder farmers' level in Northern Ethiopia.

Castration practice of rams

Respondents in Duna (89.2%) and Misha (93.5%) districts have practice ram castration. Burduzo method and traditional methods were the most applicable castration practices in the districts. Traditional method is painful and even may prone to infections and death. The present study is agreed with report of Woldeyohannes *et al.* (2021) who reported that smallholder farmers in selected districts of Sidama zone castrate their bucks by using traditional method. Reason for castration is to improve body weight gain, to get better price during selling and to control breeding. The respondents believe that castrated rams usually fatten faster than intact male if suitably managed with proper feeding and care. Period of castration was September to November; the farmers select this season to prevent risk of infection, for rapid wound healing and due to availability of surplus feeds in the areas.

Table 1. Feed resources of sheep in the districts (%)

Feed types	Districts				Overall average
	Duna		Misha		
	N	%	N	%	
Natural pasture	90	100	90	100	100
<i>Enset root</i>	73	81.11	66	73.34	77.22
Crop residues	22	24.44	31	34.45	29.44
Home waste	27	30	37	41.11	35.55
Supplement					
<i>Atella</i> (coffee residue)	43	47.78	33	36.67	42.22
<i>Bole</i> (mineral soil)	21	23.34	25	27.78	25.56
Wheat bran	16	17.78	25	27.78	22.78

Table 2. Respondents ranks for sheep production objectives in the study districts

Production objectives	Duna (N = 90)					Misha (N = 90)				
	Rank-1	Rank-2	Rank-3	Rank-4	Index	Rank-1	Rank-2	Rank-3	Rank-4	Index
Revenue	0.61	0.32	0.04	0.03	0.54	0.54	0.38	0.08	0	0.52
Saving	0.44	0.45	0.05	0.06	0.36	0.48	0.44	0.07	0.01	0.38
Meat source	0.29	0.28	0.05	0.38	0.10	0.43	0.25	0.29	0.03	0.09
Skin production	0.0	0.0	0.01	0.01	0.00	0.0	0.0	0.02	0.02	0.01

Table 3. Sheep flock size and composition in the study areas (Mean ± SD)

Sheep type	Districts		Overall mean N = 180	P-value
	Duna (N = 90)	Misha (N = 90)		
Ewe(breeding)	2.79±0.45 ^a	3.02±0.33 ^a	2.90±0.4	0.53
Ram (breeding)	0.88±0.61 ^a	1.21±0.22 ^a	1.04±0.41	0.43
Ewe(lamb)	1.32±0.67 ^{ab}	2.56±0.42 ^a	1.94±0.54	0.05
Ram(lamb)	1.40±0.69 ^a	2.05±0.73 ^a	1.73±0.71	0.32
Castrated male	0.73±0.67 ^a	0.74±0.34 ^a	0.74±0.50	0.93
Flock size	7.13±1.22 ^{ab}	9.55±1.38 ^a	8.34±1.30	0.08

^{ab} Means in a row with the same letters are not significantly different (p<0.05)

Table 4. Selection criteria for ewe and ram in the study districts.

Selection criteria	Proportion of rank and index of ewe					Proportion of rank and index of ram				
	Rank 1	Rank 2	Rank 3	Rank 4	Index	Rank 1	Rank 2	Rank 3	Rank 4	Index
Body size	0.5	0.29	0.21	0.0	0.35	0.73	0.13	0.05	0.09	0.33
Coat color	0.0	0.11	0.46	0.44	0.16	0.4	0.5	0.08	0.02	0.20
Litter size	0.08	0.05	0.42	0.44	0.09	-	-	-	-	
Lambs interval	0.04	0.06	0.34	0.56	0.06	-	-	-	-	
Mothering ability	0.09	0.06	0.53	0.32	0.17	-	-	-	-	
Twining ability	0.05	0.08	0.45	0.42	0.07	-	-	-	-	
Adaptation	0.0	0.09	0.39	0.52	0.03	0.0	0.0	0.01	0.01	0.0
Libido	-	-	-	-		0.1	0.09	0.19	0.11	0.06
Tail type	0.0	0.08	0.34	0.56	0.05	0.56	0.24	0.14	0.06	0.16
Horn shape	0.02	0.05	0.15	0.77	0.01	0.48	0.26	0.19	0.07	0.15
Pedigree	0.12	0.13	0.48	0.27	0.009	0.49	0.29	0.16	0.06	0.10

Table 5. Breeding management of sheep in study areas

Breeding management	Study districts				Overall mean	
	Duna		Misha			
	N	%	N	%	N	%
Mating system						
Uncontrolled	76	84.44	74	81.12	75	82.78
Controlled	14	15.56	16	18.88	15	17.22
Ram ownership						
No ram	67	74.44	64	71.11	66	72.77
One ram	15	16.67	17	18.89	16	17.78
> 1 ram	8	8.89	9	10	9	9.44
Sources of ram						
Born in the flock	21	22.23	21	23.34	21	22.78
Purchased from market	3	3.34	5	5.56	4	4.45
Neighbors	66	74.44	64	71.11	65	72.78

N = number of respondents

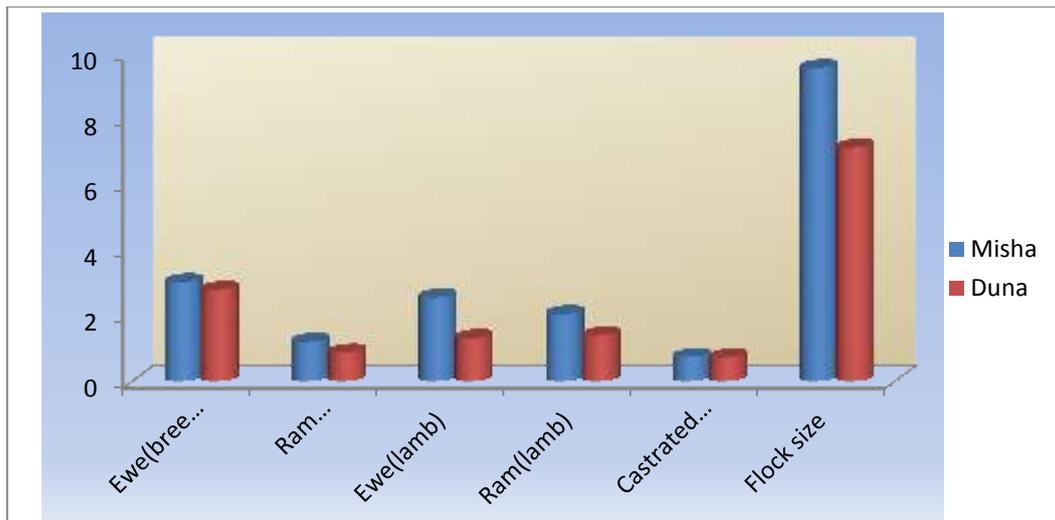


Fig 1. Flock size and composition in study areas

Table 6. Ram castration practices in the study areas (%)

Castration practices	Responses of HH	Study districts		Overall Average
		Duna	Misha	
Castration trend	Yes	89.2	93.5	91.35
	No	10.8	6.5	8.65
Method of castration	Traditional method	76	63	69.5
	Burduzo method	24	37	30.5
Age of castration	Above 12 months	86	80.22	83.11
	Below 12 months	14	19.78	16.89
Reason of castration	Improve weight gain	67	74.50	70.75
	Better selling price	25.74	16.50	21.12
	Control breeding	7.26	9	8.13
Season of castration	September	10.05	18	14.02
	October	42.95	39.5	41.25
	November	47	42.5	44.75

Conclusion

The majority of smallholder farmers have experience in judging good and poor performing sheep in the study areas. They have shown their utmost preference for larger body sizes for both ewes and ram selection and followed by coat color. The farmers have no problem with any coat color except for black one. Mothering ability and tail type were the third important selection criteria for ewes and rams, respectively. Nevertheless, selection judgments at the smallholder farmer level should not only be based on the result of characters included in the objectives of breeding but as an alternative, further preferences of local farmers need to be considered.

Author's Contribution

Conceptualization and designing of the research work (Selamu Abraham); Execution of field/lab experiments and data collection (Mulugeta Kebamo and Deginat Hailemeskel); Analysis of data and interpretation (Selamu Abraham); Preparation of manuscript (Selamu Abraham); edition of manuscript (Mulugeta Kebamo and Deginat Hailemeskel).

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