Full Length Research Paper

Characterization of goat production systems and trait preferences of goat keepers in Bench Maji zone, south western Ethiopia

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Studies to characterize goat production system and identify breeding practices and trait preferences of goat keepers were conducted in three districts (Sheko, Shey Bench and Meanit Shasha) of Bench Maji zone, southwestern Ethiopia. Semi-structured questionnaires and own-flock ranking experiments were employed for data collection. The results of the analyses revealed that the average goat flock size was 9.8±9.3. The flock structure constituted females (42.7%), intact males (19.0%), castrates (1.9%) and kids of both sex (36.5%). Goat production was rated highest for income and then as source of meat, with lowest rating as a means of saving. Most of respondents practiced selection for breeding does than bucks. Mating was predominantly uncontrolled. Twinning ability (I=0.29) for female and body size (I= 0.35) for male were the most highly rated traits at own flock ranking. The goat production system in Sheko and Shey Bench districts was characterized by mixed crop-livestock, while in Meanit Shasha, agro-pastoralism was dominant. Thus, the breeding objectives of the communities are to improve meat production and increase income through increased number of goat flocks.

Key words: Agro-pastoralism, breeding objectives, breeding practices, mixed crop-livestock.

INTRODUCTION

Goats are kept in a wide range of agro-ecological zones and management systems in Africa. They are found in small herds on mixed farms all over Africa, from the humid coastal zones in West Africa to the highlands of Ethiopia (Peacock, 2005). The majority of the goat population is found in large flocks in the arid and semi-arid lowlands which are the characteristics of pastoral and agro–pastoral production systems. Goats are kept by nearly all pastoralists, often in mixed flocks with sheep, freely grazing or browsing in the rangelands of Ethiopia

(FARM Africa, 1996; Yoseph, 2007). Goats are among the most important livestock species in Ethiopia. The population of goats in the country is estimated to be 22.78 million (CSA, 2011). Based on physical characteristics differences, four families and 13 breeds of goats have been identified in Ethiopia (FARM Africa, 1996; DAGRIS, 2007).

Goat production over the years is one of the major means of improving the livelihoods of poor livestock keepers, reducing poverty and attaining sustainable agriculture and universal food security due to their nature to produce in harsh climate with low quality roughages (Peacock, 2005; Madsen et al., 2007; Abdul-Aziz, 2010). Goats provide their owners with a broad range of products and socio-economic services and have played an important role in the social life of many African people (Tesfaye, 2004; Peacock, 2005). Goats can play a vital role in ensuring the food security of a household, often being the only asset possessed by a poor family. In times of disaster, such as crop failure or family illness, goats can be sold to purchase food or medicine (Peacock, 2005; Solaiman, 2010; CSA, 2011).

A good understanding of a production system is important for initiating programs that are meant to improve goat productivity including genetic improvement programs (Kosgey et al., 2006). Farmers in different production systems have different trait preferences due to the varying production activities and available resources (Ouma et al., 2004; Duguma et al., 2010). Definition of breeding objective should be a follow up activity, after defining the production system, in designing genetic improvement strategies (Duguma et al., 2010), since it would provide guidance for people involved in genetic improvement programmes (Kosgey, 2004). Involvement of farmers and pastoralists in defining breeding objectives and identifying traits to be targeted helps to increase the success of breed improvement programs (Getachew et al., 2010).

Bench Maji is known with diversified ethnic groups, varying agro climatic condition, different production systems and a variety of livestock genetic resources. Yet the goat production system and trait preferences of goat keepers in the area were not studied. Therefore, the objective of this study was to characterize the goat production systems and identify trait preference of goat keepers.

MATERIALS AND METHODS

Study site

Bench Maji Zone (BMZ) is located in south western Ethiopia at 34°45' to 36°10'E longitude and 5°40' to 7°40'N latitude. The altitude ranges from 500 to 3,000 masl. The annual average temperature range from 15.1 to 27.5°C, while the annual rainfall range from 400 to 2,000 mm (BMZFED, 2012). The study area consisted of three districts namely Sheko, Shey Bench and Meanit Shasha.

Sampling techniques and data collection methods

The study was conducted from December 2011 to August 2012. A total of 180 (60 per district) goat owners were selected by using stratified sampling techniques. The selected respondents were interviewed by semi-structured questionnaires. General information list of FAO (2011) and Oromiya livestock breed survey questionnaire (Workneh et al., 2004) were used as a checklist in designing the questionnaire. In addition, own-flock ranking was used to identify trait preferences and the breeding objectives as used earlier by Tadele (2010) and Duguma et al. (2010).

Data analysis

Descriptive statistics, Chi-square tests and multiple mean comparisons using Bonferroni's correction were employed to analyze the data by Statistical Analysis System (SAS 9.0, 2002). Indexes were also calculated for all rankings data according to the following formula: Index = sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) given for an individual reason (attribute) divided by the sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) for overall reasons (attributes).

RESULTS

Household socio-economic characteristics

The average family size of the households sampled in the study was about 7.4 (SD=2.91). The average reported age of the respondents was 40.6 (SD=12.35) years with a range of 19-81 years. The majority of respondent households were male headed (93.3%) and only 6.7% of the households were female headed. In terms of literacy of respondents, higher proportion of illiterate (44.4%) was found followed by respondents which could read and write (28.9%).

On average, respondents in the three districts ranked their main source of cash income into sale of crops (I=0.52) as the first, while livestock and livestock products (I=0.35) ranked the second. Sale of homemade beverages was ranked as third source of income (I=0.11). In contrast to Sheko and SheyBench districts, the respondents in Meanit Shasha ranked their source of cash income into sale livestock and livestock products as the first (I=0.57) while sales of crops (I=0.35) ranked the second. Sale of homemade beverages was ranked as third source of income (I=0.08).

Livestock holding

The livestock species maintained in the area were cattle, sheep, goats, chickens and equines. The average reported livestock possessions are presented in Table 1. Respondents at Meanit Shasha had significantly higher (P<0.05) number of cattle, goat and chicken, while respondents at Shey Bench had significantly higher (P<0.05) number of sheep than their counterparts. However, there was no significant difference (P<0.05)

Table 1. Livestock holdings per household in the study areas.

Animal	Sheko	Shey Bench	Meanit Shasha	Overall
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Cattle	4.50 ±2.82[b]	5.25±3.31[b]	8.95±5.45[a]	6.23±4.42
Goat	6.10 ± 2.31[b]	4.55±1.73[b]	18.75±11.51[a]	9.80±9.30
Sheep	1.60 ±1.46[b]	5.85± 3.12[a]	2.60±2.21[b]	3.35±2.98
Chicken	4.45±4.50[b]	6.15±5.13[b]	12.50±8.29[a]	7.70±7.03
Donkey	0.05±0.22[a]	0.25±0.44[a]	0.20±0.41[a]	0.17±0.37
Mule	0.20±0.52[a]	0.10±0.31[a]	0[a]	0.10±0.35
Horse	0[b]	0.35±0.58[a]	0[b]	0.12±0.37

[a,b]Means on the same row with different superscripts are significantly different (P<0.05).
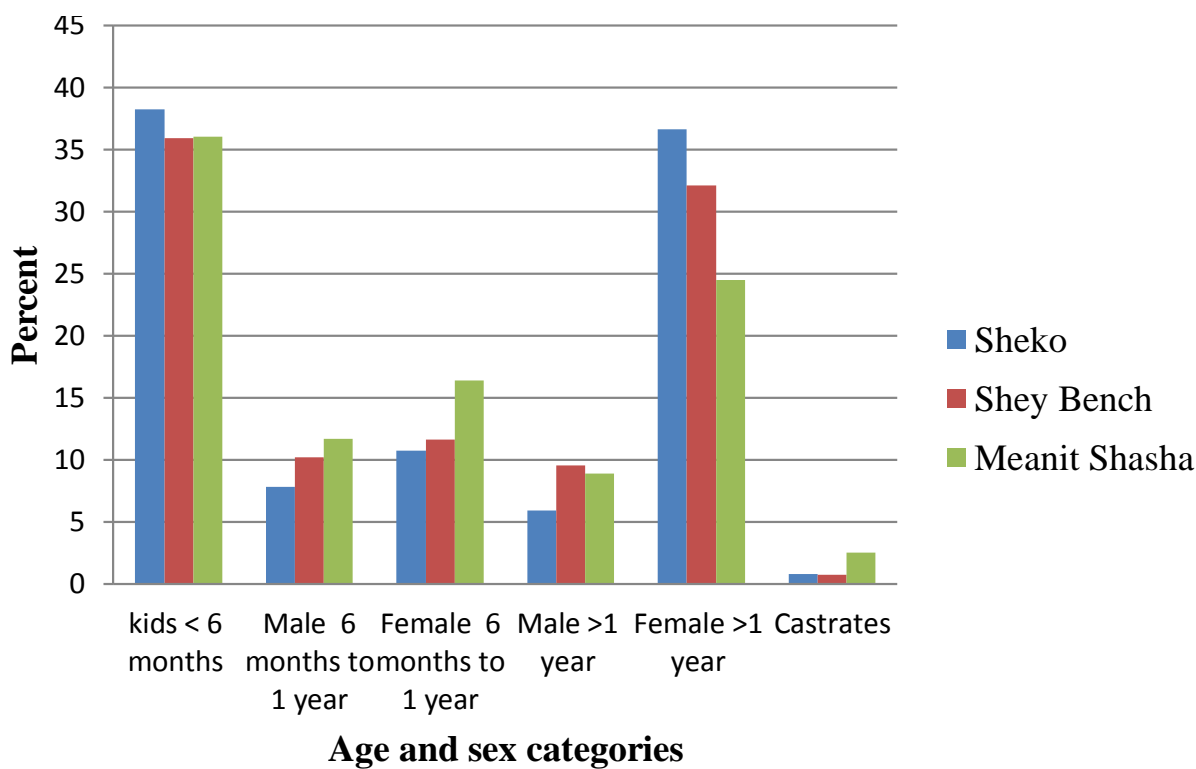
Figure 1. Goat flock size and structures in the study areas.

between the three districts in horse, mule and donkey holding.

Goat flock structure

The flock structure obtained in the study is presented according to age and sex classes in Figure 1. In total, the proportion of females older than six months constituted 42.7%, while intact and castrate males in the same age constituted 19.0 and 1.9% of the whole flock, respectively. Kids (both sexes) less than 6 months of age

constituted 36.5%, while females older than one year of age and 6 months to 1 year of age accounted for 28.2 and 14. 5% of the population, respectively and ranked first, second and third from the whole flock.

Purpose of keeping goat

The respondents in the three districts were ranked according to the reason why they kept goats, accordingly, goat production has been serving as source of income, meat, saving, wealth storage and cultural ceremonies for

Table 2. Ranked constraints of goat production in the study areas.

Constraints	Sheko		Shey Bench		Meanit Shasha		Overall Index
	Index	Rank	Index	Rank	Index	Rank	
Feed shortage	0.35	1	0.34	1	0.33	2	0.33
Water shortage	0		0.04	5	0.15	3	0.06
Disease	0.05	4	0.25	2	0.41	1	0.24
Drought	0		0		0.04	4	0.009
Market	0.04	5	0.02	6	0.01	6	0.02
Mobility	0.02	6	0		0.04	4	0.015
Labor shortage	0.34	2	0.22	3	0.01	6	0.2
Predator	0.2	3	0.13	4	0.02	5	0.15

the goat keepers of the study areas. The overall index result indicated that majority of the respondents (index value of 0.42) rated goat was primarily kept for income source, meat was the second with index value of 0.32 and saving was rated as third having index value 0.16.

Breeding practices

Mating was predominantly uncontrolled in the area. About 23.3, 20 and 76.7% of respondents in Sheko, Shey Bench and Meanit Shasha, respectively, kept their own breeding buck. Majority of respondents at Meanit Shasha (86.7%), Sheko (75%) and Shey Bench (73.3%) reported breeding bucks were originated from own flock while the rest of them reported that bucks were purchased from market. The majority (about 83.3% at Sheko, 58.3% at Meanit Shasha and 76.7% at Shey Bench) of respondents keep bucks for fattening while others reported that they were maintaining bucks for both fattening as well as mating purpose. When the flocks did not have a breeding male, the majority (93 to 100%) of the goat keepers relied on bucks from neighbors' flocks to service the females.

Moreover, few of the respondents at Sheko reported that they got the service by taking their does to a local market where bucks for sale can be used and paying the buck owner an amount of money.

Selection of breeding goats

Selection of parents of the next generation for both males and females was practiced at varying rate. Out of the whole respondents, 77.8% were interested in selection for females while only 37.2% have interest in selecting for males. Majority of the respondents (78.3% at Sheko, 81.7% at Meanit Shasha and 73.3% at Shey Bench) gave attention and practice selection of breeding females. On the other hand, only 38.5, 47.6 and 36.7% reported practicing selection of breeding males at Sheko, Meanit Shasha and Shey Bench, respectively.

Castration

Castration was practiced by 81.7% of respondents at Meanit Shasha, 68.3% at Sheko and 65% at Shey Bench. Male kids of more than six months old were commonly castrated. The respondents have multiple castration objectives such as for improving fattening potential and temperament of buck and indirectly controlling breeding. Male kids of more than six months old were commonly castrated. Castration was entirely done through traditional method using local materials such as wood and stone. Majority of the respondents did not supplement castrated bucks.

Goat production constraints

Constraints of goat production in the study area are presented in Table 2. The constraints were reported across the districts and some of them may not have appeared on the first to third rank lists according to respondents' prioritization. Feed shortage was the most frequently mentioned production constraint and ranked as the first with index value of 0.33. Disease ranked the second mentioned as important constraints threatening goat production (I=0.24) while labor shortage for goatherd shepherding was the third frequently mentioned constraint with index value of 0.20.

Trait preference and breeding objectives

The results obtained on the trait preference from own flock ranking for female and male goats are presented in Tables 3 and 4, respectively. Twinning ability (I=0.31), kid growth (0.21), mothering character (I=0.13) and body size (I=0.13) were the most highly rated traits for selecting female goat from their own flocks. On the other hand, body size and growth rate were ranked as first and second preferred traits with overall index value of 0.42 and 0.27, correspondingly to the selection of best male from their own flocks.

Table 3. Reasons for ranking preferred female goats within own flock.

Characters	Sheko		Shey Bench		Meanit Shasha		Overall Index
	Index	Rank	Index	Rank	Index	Rank	
Body size	0.1	5	0.2	3	0.12	5	0.13
Color	0.05	6	0.06	5	0.04	6	0.05
Mothering character	0.11	4	0.12	4	0.16	3	0.13
Kid growth	0.22	2	0.21	2	0.2	2	0.21
Age at first Kidding	0.03	8	0.02	7	0.02	8	0.02
Kidding interval	0.12	3	0.05	6	0.14	4	0.10
Twining ability	0.3	1	0.36	1	0.27	1	0.31
Adaptive	0.02	7	0.02	7	0.03	7	0.02
Longevity	0.01	9	0.02	7	0.03	7	0.02
Temperament	0.01	10	0.02	7	0		0.01

Table 4. Reasons for ranking preferred male goats within own flock.

Preferred traits	Sheko		Shey Bench		Meanit Shasha		Overall Index
	Index	Rank	Index	Rank	Index	Rank	
Body size	0.45	1	0.46	1	0.35	1	0.42
Color	0.19	3	0.15	3	0.15	4	0.16
Horn	0.04	5	0		0.02	6	0.02
Growth rate	0.27	2	0.3	2	0.24	2	0.27
Adaptability	0		0.02	6	0.17	3	0.07
Mating ability	0.05	4	0.03	5	0.06	5	0.05
Temperament	0		0.04	4	0		0.01

Twinning ability for female and body size for male were the most highly rated traits for selecting goat at own flock ranking experiment. The production objectives of goat keeper are income sources, meat and saving. Therefore, breeding objectives of the community are to improve growth of goat thereby improving meat production potential of goats and increased income through increased number of kid crops in goat flocks.

DISCUSSION

From the results, higher number of goat population was obtained at Meanit Shasha (18.75±11.51) which is significantly different from both Sheko (6.10±2.31) and Shey Bench (4.55±1.73). This is because Meanit Shasha area is characterized as that of agro-pastoral having huge goat population. The average goat flock size (9.8) is higher than the case reported for FARM Africa (1996) which suggested a mean flock size of 7 for Arsi-Bale goats, 4 for Hararghe Highland goats, and 6 for Keffa goats. The result closely relates with average flock sizes of 10 for Central Highland, 11 for Woyto-Guji and 11 for Western lowland goats as reported by the same author. In contrast, Grum (2010) reported average flock size of 32.8 for Short Eared Somali goat population which is quite higher than flock size reported by this study.

The study showed that goats were not milked in the study areas, because no respondents reported they keep goats for milk. This is in agreement with the report for FARM Africa (1996) that goats were not milked in parts of Gojam, Wellega, Keffa and Wolayta. However, reports of Girum (2010) for Short Eared Somali Goats and (FARM Africa, 1996) showed goats are milked in all other parts of the country except in the parts of the country indicated above.

Castration was mainly practiced to improve the fattening potential, thereby it is a means of getting higher sale prices at a later date. It was also practiced to improve temperament of buck and the respondents believe that castrated goats can be raised with females together without problem. Male kids more than six month old were commonly castrated. In agreement with this report, different findings indicated that castration at early age has positive impact on weight gain (Singh, 2000; Wondwosen, 2007). Usually better bucks with good body conformation and having potential for fattening are subjected to castration at early age which results in loss of important gene (negative selection).

Good understanding on the relative importance of the

different constraints is fundamental prior to initiating any genetic improvement programme (Baker and Gray, 2003). Across districts, different constraints with variable rank were reported for instance feed shortage ranked as the first most limiting production constraint at Sheko and Shey Bench, while disease occurrence was ranked as the first followed by feed shortage at Meanit Shasha. Water shortage was third ranked problem at Meanit Shasha. On average, index value, in this finding in agreement with Takele (2005) report that feed shortage, disease and shortage labor for herding is the most limiting production constraints in the same study area. Similarly, in other parts of the country, feed shortage was also the most frequently mentioned goat production constraint (Grum, 2010).

Conclusion

In conclusion, the goat production system in the Sheko and the Shey Bench areas were characterized by mixed crop-livestock, whereas the Meanit Shasha area was characterized by agro-pastoral. Goats in the mixed crop-livestock production system were characterized by small flock size than the agro-pastoral. Goats are kept in the areas for multiple production objectives contributing to household income and food security. Does having high twinning ability with best kid growth and bucks with large body size with good growth rate were the most preferred traits. Higher twinning rate was obtained from the goat flocks because of higher preference for twinning by goat owners. This showed that the goat populations are relatively productive. Thus, the breeding objectives of the communities are to improve meat production and increase income through increased number of kid crops and improved growth.

Conflict of interests

The authors have not declared any conflict of interests.

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