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*Full Length Research Paper*

# Sheep breeds, traditional breeding and flock structure in Burie District, North Western Ethiopia

**Yenesew Abebe[1], Solomon Melaku[2] and Azage Tegegne[3]**

[1] Andassa Livestock Research Center, P.O.Box 27, Bahir Dar, Ethiopia
[2] Haramaya University, P.O.Box 138, Dire Dawa, Ethiopia
[3] International Livestock Research Institute, P.O.Box 5689, Addis Ababa, Ethiopia

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**This study was conducted to assess the sheep breeds, traditional sheep breeding practices and flock structure in four selected representative rural kebeles in Burie district North Western Ethiopia. Informal and formal surveys in the selected kebeles were conducted. The farmers interviewed were selected by using random sampling method. In addition, sheep flocks within the selected kebeles were selected and body weight (BW) using hanging scale, sex and age (estimated based on dentition) of the animals were measured and recorded. There were two sheep breeds in the study area, Washera and Horro. The proportion of the sheep breeds in the sheep flocks among the study kebeles was different. There were more Washera sheep (98%) in Woheni Durebetie kebele and more Horro sheep (92%) in Boko Tabo kebele. On average, one farmer had 3.7±2.46 heads of sheep per household (n = 127). The mean body weight of sheep in the sheep flocks was 21.6±9.34 kg (n = 1211). The proportion of male and female sheep in the sheep flocks was 30.5% and 69.5%, respectively. Farmers in the study area practice crossbreeding Washera with Horro breed. There is a possibility of inbreeding in the sheep flocks. In addition, more productive male animals are being sold, slaughtered or castrated at a young age, so, there is a chance to reduce the population of such animals in future generations. To bring improvements in sheep production and to maintain genetic diversity in the sheep flocks in Burie District, proper sheep breeding system should be planned and implemented.**

**Keywords:** Sheep breeds, breeding, Washera, Horro, Ethiopia.

## INTRODUCTION

The livestock population of Ethiopia is currently estimated at 43.1 million cattle, 23.6 million sheep, 18.6 million goats, 1.7 million horses, 0.3 million mules and 4.5 million donkeys excluding nomadic areas (CSA, 2008) and it is diverse genetically. Small ruminant productivity in Ethiopia is low compared with the apparent potential (EARO, 2001a). Generally, technical and non-technical constraints limit animal productivity in Ethiopia (EARO, 2001b). Among the technical constraints, poor nutrition both in quantity and quality, diseases and low genetic potential for higher production are the main ones.

Small ruminant population of Ethiopia is one of the largest in Africa (IBC, 2007). Most of the small ruminant population of the country is kept by smallholder farmers

*Corresponding Author's Email: yenesew_abebe@yahoo.com

and small ruminant production in the country is traditional (EARO, 2001a). In Ethiopia, the small ruminant production system in different agro-ecological zones is not studied fully and farmers' needs and production constraints have not been identified (EARO, 2001a). Assessment of the sheep breeds, breeding system and flock structure in the smallholder production system is important to bring improvement in sheep productivity in the country. Understanding the breeds and breeding system in the production system helps to design appropriate breeding system for its improvement that is compatible with the system. Therefore, this study was conducted to assess the sheep breeds, the traditional breeding practices and the flock structure in the smallholder mixed crop-livestock production system in Burie District in North Western Ethiopia.

## MATERIALS AND METHODS

Burie District is located between 10˚15′N and 10˚42′29″N and between 36˚52′1″E and 37˚7′9″E in Amhara National Regional State, Ethiopia. It has an estimated area of 838.9 square kilometers with altitude range of 713 – 2604 masl (BOFED, 2008; IPMS, 2007). The rainy season in Burie is from May to September with a monomodal pattern and a mean annual rainfall of 1386 – 1757 mm (IPMS, 2007). According to IPMS (2007), the long term annual temperature of Burie ranges from 14 ºC to 24 ºC. As the district has different ecological settings, it is suitable for different crops and livestock species production.

At the beginning of the study, secondary data were collected from several sources. Based on the secondary data and participation of Burie district office of agriculture and rural development experts, 4 representative rural kebeles were selected for the study. The criteria used to select the study kebeles were agro-climatic and agro-ecological zone of the kebeles, sheep population and density in the kebeles, accessibility of the kebeles by vehicle and non-adjacent kebeles to one another. The selected kebeles for the study were Woheni Durebetie, Woyenema Ambaye, Denbun and Boko Tabo.

Data were collected using both informal and formal survey methods (Roeleveld and Broek, 1996). For the informal survey, checklist was prepared and used for the study. Farmers to be interviewed for the informal survey were selected purposively from the study kebeles. For key informant interviews, kebele administrators and religious leaders were selected and interviewed. For individual interviews, farmers who were involved in sheep production and from various economic statuses (poor, medium and rich; based on resident farmers' evaluation) were selected and interviewed. During key and individual interview selection, those farmers who lived in the area for several years were selected and interviewed. For the group interview, farmers from different age, economic status and gender were selected and interviewed.

To assess the nature of the sheep flock structure, data were collected from each kebele during the informal survey field work. Sheep flocks in each kebele were randomly selected in the grazing fields and each animal in the flock was caught, measured and the data were recorded. Data on sex, age, heart girth, BW (body weight) and breed of each sheep was taken and recorded. Body weight of the sheep was measured using hanging scale. Age of the animals was estimated based on observation of their dentition (Girma and Alemu, 2008).

Based on the informal survey result, questionnaire was prepared and pretested. The formal survey was conducted on those kebeles where the informal survey was carried out. Farmers interviewed were selected from each study kebele by systematic random sampling method from each kebele residents list. Enumerators from each kebele were selected and trained on data collection. The trained enumerators collected the data from the selected individuals. The data collected from the four kebeles were analyzed through descriptive statistics and analysis of variance using SPSS statistical software (SPSS 12.0, 2003).

## RESULTS

Farmers in the study area rear sheep for two main purposes. They rear sheep mainly to get cash income and for home slaughter on festivals. The purpose of sheep production in Ethiopia differs from place to place. According to Abebe *et al*. (2000), the purpose of sheep production in the central highlands part of Ethiopia is for sale, production of wool, household consumption and sacrifice in order of importance. Farmers in the study area on average had 3.7 heads of sheep (n = 127, SD = 2.46) per household. This result is small when it is compared with a result which is conducted in the central highlands of Ethiopia. According to Abebe *et al.* (2000), sheep owners in the central highlands of Ethiopia have on average 15.1 heads of sheep. There were two sheep breeds in the study kebeles of the district. These were Horro and Washera. In addition, there was a crossbred sheep between Horro and Washera in the study kebeles of the district. Washera breed is a short-fat-tailed, short-haired, predominantly brown, and polled sheep breed indigenous to Ethiopia (Solomon *et al*., 2010). This sheep breed is one of the most productive sheep breeds in the country with large body size and litter size of 1.11. The proportion of the two breeds and the crossbred sheep in each study kebele is different (Table 1). There were more Washera sheep in Woheni Durebetie kebele and, more Horro sheep in Boko Tabo kebele (Figure 1 and Table 1). The sheep breeds in the Woina Dega kebeles (Woyenema Ambaye

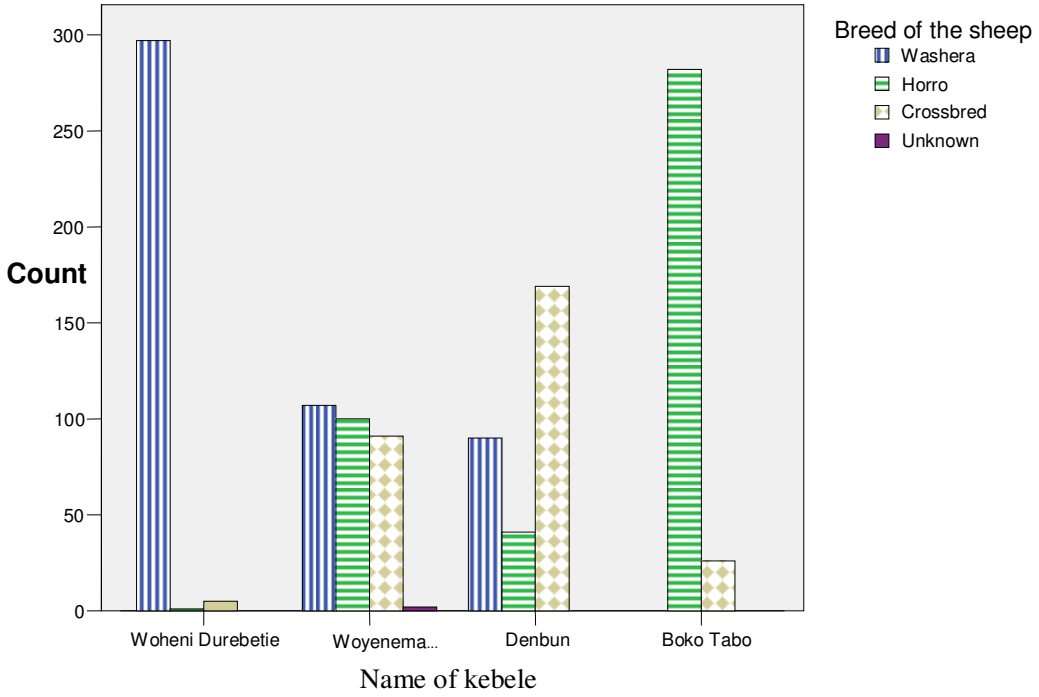


**Figure 1.** Proportion of sheep breeds in the study kebeles of Burie District

**Table 1.** Proportion of different sheep breeds and expected count in the study kebeles of Burie District

| Name of Kebele | | Sheep Breed type | | | Total |
|---|---|---|---|---|---|
| | | Washera | Horro | Crossbred | |
| Woheni Durebetie | Count | 297 | 1 | 5 | 303 |
| | Expected count | 123.8 | 106.3 | 72.9 | 303.0 |
| | % within the kebele | 98.0% | .3% | 1.7% | 100.0% |
| Woyenema Ambaye | Count | 107 | 100 | 91 | 298 |
| | Expected count | 121.8 | 104.5 | 71.7 | 298.0 |
| | % within the kebele | 35.9% | 33.6% | 30.5% | 100.0% |
| Denbun | Count | 90 | 41 | 169 | 300 |
| | Expected count | 122.6 | 105.2 | 72.2 | 300.0 |
| | % within the kebele | 30.0% | 13.7% | 56.3% | 100.0% |
| Boko Tabo | Count | 0 | 282 | 26 | 308 |
| | Expected count | 125.8 | 108.0 | 74.1 | 308.0 |
| | % within the kebele | .0% | 91.6% | 8.4% | 100.0% |
| Total | Count | 494 | 424 | 291 | 1209 |
| | Expected count | 494.0 | 424.0 | 291.0 | 1209.0 |
| | % in all the kebeles | 40.9% | 35.1% | 24.1% | 100.0% |

and Denbun) are a mix of Horro, Washera and crossbreds. Originally, according to the respondents, there was Washera breed in Woheni Durebetie and Woyenema Ambaye kebeles; and Horro breed, in Boko Tabo kebele. Recently, Horro breed is being introduced to the highland kebeles and Washera breed to the lowland kebele for different purposes. During the study, there were 40.9% Washera, 35.1% Horro and 24.1% crossbred sheep in the sheep flocks in the study area (Table 1).

Farmers say that Horro breed is more disease resistant than Washera breed. About 59% of the respondents said that Horro breed is more disease resistant than Washera

**Table 2.** Proportion of male and female sheep in the sheep flocks in the study kebeles of Burie District

| Name of kebele | | Sex of the sheep | | |
|---|---|---|---|---|
| | | Male | Female | Total |
| Woheni Durebetie | Number of animals | 84 | 219 | 303 |
| | % within the kebele | 27.7 | 72.3 | 100.0 |
| Woyenema Ambaye | Number of animals | 81 | 219 | 300 |
| | % within the kebele | 27.0 | 73.0 | 100.0 |
| Denbun | Number of animals | 105 | 195 | 300 |
| | % within the kebele | 35.0 | 65.0 | 100.0 |
| Boko Tabo | Number of animals | 99 | 209 | 308 |
| | % within the kebele | 32.1 | 67.9 | 100.0 |
| Total | Number of animals | 369 | 842 | 1211 |
| | % of all the kebeles | 30.5 | 69.5 | 100.0 |

and the crossbred sheep found in the study area. According to Sansthan and KÖhler-Rollefson (2005), communities know better than anyone else the special characteristics of their animals. According to the above source, scientists can quantify many aspects of indigenous breeds but it is the communities who are familiar with the qualitative traits that are so important for survival and subsistence in harsh environments. Horro breed is less preferable on market and for home consumption compared to Washera breed by farmers in the highland kebeles. According to respondents in the study area Horro breed yields more meat per head than Washera breed. Horro breed also reproduces more frequently than Washera breed (lambing interval is short) in the area. Horro breed gives birth to twins usually and triplets occasionally. But Washera breed usually gives birth to one lamb at a time.

The more preferable sheep breed in the highland kebeles of the district, Washera breed, is becoming more susceptible to diseases recently and death rate for the breed is high. So, the farmers practice crossbreeding Washera with Horro breed and get a local crossbred sheep called *Anfet* in Amharic. The crossbred sheep are more disease resistant and better in reproduction than Washera breed. In addition, they are intermediate in phenotypic characteristics to Washera and Horro and hence they are more preferable compared to Horro breed by farmers in the highland kebeles for home consumption. In the next generation, farmers get the crossbred females (ewes) mate with Washera rams and get the second generation animals. These second generation animals are more similar phenotypically to Washera breed. The farmers' intention by crossbreeding is to make their animals more disease resistant as well as to get more preferable animals phenotypically on market and for home consumption purposes.

There was a difference in proportion between the male and female sheep in the sheep flocks in the study kebeles. Generally, there was 30.5% male and 69.5% female sheep in the sheep flocks in the study kebeles (Table 2). As the main purpose of sheep production in the study area is for cash income and home slaughter on festivals, in all kebeles male animals are either sold or slaughtered and their number is less in the flock. The number of male animals usually decreases especially after the duration of festivals. The male animals are either sold or slaughtered at home during festivals. Female animals are retained in the flock for breeding purpose. During the study, young sheep, age less than 1 year, predominated in the sheep flocks (56.2%) (Table 3). According to Abebe *et al*. (2000), a study conducted in the central highlands of Ethiopia, the proportion of sheep that were less than 15 months of age is 47.52%.

The overall mean body weight of sheep in the sheep flocks was 21.6±9.34 kg (n = 1211). There was a difference in mean BW (body weight) of animals among age groups and among sheep flocks in the study kebeles (Table 4 and 5). But there was no BW difference ($P>0.05$) between the sheep breeds and the crossbred sheep (Table 6). The mean BW increased ($P<0.05$) with advance in age of the animals as expected. The mean body weight of sheep in Denbun and Boko Tabo kebeles was significantly higher ($P<0.05$) than Woyenema Ambaye kebele which could be attributed to differences in sheep breed composition, feed availability or other factors in the area. The overall mean body weight of 2178 sheep surveyed in the central highlands of Ethiopia is 15.74±0.23 kg (Abebe *et al*., 2000).

**Table 3.** Proportion of the different age groups of sheep in the sheep flocks in the study kebeles of Burie District

| Name of kebele | | Estimated age of the sheep in years | | | | | Total |
|---|---|---|---|---|---|---|---|
| | | < 1 year | 1 - 2 years | 2 years | 3 years | > 3 years | |
| Woheni Durebetie | Count | 158 | 25 | 53 | 8 | 59 | 303 |
| | % within name of kebele | 52.1% | 8.3% | 17.5% | 2.6% | 19.5% | 100.0% |
| Woyenema Ambaye | Count | 165 | 24 | 23 | 21 | 67 | 300 |
| | % within name of kebele | 55.0% | 8.0% | 7.7% | 7.0% | 22.3% | 100.0% |
| Denbun | Count | 185 | 24 | 17 | 15 | 59 | 300 |
| | % within name of kebele | 61.7% | 8.0% | 5.7% | 5.0% | 19.7% | 100.0% |
| Boko Tabo | Count | 172 | 41 | 26 | 23 | 46 | 308 |
| | % within name of kebele | 55.8% | 13.3% | 8.4% | 7.5% | 14.9% | 100.0% |
| Total | Count | 680 | 114 | 119 | 67 | 231 | 1211 |
| | % of all the kebeles | 56.2% | 9.4% | 9.8% | 5.5% | 19.1% | 100.0% |

**Table 4.** Mean body weight of sheep in different age groups in the study kebeles of Burie District

| Estimated age of the animal (year) | BW (kg) Mean±SE | N |
|---|---|---|
| <1 | $15.3\pm0.23^{d}$ | 680 |
| 1 – 2 | $26.6\pm0.53^{c}$ | 114 |
| 2 | $28.6\pm0.46^{bc}$ | 119 |
| 3 | $30.6\pm0.65^{ab}$ | 67 |
| >3 | $31.6\pm0.38^{a}$ | 231 |

SE = Standard error; Means with different superscript letters within a column are significantly different ($P<0.05$)

**Table 5.** Mean body weight of sheep in the sheep flocks in the study kebeles of Burie District

| Name of kebele | BW (kg) Mean±SE | N |
|---|---|---|
| Woheni Durebetie | $21.2\pm0.49^{ab}$ | 303 |
| Woyenema Ambaye | $20.0\pm0.48^{b}$ | 300 |
| Denbun | $22.6\pm0.53^{a}$ | 300 |
| Boko Tabo | $22.5\pm0.62^{a}$ | 308 |

SE = Standard error; Means with different superscript letters within a column are significantly different ($P<0.05$)

**Table 6.** Mean body weight of sheep in different sheep breeds in the study kebeles of Burie District

| Name of sheep breed | BW (kg) Mean±SE | N |
|---|---|---|
| Washera | 21.5±0.37[a] | 494 |
| Horro | 21.5±0.51[a] | 424 |
| Crossbreds | 22.0±0.54[a] | 291 |

SE = Standard error; Means with the same superscript letter within a column are not significantly different (P>0.05)

**Table 7.** Mean castration age of breeding male sheep in the study kebeles of Burie District

| Name of kebele | Age (Months) Mean±SE | N |
|---|---|---|
| Woheni Durebetie | 5.3±0.21[c] | 21 |
| Woyenema Ambaye | 8.3±0.84[ab] | 7 |
| Denbun | 6.2±0.44[bc] | 10 |
| Boko Tabo | 9.7±1.71[a] | 7 |
| Total | 6.8±0.40 | 45 |

Farmers mostly sell, slaughter or castrate males at young age (Table 7). In addition, the number of mature and uncastrated males in the production system may be small in number. The proportion of uncastrated and castrated males in the sheep flocks of the central highlands of Ethiopia is 28.1% and 4.6%, respectively (Abebe *et al*., 2000). Most farmers in the study area do not have breeding males and they use their neighbours breeding males for breeding purpose. In some areas, there is individual herding of sheep flocks and small flock size during herding of animals. In addition, more productive animals are being sold, slaughtered or castrated at a very young age. According to Solomon *et al*. (2010), Washera sheep flocks are kept in communal grazing lands during the day time with little or no supplementary feeding. There is no planned breeding. Unintentional negative selection is practiced as ram lambs with good body conformation are sold at an early age of 3 – 6 months for immediate cash needs and inferior ones are maintained for breeding (Solomon *et al*., 2010).

Farmers also castrate male sheep for fattening purpose. They employ either modern or traditional methods of castration. According to Abebe *et al*. (2000), farmers mostly use traditional methods of castration in the central highlands of Ethiopia. Male sheep between the age of 4 to 12 months are mostly castrated for fattening purpose. Farmers castrate male sheep during September, October or November. During this time the ambient temperature is suitable and there is more quality feed available to the animals in the grazing lands and the animals castrated increase in BW and body condition after castration. The farmers believe that if the animals are castrated in other months, they will be susceptible to diseases and do not increase in BW and body condition.

Selection of sheep by farmers for breeding is common in the study area. Farmers have their own criteria for selection of breeding sheep. About 80% of the farmers in the study area practice selection of male sheep for breeding purpose. On the other hand, about 92% of the farmers in the study area practice selection of female sheep for breeding purpose. The selection criteria used for male and female sheep is different. For males, tail type, colour and height are given the most emphasis for selection (Table 8). Hence, males with bigger fat tail, brown body colour and having white patches on their forehead, legs and tip of the tail and bigger body size are selected. Those males with white and off-white colour are also preferred. In all the study kebeles black coloured males are not preferred for breeding. In the highland kebeles, Horro breed males are not preferred for breeding.

**Table 8.** Criteria used and percentage of farmers to select male breeding sheep in the study kebeles of Burie District

| Name of kebele | Criteria used for breeding male selection | | | | | |
|---|---|---|---|---|---|---|
| | Colour | | Height | | Tail type | |
| | N | %* | N | % | N | % |
| Woheni Durebetie | 34 | 100 | 34 | 68 | 34 | 100 |
| Woyenema Ambaye | 32 | 78 | 32 | 41 | 32 | 94 |
| Denbun | 16 | 94 | 16 | 94 | 16 | 94 |
| Boko Tabo | 20 | 55 | 20 | 45 | 20 | 65 |
| Total | 102 | 83 | 102 | 59 | 102 | 90 |

N = Total number of respondent; * percentage of respondents that used this criteria for the selection of male breeding sheep

**Table 9.** Criteria used and percentage of farmers to select female breeding sheep in the study kebeles of Burie District

| Name of kebele | Criteria used for breeding female selection | | | | | |
|---|---|---|---|---|---|---|
| | Colour | | Height | | Reproduction | |
| | N | %* | N | % | N | % |
| Woheni Durebetie | 33 | 70 | 33 | 67 | 33 | 79 |
| Woyenema Ambaye | 35 | 74 | 35 | 49 | 35 | 89 |
| Denbun | 29 | 86 | 29 | 55 | 29 | 86 |
| Boko Tabo | 20 | 60 | 20 | 30 | 20 | 95 |
| Total | 117 | 74 | 117 | 52 | 117 | 86 |

N = Total number of respondent; * percentage of respondents that used this criteria for the selection of female breeding sheep

For selecting breeding females, farmers select the sheep based on colour, body size, reproductive performance, breed and milk yield for the new born lamb (Table 9). Its pedigree is also considered when the breeding female is a home grown one. Hence, females that are brown and white colours or a mix of them, bigger in body size and those female that have shorter lambing interval are preferred. Those ewes which give birth to twins and triplets are also preferred by most farmers. There is a difference among the study kebeles on breed preference for the female sheep selected for rearing. In the Kolla kebele (Boko Tabo), farmers prefer Horro ewes and in the Woina Dega kebeles (Woyenema Ambaya and Denbun) crossbred ewes are preferred. But in the Dega kebele (Woheni Durebetie) farmers prefer Washera ewes.

Farmers cull both male and female sheep that are not preferred for breeding purpose. About 62% of the farmers in the study area practice culling of male sheep which are considered unfit for breeding purpose. On the other hand, about 63% of the farmers in the study area practice culling of female sheep which are considered unfit for breeding purpose. Farmers have their own criteria for culling male and female breeding sheep (Table 10 and 11). For breeding males, black coloured, poor conditioned and small sized sheep are not preferred in all places. These sheep types are culled at a young age. These animals will be sold or slaughtered at home. Horro rams are not preferred for breeding in the highland kebeles. For breeding females, black coloured, old aged, poor conditioned and those females which do not produce adequate milk for their new born lambs and those ewes which have long lambing interval are culled. Those ewes which give birth to small or poor conditioned lambs are culled after lambing one or two times. Unlike the Horro rams, Horro ewes are preferred for rearing in the highland kebeles, especially for crossbreeding purposes with

**Table 10.** Criteria used and percentage of farmers to cull male breeding sheep in the study kebeles of Burie District

| Name of kebele | Criteria used for culling breeding male sheep | | | | | |
|---|---|---|---|---|---|---|
| | Colour | | Height | | Tail type | |
| | N | %* | N | % | N | % |
| Woheni Durebetie | 29 | 100 | 29 | 31 | 29 | 97 |
| Woyenema Ambaye | 16 | 56 | 16 | 0 | 16 | 50 |
| Denbun | 19 | 95 | 19 | 84 | 19 | 79 |
| Boko Tabo | 16 | 69 | 16 | 19 | 16 | 25 |
| Total | 80 | 84 | 80 | 35 | 80 | 69 |

N = Total number of respondent; * percentage of respondents that used this criteria for culling

**Table 11.** Criteria used and percentage of farmers to cull female breeding sheep in the study kebeles of Burie District

| Name of kebele | Criteria used for culling breeding female sheep | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Colour | | Height | | Reproduction | | Age | |
| | N | %* | N | % | N | % | N | % |
| Woheni Durebetie | 29 | 48 | 29 | 59 | 29 | 79 | 29 | 17 |
| Woyenema Ambaye | 17 | 47 | 17 | 0 | 17 | 35 | 17 | 6 |
| Denbun | 16 | 100 | 16 | 88 | 16 | 88 | 16 | 94 |
| Boko Tabo | 18 | 33 | 18 | 6 | 18 | 94 | 18 | 0 |
| Total | 80 | 55 | 80 | 40 | 80 | 75 | 80 | 26 |

N = Total number of respondent; * percentage of respondents that use this criteria for culling

Washera breed. This crossbreeding activity is practiced to make the Washera breed in the highland kebeles more disease tolerant.

## DISCUSSION

There were two sheep breeds in the study area. These were Washera and Horro breeds. According to Solomon (2008), these two sheep breeds are the main sheep breeds found in Ethiopia among the 9 sheep breeds classified in the country. During the study there were no exotic sheep breeds in the study area. There were more Washera sheep (98.0%) in the Dega kebele (Woheni Durebetie) and more Horro sheep (91.6%) in the Kolla kebele (Boko Tabo) (Figure 1 and Table 1). Originally, there was Washera breed in Woheni Durebetie and Woyenema Ambaye kebeles; and Horro breed, in Boko Tabo kebele. Currently, Horro breed is being introduced to the highland kebeles and Washera breed to the lowland kebele for various reasons. Horro breed is being introduced to the highland kebeles for crossbreeding with Washera breed; and Washera breed is being introduced to the lowland kebele as the breed is more preferable on market. According to Gibson *et al*. (2006), changes in market preferences are one of the key factors identified as causing threats for the survival of local farm animal genetic resources. According to the respondents there is a change in breed composition of sheep flocks in the study area when we compare the current sheep flocks with the previous ones.

Currently Washera breed is becoming more susceptible to diseases and death rate for the breed is high in the highland kebeles. So, the farmers practice crossbreeding Washera with Horro breed and get a local crossbred sheep that is disease tolerant. According to Gibson *et al*. (2006), endemic diseases are one of the key factors identified as causing threats for the survival of local farm animal genetic resources. It is also believed that disease resistance in animals is strongly genotypic rather than environmental effects (Charray *et al*., 1992). This crossbreeding activity will endanger the existence of the two breeds. It is well established that indigenous sheep breeds are well adapted to the local environmental conditions and they have unique characteristics of their own. Local breeds are resistant to diseases, feed shortage, low level of management and harsh climatic conditions (EARO, 2001a). A great diversity of local breeds supports the livelihood of smallholder farmers. They give products to the producers under unfavourable environmental conditions. So, to the smallholder farmers those local breeds which are low productive are preferable

to them than those breeds which give higher yields considering the uncertain climate and attack due to diseases. Using local breeds under such circumstances decreases risk (Sansthan and KÖhler-Rollefson, 2005). Hence, crossing the two breeds which have advantages of their own will endanger their survival and utilization by farmers currently and in the future.

From the current study, about 30.5% of the flock are males and 69.5% are females (Table 2). This result is similar to a study conducted in the central highlands of Ethiopia (Abebe *et al*., 2000). This study shows that the proportion of males, females and castrates was 28.1%, 67.3% and 4.6%, respectively. The proportion of sheep less than one year of age in the current study was 56.2% (Table 3). The proportion of sheep age less than 15 months of age in the central highlands of Ethiopia is 47.52% (Abebe *et al*., 2000).

There is a possibility of inbreeding in the sheep flocks in the study area. Farmers mostly sell, slaughter or castrate males at a very young age. Farmers on average castrate breeding males at the age of 6.8 months (n = 44, SD = 2.49). This figure is different from the result obtained from the central highlands study result (Abebe *et al*., 2000). According to this study the average age of castration in the central highlands of Ethiopia is 2.4 years. About 79.5% of the farmers do not have breeding males of their own and they use their neighbors' breeding males for breeding. In addition, most of the farmers use home grown males for breeding purposes. In some areas, there is individual herding of sheep flocks by the household and small flock size during herding of animals. According to Abebe *et al*. (2000), a study conducted in the central highlands of Ethiopia, sheep are herded separately for grazing and watering all year round by family members. In addition, only household flocks are herded separately at times of grazing. These conditions may enhance inbreeding as the male used by the household for breeding will mate their relatives in the sheep flock as the breeding male used for breeding is usually home grown. The age of breeding males' used for breeding is also low. The use of such animals is not advisable as they do not produce much fertilizing sperm as adults (Charray *et al*., 1992).

More productive animals are being sold or slaughtered at a very young age. So, there is a chance to reduce the population of such animals in future generations as these animals will not get a chance to reproduce. According to Sansthan and KÖhler-Rollefson (2005), animal genetic resources are very important for farmers and breeders. According to this source, agricultural biodiversity safeguards the natural potential of a farming system to adapt to changes in environment or changing patterns of demand for food. According to Gibson *et al*. (2006), the diversity of livestock species represents an irreplaceable source of traits for livestock development in response to changing environmental and human needs. But, these genetic resources are being eroded as a result of changing agricultural practices and economic, environmental and other factors. There is a high rate of loss of indigenous animals in developing countries. According to this same source, conservation of livestock genetic diversity is important to maintain genetic diversity to meet the needs of current and future utilization. In addition, it also provides genetic resources for cross-breeding and development of new genotypes and the demands of new markets for livestock products and services.

In all the study areas, farmers have their own criteria for culling and selection of animals for breeding purposes. Most farmers select those ewes which give birth to twins and triplets for breeding. According to Wiener (1994), the average heritability estimate for the number of lambs at birth is about 0.14. But twins have a high rate of mortality and less growth rate than single born lambs (Gatenby, 1986). So, selection of ewes for breeding based on this criterion is not recommended. In addition, as there is feed shortage in the study area selection of animals based on this criterion is not advisable. When selection within the local breed is the best option, the environment will influence the priorities to give to different traits (Wiener, 1994).

Selection of sheep for rearing is common in the study area. Farmers have their own criteria for selection of breeding animals. In general, farmers seem to follow individual culling level selection method (Wiener, 1994). But farmers lack animal records, the heritability, interrelationships and economic values of traits. It seems to depend on individual farmer's decision. The selection criteria used for male and female sheep is different. For males, colour, body size and tail type are given the most emphasis for selection. Hence, males with large body size, brown body colour and having white patches on their forehead, legs and tip of the tail are selected. Males of big body size, long body length and fat tailed types are the most preferred. Those males with white and off-white colour are also preferred. In all the study kebeles black coloured males are not preferred. In the highland kebeles, Horro males are not preferred for breeding.

For breeding females, there is a difference in the criteria used for the selection of animals in different kebeles. In all areas, farmers select female sheep based on their colour, body size, breed, reproductive performance and milk yield for the new born lamb. Its pedigree is also considered when the female is a home grown one. Hence, females with large body, brown and white colours or a mix of them are preferred. In the Kolla kebele (Boko Tabo), farmers prefer Horro ewes and in the Woina Dega kebeles (Woyenema Ambaya and Denbun) crossbred females are preferred. But in the Dega kebele (Woheni Durebetie) farmers prefer Washera breed. Those ewes which give

birth to twins and triplets are also preferred by farmers. For female selection, colour of the sheep is not as strict a criterion as male selection. According to Wiener (1994), the more traits that are selected the less the progress which can be made in any one of them. When individual flocks are small, selection by individual famers would be ineffective. When the number of animals involved is large, progress in animal breeding is easier to achieve than when numbers are small (Wiener, 1994). But the criteria used by the farmers for selection of breeding animals is large and their flock is also small in number that makes genetic improvement difficult in the area. In this case, co-operation among farmers and keeping some records is recommended.

Farmers cull both male and female animals that are not preferred for breeding. Farmers have their own criteria for culling. For males, Horro rams are not preferred in the highland kebeles. Black coloured and poor conditioned and small sized males are not preferred in all places. These males are culled at an early age. They will be either sold or slaughtered. In the central highlands of Ethiopia, rams with undesirable characteristics are castrated before the emergence of the first pairs of permanent incisors or before they start first service (Abebe *et al*., 2000). For females, black coloured, old aged, poor conditioned and those females which do not produce adequate milk for their new born lambs and those ewes which have long lambing interval are culled. Those ewes which give birth to small or poor conditioned lambs are culled after lambing one or two times. Unlike the Horro rams, Horro ewes are preferred for rearing in the highland kebeles, especially for crossbreeding purposes.

Farmers in the study area sell, slaughter or castrate males at a very young age. This practice will have an impact on inbreeding and loss of genetic material. In addition, farmers practice crossbreeding Washera with Horro breed. This practice may reduce the population of these breeds. So, to avoid the above mentioned disadvantages better breeding should be practiced. The breeding system should consider the production system under consideration. According to Yosef and Pal (2012), for the success of a breeding program consideration of the production system is important. According to this source, for the success of a breeding program local ecological conditions, socio-cultural norms, aesthetic preferences, religion of the farmers and behavioral traits of animals should be considered.

## CONCLUSIONS

Due to poor traditional sheep breeding practice there is a possibility of inbreeding, loss of more productive animals and loss of genetic diversity in the sheep flocks. In addition, as the farmers practice crossbreeding Washera with Horro in the area there is a possibility of reduction or loss of these breeds in the future. The disease susceptibility of Washera sheep breed in the highland kebeles of the study area may be due to feed shortage, inbreeding or other factors. To ascertain these assumptions further studies are needed. Generally, to bring improvements in sheep production and make the sheep production sustainable in the study area proper sheep breeding system should be planned and implemented.

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### REFERENCES

Abebe M, Alemu Y, Mekonnen H (2000). Management of traditional sheep production in Lallomamma Mider woreda, North Shoa, Amhara. Pp. 143 – 153. Proceedings of the 7th annual conference of the Ethiopian Society of Animal Production (ESAP). Addis Ababa, Ethiopia, 26 – 27 May 1999, ESAP (Ethiopian Society of Animal Production).

Bureau of Finance and Economic Development (BOFED) (2008). The Amhara National Regional State Bureau of Finance and Economic Development 2006/ 2007 Budget Year Annual Statistical Bulletin. Bureau of Finance and Economic Development, Bahir Dar.

Central Statistics Authority (CSA) (2008). Statistical Abstracts 2007. Addis Ababa, Ethiopia.

Charry J, JM Humbert, Leuif J (1992). Manual of sheep production in the humid tropics of Africa. CAB International, UK. 187p.

Ethiopian Agricultural Research Organization (EARO) (2001a). Small ruminant research strategy. EARO (Ethiopian Agricultural Research Organization), Addis Ababa. 59p.

Ethiopian Agricultural Research Organization (EARO) (2001b). Executive Summary of Livestock Research Strategy. EARO (Ethiopian Agricultural Research Organization), Addis Ababa. 31p.

Gatenby RM (1986). Sheep production in the tropics and sub-tropics. Longman Group Limited, London and New York. 351p.

Gibson J, Gamage S, Hanotte O, Iñiguez L, Maillard JC, Rischkowsky B, Semambo D, Toll J (2006). Options and strategies for the conservation of farm animal genetic resources: Report of an international workshop (7 – 10 November 2005, Montpellier, France). CGIAR Sytem-wide Genetic Resources Programme (SGRP)/ Bioversity International, Rome, Italy. 53p.

Girma A, Alemu Y (2008). Sheep and goat management. Pp. 33 – 56. In: Alemu Yami and R.C. Merkel (eds). Sheep and goat production handbook for Ethiopia. Ethiopian sheep and goat productivity improvement program.

Improving Productivity and Market Success of Ethiopian Farmers (IPMS) (2007). Burie pilot learning district diagnosis and program design: Final draft. 95p.

Institute of Biodiversity Conservation (IBC) (2007). Domestic animal genetic resources of Ethiopia. Web-site (http://www.ibc-et.org/ibc/dpt/animal/domestic_animals.html)

Roeleveld AC, Van den Broek A (1996). Focusing livestock systems research. Royal tropical institute, Amsterdam. 150p.

Sansthan LP, Ilse KÖhler-Rollefson (2005). Indigenous breeds, local communities: Documenting animal breeds and breeding from a community perspective. Mudra, India. 66p.

Solomon G (2008). Sheep resources of Ethiopia: Genetic diversity and breeding strategy. A PhD Thesis Presented to Wageningen University. 145p.

Solomon G, Aynalem H, Tadelle D (2010). Breeding objectives and breeding plans for Washera sheep under subsistence and market-oriented production systems. Ethiopian Journal of Animal production (EJAP), Volume 10, Number 1. Pp. 1 – 16.

Statistical Package for Social Sciences (SPSS) (2003). SPSS 12.0 for Windows, SPSS Inc.

Wiener G (1994). Animal Breeding. Technical Centre for Agriculture and Rural Co-operation and Macmillan. The Tropical Agriculturalist. Malaysia.

Yosef T, Sanjoy KP (2012). Success and failure of small ruminant breeding programmes in relation to indigenous knowledge, genotype and local environment in the Sub-Saharan African countries (SSA). Pp. 23 – 30. Proceedings of the 19th annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, December 15 – 17, 2011, ESAP (Ethiopian Society of Animal Production), Addis Ababa.