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Full Length Research Paper

Growth performance evaluation of sheep breeds under farmers' management at Fentale District, Oromia Regional State, Ethiopia

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ABSTRACT

On Farm growth performance evaluation of sheep population found in Fantale districts of east Shoa zone of Oromia regional state was conducted with the objective of assessing the growth performance of sheep under farmers' management condition in fantale districts in East Shoa zone of Oromia Regional State. The study was a monitoring study which took place for two years (2015-2016). Body weights (birth, three, six and Yearling) records and per-weaning and post-weaning performance were assessed from 113 heads of sheep. The data were analyzed using the GLM procedures of SAS. The overall least square means (±SE) for BW, WW, SMW and YW weights (kg) of Sheep lambs at Fantale district monitoring site were 2.84± 0.04, 7.95±.0.04, 11.81±0.21 and 15.82±0.13 respectively. Birth weight was significantly ($P<0.05$) influenced by birth type of the lamb, whereas weaning weight is influenced by year of birth of lamb. In general, sheep breed in fantale district monitored site significantly ($p<0.05$) comparable in all the parameters (in birth weight, three, six and yearling weight) compared with other sheep breed in Ethiopia. To increase in the production and reproductive efficiency of sheep in the study site and reduce the mortality of lamb improvement of management system is very crucial.

Key words: Growth performance; reproduction; weaning weight; Yearling weight

INTRODUCTION

In Ethiopia, sheep are the second numerous farm animals after cattle with about 14 traditional sheep populations and nine identified sheep breeds (Solomon et al., 2007) and with a population of around 30.69 million heads of sheep (CSA, 2016/17). According to Solomon G. (2008) sheep production systems in Ethiopia are classified into five sub systems, viz. Highland cereal–livestock system, Lowland crop–livestock system, Agro-pastoral and pastoral systems, Sub-alpine sheep-barley system and Highland perennial crop system.

Indigenous sheep in Ethiopia play multifarious roles viz. sources of income, meat, skin, manure and coarse hairy fleece. They are also means of risk avoidance (during crop failures) especially under marginal productivity, under low and erratic rainfall, severe land erosion, frost, and water logging problems (Zewdu et al., 2008). Thus, sheep reared by the smallholder farmers provide support to the economic stability and compliment the crop production (Tsedeke, 2007). Sheep rearing also play an important role in cultural, social livelihoods and religious values for large and diverse human population in Ethiopia (FAO, 1999). Rearing of sheep can result in

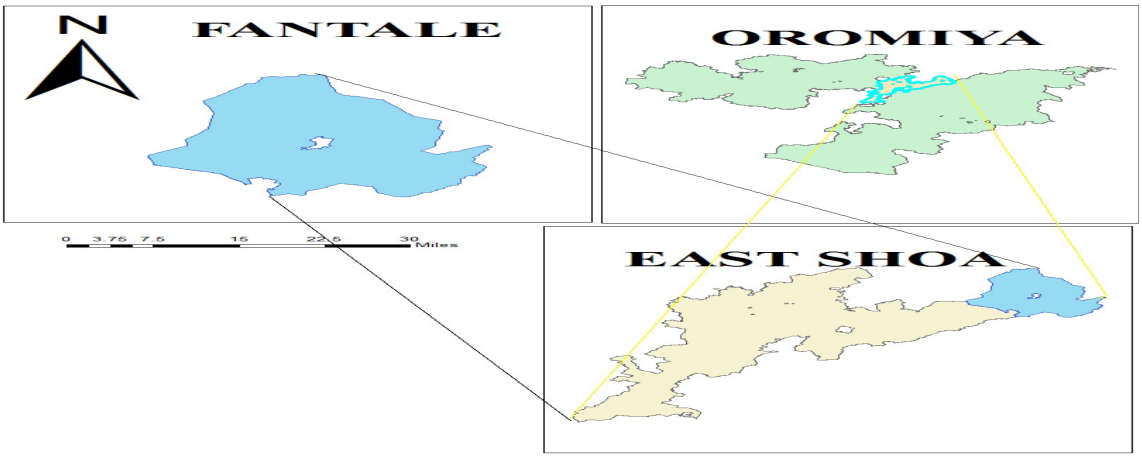

Figure 1. Map of the study area

enhancement of farm family nutrition by enhancement in productivity at the farm. The low productivity of livestock breeds in general and sheep in particular may be due to different factors such as reproduction efficiency, poor nutrition (of the animal), prevalence of diseases, especially among livestock reared under challenging conditions (Tesfaye, 2008). Understanding the genetic performance of livestock is quite relevant for the developing countries where specific adaptive attributes the livestock genetic resources make them more important especially under the unforeseen climate changing conditions (Workneh *et al*., 2004).

Designing a suitable breeding scheme for the smallholder livestock production system has remained a challenge hitherto especially in the developing world (Aynalem *et al*., 2013). Until recently, livestock breeding in Ethiopia had adopted exclusively the conventional hierarchical breeding schemes (Gizaw *et al*., 2013). The conventional hierarchical breeding schemes of the past had several drawbacks (Gizaw and Getachew, 2009). Such breeding systems fail to consider the different intangible, socio-economic, and cultural roles that livestock plays in each situation.

Knowledge of the reproduction and growth performances is important to develop sustainable genetic improvement schemes especially under smallholder situations (Kosgey, 2004). The previous approaches on livestock breeding and development were based on top down approach where all the stakeholders were rarely consulted by the researchers (Solomon *et al*., 2007). Thus, the knowledge gap usually led to the setting up of unrealistic breeding goals in the design of livestock genetic improvement programs, the consequence of which often endangered the conservation of indigenous animal genetic resources (Zewdu *et al*., 2006). The productivity of local sheep under village management condition is alleged to be poor. The lambs with higher growth performance and better condition score are sold at premium price to gate profit whereas unthrifty ram lambs remain in a flock for breeding. These might contribute to poor performance of sheep in the village management condition.

The growth performance of sheep has not been documented in the central eastern part of Oromia, which is fantale. Reproductive performances of sheep together with survival and growth traits are important determinants of productivity of sheep in a meat livestock farming and needed to be recorded for genetic and management improvement. However, a detailed analysis of growth parameters that is affecting the growth performance has not been documented in the fantale area. Therefore, the current study was performed to assess the effect of non-genetic factors on reproductive traits such as litter size, birth weight to yearling weight under village management conditions to make sound recommendations for improvement of productivity of sheep.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Fantale districts of Oromia region from 2015 to 2016. Fantale Districts is located 200 km east of Addis Ababa. It lies at an altitude between 943- 1135m above sea level. The minimum temperature is 28^0C and the maximum temperature is 40^0C. The annual average rainfall is about 520mm. The map of the study area is indicated in figure 1.

Study sites selection

A total of two study sites were purposively selected depending on their flock size and accessibility; ten households from each site with average flock size of

twenty sheep were purposively selected and used for monitoring. Two hundred and thirteen Ewe and one hundred and thirteen Lambs were monitored for this study.

Data to be collected

Animals under the study were identified by permanent plastic ear tags applied at the beginning, birth or at purchase of the animals to facilitate recording. Performance data were collected from 2015 to 2016 using trained enumerator. The enumerator was supervised and data crosschecking was done by researchers from Adami Tullu agricultural research center.
The following growth performance data were collected**.**

- ✓ Date of Birth, Weaning, Six month and yearling
- ✓ Birth weight,
- ✓ Weaning weight,
- ✓ Six month weight,
- ✓ Yearling weight
- ✓ Prolificacy (type of birth)

On- farm flock management

The ewes were kept under village management condition. The management of sheep was in such a way that in both the wet and cropping season they were kept on the grazing land. While in the dry season most of the pastoralists in the area move their flock from place to place in searching of feeds. Breeding rams run with the group flock to mate with any ewes in heat during wet and dry season. The sheep breed in the study area was naturally selected for seasonal breeder. Animals were provided with fenced/Karla shelter during the night. The sheep were tagged and data collectors who resided in villages monitored and followed date of birth of the ewe, the type of birth of the ewe, birth to yearling weight record, deaths, sale and exits of sheep in the households of the villages. The growth traits were recorded for animals that gave birth during the monitoring period. Since the start of data collection, internal and external parasite control has been carried out. Ivermectin was used for de-worming and sick sheep were treated.

Data management and statistical analysis

All the data collected were entered and managed using Microsoft Excel computer program. The data were analyzed using General linear model (GLM) procedures of SAS (SAS 2003). Tukey Kramer test was performed to separate means of effect with two or more levels which were significant in the least squares analysis of variance.

The traits studied were: Birth weight, Weaning weight, six month weight, yearling weight and ADWG. The fixed effects fitted in the model for BW, WW, SMW and YW were Year (2015 and 2016); season (Autumn, winter, Spring, and Summer); type of birth at lambing (single, twin) and Sex (Male, Female).
For the analysis of the growth performance of the breed, the following model was used:
The statistical model was explained as follows:

$Y_{ijklm} = \mu + G_k + S_j + Y_l + + L_m + e_{ijklm,}$
Where:
$Y_{ijklm=}$Observation on birth weight and weight at different ages;
μ = overall mean;
$G_{k=}$ Fixed effect lamb sex (k= male, Female)
S_j= Fixed effect of lamb birth season(j=Autumn, Winter, Spring, and Summer);
$Y_{l=}$ Fixed effect of lamb birth years (l=2015, 2016);
$L_{m=}$ Fixed effect of lamb birth type (m=Single, twin)
e_{ijklm}= is the random error attributed to the n^{th} lamb.

Average daily weight gain (ADG)

Average daily weight gain were calculated as follows

$$ADG\ (ADG1,\ ADG2\ \&\ ADG3) = \frac{\text{Weight at the end of period} - \text{weight at the beginning of the period}}{\text{length of the periods}}$$

Where:-
ADG1 = Average daily weight gain from birth to three month of age;
ADG2 = Average daily weight gain from three month to six month of age;
ADG3 = Average daily weight gain from six month to yearling age.

RESULTS AND DISCUSSION

Pre-Weaning weight and growth performance of sheep in the study areas

Growth is the most important trait in small ruminant production affecting the contribution of the sector to the farm household through live animal sale and meat production (Kosgey, 2004). Growth performances of lambs' in the study areas were studied at different ages (three, six, and yearling) by considering sex of lambs, year, season and type of births as fixed independent non genetic factors. The analysis of variance showed that the fixed factors considered (year of birth, season of lambing and sex of lamb) were not affect statistically (P>0.05)

Table 1. Least squares mean of birth and weaning weight of sheep breed in Fantale districts

Factors	Traits			
	N	Birth weight	N	Weaning weight
Overmeans	**113**	**2.84± 0.04**	**106**	**7.95±0.04**
Year of birth	-	-	-	
2015	83	2.86±0.05	76	7.69±0.22
2016	30	2.79±0.06	30	8.62±0.43
Seasone of Birth				
Autoum(Sep-Nov)	52	2.87±0.05	52	8.51±0.32
Winter (Dec - Feb)	21	2.93±0.05	19	7.12±0.28
Spring(Mar– May)	12	2.84±0.10	11	7.72±0.74
Summer(Ju – Aug)	28	2.72±0.10	24	7.53±0.35
Type of birth				
Single	111	2.87±0.03[a]	104	7.99±0.21
Twin	2	1.25±0.05[b]	2	6.10±0.10
Sex				
Male	57	2.89±0.06	51	8.03±0.26
Female	56	2.79±0.05	55	7.89±0.31

[ab] *Row means with in columns with different superscript letters are significant at (P<0.05)*

birth weight of the sheep in the study area. This may relate to the breeding season and lambing concede with the rainy season which is naturally selected.

The current results disagree with the report of Getahun, (2009) that reported significant effects of sex and season of birth on birth weight. Only type of birth had effect on birth weight of sheep breed at monitoring site at p<0.05 significant levels (Table 1). Single born lambs were heavier than twin contemporaries (2.87±0.03 Vs 1.25±0.05). This result agreed with the result reported by Gemeda et al. (2002): Gardner et al. (2007). This may be due to the finite capacity of the maternal uterine space to gestate offspring (Gardner et al., 2007) and as litter size increase the individual birth weight will decline (Robinson, 1977).

The overall least square mean birth weight of sheep breed at the study site had higher value than the report (2.45±0.40kg) of Berhanu and Aynalem (2009) for sheep around Jima Zone south-west Oromia, 2.30±0.03kg for Alaba sheep were reported Gemiyu (2009). The birth weight is a trait which has a lot of economic importance and therefore the lambs with higher birth weight are usually having higher growth performance throughout lifetime (Kosgey, 2004). The observed overall least square mean birth weight (2.84±0.04kg) of sheep breed at Fantale district was more or less comparable for many of the reports made on different Ethiopian indigenous sheep breeds birth weight.

The findings pertaining to the weaning weight performances of the ewes are presented in Table 1. The findings show that the weaning for the lambs did not vary across birth type and sex of the lambs. This might be ascribed to similar management of the lambs and ewes in the studied districts. The findings also show that weaning of the lambs varies (P<0.05) across year of birth. The lowest weaning weight was recorded in 2015 and the highest in 2016. The highest weaning weight was observed in lambs born in autumn season which may related with the availability of feed resource in that season (Table 2).

The weaning weight obtained in this study is in close accordance with the findings of Tsedeke (2007) for Arsi Bale sheep. Similar results have also been reported by Solomon *et al.* (2007) in Gumuz breed of sheep reared at Benushangul Gumuz in Ethiopia. However, the weaning weight observed in this study was higher than those reported by Fsahatsion (2013) for Gamogofa native sheep and Dhaba (2013) for Illu Abba Bora native sheep.

The differences as observed may be ascribed to the management of the sheep besides the genotypes being reared in the studied areas. While the weaning weight of the sheep in the studied districts is lower than those reported by Deribe (2009), 10.35±0.19 for Alaba sheep.

Post- Weaning weight and growth performance of sheep in the study areas

The result ascribed to the six month and yearling body weight is presented in Table 2. The findings show that the six month weight for the lambs did not vary across year of birth, birth type and sex of the lambs. This might be ascribed to similar management of the lambs and ewes in the studied districts. Whereas the six month weight is significantly (<0.05) vary on the season of birth with highest value observed autumn season which may be due to the availability of feed resource in this season.

The results related to the six month as recorded in this

Table 2. LS Mean of six month and Yearling weight of sheep breeds in Fantale districts

Factors	Traits			
	N	Six month weight	N	Yearling weight
Overmeans	102	11.81±0.21	98	15.82± 0.13
Year of birth				-
2015	74	11.42±0.23[b]	70	15.72±0.16
2016	28	12.80±0.40[a]	28	16.20±0.21
Seasone of Birth				
Autoum(Sep-Nov)	49	12.15±0.31[a]	48	15.90±0.20[ab]
Winter (Dec - Feb)	18	10.60±0.40[b]	18	15.35±0.27[b]
Spring(Mar– May)	11	11.82±0.58[ab]	10	16.45±0.31[a]
Summer(Ju – Aug)	24	12.46±0.42[a]	22	16.03±0.26[ab]
Type of birth				
Single	100	11.86±0.21[a]	96	15.80.137±
Twin	2	9.25±0.25[b]	2	15.00±1.00
Sex				
Male	47	11.67±0.28	43	16.00±0.20
Female	55	11.92±0.31	55	15.74±0.17

[ab] *Row means with in columns with different superscript letters are significant at (P<0.05)*

study too indicate similarity from the results obtained by Zewdu (2008) for Horro sheep. The current result of six month weight was lower than those reported by Birhanu and Ayinalem (2009) for sheep around Jima native sheep.

The result presented in Table 2 indicate that yearling weight of sheep (lambs) in the study area, the findings show that season of lamb birth and sex of lamb do not have any effect on yearling weight of the lambs. Both the year of birth and type of birth have significant effect (P<0.05) on yearling weight of lambs. The yearling weight of the fantale sheep were in close accordance with the findings of Duguma et al. (2017) for Afar sheep (16.10) of the same breed sheep.

The yearling weight of fantale sheep as observed in the present study are also in close accordance with the findings of Sisay, (2002) among central highland breed of sheep. The similarity as observed may be related to the management besides the genotype of the sheep. The present values were however lower than those reported by Markos and Ginber (2004) for Bonga ram reared in Keffa, Sheka and Bench communities and Solomon *et al.* (2007) for Gumuz ram reared Gumz and Amhara communities and Duguma et al. (2017) for Horro (28.20) ram Bonga ram (34.60). Contrary to the same, lower values of the trait have been reported by (Sisay, 2002) for rift valley sheep type.

Pre and post weaning growth rate

The result pertaining to the average daily weight gain at different age categories were presented in Table 3. From the result, the pre-weaning growth rate was 56.78 ± 2.17gm and it is very lower (123.18 ± 15.20) than washera sheep in its home areas (Mengistie *et al*., 2009). The variation may be due to the difference in breed and feed availability both in quality and quantitiy for lactating ewes and lambs as well as management difference for supplementing of lactating ewes and lambs as lambs enteirely depends on their dam for growth.

As the result show that the year of birth and season of birth have statistical significant effect (P<0,05) on the pre-weaning growth rate of the lambs. This difference of growth rate between years could be partly explained by the difference in the nutritional status of dam, since weaning lambs mostly dependent on their dam for their growth requirement. Season was source of variation (P<0.05) for lamb growth rate in all groups of age categories; lambs born in wet season have higher average daily weight gain than those born in dry season. According to the report of Tibbo (2004), lambs born in the wet season have fast growth rate than in the dry seasons which might descriebed that seasonal variation in feed availability both in quality and quantity on natural pasture for the dam during lactation to produce and supply sufficient milk for thier lambs.

Result of the daily weight gain from 90 to 180 days of age was 43.01 ± 2.02gm. The result of post-weaning gaind in current study is comparable with Washera sheep breed (Mengistie *et al*., 2009) but higher than Farta sheep breed (Agraw *et al*., 2014) under on farm condition. Season of birth was source of variation (P<0.05) for lamb growth rate in post-weaning of age categories, lambs born in wet season have higher average daily weight gain than those born in dry season.

The overall least square mean of birth to yearling

Table 3. Least square means for growth rates of sheep in study areas at different ages

Factors	Traits					
	Birth to 90 days		90 to 180 days		Birth to 360 days	
	N	LSM ± SE	N	LSM ± SE	N	LSM ± SE
Overmeans	106	56.78 ± 2.17	102	43.01 ± 2.02	98	36.16 ± 0.37
Year of birth						
2015	76	53.63 ± 2.36 [b]	74	41.29 ± 2.29	70	35.73 ± 0.46
2016	30	64.78 ± 4.53 [a]	28	47.54 ± 4.10	28	37.24 ± 0.55
Seasone of Birth						
Autoum(Sep-Nov)	52	62.67 ± 3.39 [a]	49	40.77 ± 2.88 [b]	48	36.20 ±0.57 [ab]
Winter (Dec - Feb)	24	53.15 ± 3.61 [ab]	24	34.21 ± 2.91 [b]	22	35.10 ± 0.83 [b]
Spring(Mar– May)	11	54.34 ± 8.13 [ab]	11	45.56 ± 6.46 [b]	10	37.89 ± 0.81 [a]
Summer(Ju – Aug)	19	46.67 ± 3.05 [b]	18	59.26 ± 4.55 [a]	18	36.42 ± 0.69 [ab]
Type of birth						
Single	104	56.84 ± 2.21	100	43.17 ± 2.06	96	36.12 ± 0.37
Twin	2	53.89 ± 0.56	2	35.00 ± 1.67	2	38.19 ± 2.64
Sex						
Male	51	57.08 ± 2.77	47	40.95 ± 3.03	43	36.45 ± 0.60
Female	55	56.51 ± 3.32	55	44.77 ± 2.71	55	35.93 ± 0.47

[ab] *Row means with in columns with different superscript letters are significant at (P<0.05)*

growth rate is comparable with Farta sheep breed (Agraw *et al*., 2014) under on farm condition. But lower than Washera sheep breed (Mengistie *et al*., 2009). The variation may be due to the difference in breed and feed availability both in quality and quantitiy for lactating ewes and lambs as well as management difference. Season have siginificant effect on overall growth rate. Lambs born during wet season have faster growth in pre-weaning, pos-weaning and overall growth rate than dry season born lambs. There should be having all birth during the wet season when there is better feed availability in terms of quality and quantity for lactating ewes and lambs.

CONCLUSIONS AND RECOMMENDATION

In general, sheeps breed of fantale district at monitoring site was significantly ($p<0.05$) outsmarted in all the parameters (in birth weight, three, six, and yearling weight) compared with other sheep breed in Ethiopia. The study has demonstrated that the non-genetic factors exerted a significant effect on growth performances of lambs.

From these it can be recommended that:-

- ✓ Strong extension service is required to convince the farmers not sale rams at younger age
- ✓ Strengthen veterinary services and training should be given to farmers
- ✓ Feed conservation, introduction of adapted improved forages and strategic supplementation schemes should be implemented to increase the growth performance of sheep
- ✓ Appropriate community breeding schemes should be designed and implemented

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