

*Full Length Research Paper*

# **Local sheep and goat reproductive performance managed under farmer condition in Southern Ethiopia**

**Taju Hussein**

College of Agriculture, Wolaita Sodo University, Ethiopia

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Sheep and goats represent an important component of the farming system by providing about 12% of the value of livestock products consumed and 48% of the cash income generated at the farm level. Although diverse sheep and goats resources are found in Ethiopia, their productivity is low; the sector has not received a great deal of attention from scientists, administrators and legislators. Strategic recording and documentation of the performances of the animals in their native environment under farmer's condition is very essential. Current survey study was conducted in Dwaro zone, Southern Ethiopia to assess productive and reproductive performance of sheep and goat kept under framers management condition. Primary data were collected from 270 household selected randomly, while secondary data from relevant written documents. Survey result showed that ewes and does were weaned on average at age of  $126.2 \pm 1.44$  and  $145.5 \pm 1.48$  and  $249.0 \pm 3.10$  days in order and weaning age was significantly longer in highland and midland as compared to lowland whereas ewes age at puberty does not vary significantly across agro-ecological zone but does age at puberty is significantly shorter in highland. In addition, the finding indicated that age at first lambing and kidding was  $408.0 \pm 3.32$  and  $393.5 \pm 3.05$  days, respectively. Age at first lambing was not significantly ( $p > 0.05$ ) affected by agro-ecological zones while age at first kidding of does was significantly ( $p < 0.05$ ) longer in lowland ( $408.6 \pm 7.75$  days) as compared to midland ( $385.6 \pm 4.31$  days) and highland ( $386.2 \pm 0.83$  days). Furthermore, survey result revealed that mean kidding and lambing interval was  $269.9 \pm 3.08$  and  $269.0 \pm 2.89$  days, respectively and kidding interval was significantly shorter in highland ( $263.5 \pm 6.0$  days) and midland ( $264.0 \pm 5.89$  days) relative to lowland ( $281.7 \pm 3.70$  days), whereas lambing interval was not affected by agro ecological differences. Furthermore, the survey pointed out that household in the study area slaughtered sheep and goat at mean age of  $258.1 \pm 4.39$  and  $255.6 \pm 2.49$  days in sequence. Lowland household were preferred to slaughter sheep and goat at younger age as compared to midland and highland household for both species that preferred slaughtering of sheep and goat at older age. Feed and other related management improvement and implementing strategic breed improvement is the area that need further work in the future.

**Key words:** Age at first kidding, lambing interval, weaning age, Dawro.

## **INTRODUCTION**

Small ruminants are widely reared in a crop-livestock farming systems and are distributed across different

agro-ecological zones of Ethiopia (Adane and Girma, 2008). The total population of goats and sheep in

Ethiopia is estimated at 30.2 and 30.7 million, respectively and each of them (99.7%) are indigenous (CSA, 2017). At the national level, sheep and goat account for about 90% of the live animal/meat and 92% of skin and hide export trade value. Sheep and goats represent an important component of the farming system by providing about 12% of the value of livestock products consumed and 48% of the cash income generated at the farm level (FAO, 2004).

Although diverse sheep and goats resources are found in Ethiopia, their productivity is low; the sector has not received a great deal of attention from scientists, administrators and legislators (Girma et al., 2000). The research approach has not also invited the end users for active participation. Improvements were too slow due to lack of identifying the actual on-farm situations and weighting the socioeconomic and cultural benefits of the animals for the poor farmers. Farmers do make decisions not only from the point of view of profitability, but also security, income generation and cultural values (Tatek et al., 2004). Strategic recording and documentation of the performances of the animals in their native environment under farmer's condition is very essential for understanding productivity of animal under a given situation. Monitoring of the productive, reproductive and economic performance of small ruminants and their existing level of integration with crop production and other livestock keeping is required to capture a full picture of their contribution and thereby verifying possible intervention areas (Getahun, 2008). In line with this in Dawro zone, Southern Ethiopia, the information of productive and reproductive performance of sheep and goat is scarce. Thus, there is need for compiling of information and understanding the existing condition is compulsory to identify priority of intervention and to plan implementation ways accordingly. Therefore, the current study was undertaken to assess productive and reproductive performance of local sheep and goat managed under farmer condition in Dawro zone, Southern, Ethiopia.

## MATERIALS AND METHODS

### Description of the study area

The study was conducted in Dawro zone, Southern Ethiopia. Dawro zone is located at a distance of 512 km far from Addis Ababa. The study area has an altitude ranging from 501 to 3000 m above sea level, mean annual rainfall varying between 1201 and 1800 mm and the mean minimum and maximum annual temperatures of 15.1 and 27.5°C, respectively. The study zone has five districts/woredas distributed in three agro-ecological zones; lowland or kola (55.6%), midland or weinadega (41.4%), and highland or dega (3%). Mixed crop-livestock farming system, involving the production of cereals

and different livestock species is predominantly practiced (Southern Regional State Investment Bureau, 2011).

### Sampling techniques and sample size

Purposive and random sampling methods were employed for the study. At the first stage, to make sampling system representative of the zone, three woredas or districts namely, Mereka district from highland, Loma from midland and Gena Bosa from lowland were selected purposively based on the number and intensity of livestock production and accessibility. At the second stage, by employing random sampling from each of selected districts, three representative peasant associations (PAs)/kebeles (lower administrative structure) were randomly selected. At the third (finally) stage, a total of 270 respondents or 90 respondents from each district were included purposively randomly for interview.

### Data sources and data collection method

Both primary and secondary sources of data were used for the study. To collect the primary data, a semi-structured questionnaire was designed, pre-tested and then modified for appropriateness before the actual data collection commenced. Experienced enumerators were recruited and trained to facilitate this task of primary data collection under the close supervisions of the researcher. To reinforce the primary data, direct observation and informal interview were carried. The secondary data was collected from different office of study zone, selected districts' and other relevant sources.

### Data analysis

Statistical package for social science (SPSS) version 20 was used to analyze the collected data. The difference between means was separated via LSD and Tukey HSD at  $p < 0.05$  or 95% of confidence interval.

## RESULTS AND DISCUSSION

### Reproductive performances of sheep and goat

For each of reproductive performances, the respondent number varies due to the fact that the respondents forwarding their opinion for each parameter vary and all respondents could not respond for each parameter. Moreover, productive performance of sheep and goat was separately discussed except slaughter age.

### Reproductive performance of sheep

**Weaning age:** Overall mean (mean  $\pm$  standard error [SE]) of weaning age of lamb at different agro-ecological zones in the current study is  $126.3 \pm 1.440$  days (Table 1). Weaning age of lamb in lowland agro-ecology ( $119.3 \pm$

E-mail: tajuh47@gmail.com.

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**Table 1.** Reproductive performance of sheep in the study area.

Parameter (days)	Agro ecological zones (AEZs)			Overall (Mean±SE)	p value
	Lowland* (Mean±SE)	Midland* (Mean±SE)	Highland* (Mean±SE)		
Slaughter age	83 (200.9±2.06) <sup>b</sup>	79 (280.2±1.82) <sup>a</sup>	84 (292±10.32) <sup>a</sup>	258.1±4.39	0.00
Weaning age	83 (119.3±3.39) <sup>b</sup>	84 (129.2±2.01) <sup>a</sup>	85 (130±1.49) <sup>a</sup>	126.2±1.44	0.02
Age at puberty	77 (246±2.16)	82 (251±6.01)	84 (249±6.56)	249.0±3.10	0.86
AFL	79 (412±3.05)	78 (411.4±4.23)	85 (400.7±8.11)	408.0±3.32	0.27
LI	82 (270.2±0.73)	80 (268.3±4.06)	85 (268.45±6.55)	269.0±2.89	0.95

<sup>a,b</sup>Mean with row having different supper script is significantly different at  $p < 0.05$ ; AFL: Age at first lambing, LI: lambing interval, SE: standard error. \*Number of respondents.

3.39 days) is significantly ( $P < 0.05$ ) shorter in compression with midland (129.2±2.01 days) and highland (130.3571 ±1.49 days).

**Age at puberty:** Age at which sheep shows the willingness to mate with ram for the first time is shown in Table 1. As indicated in Table 1, on average, ewes show sign of first heat for the first time at age of 249.0 ±3.10 days and this age was not significantly ( $P > 0.05$ ) affected by agro-ecological zones. Contrary to the current finding, Assen and Aklilu (2012) found that sheep in lowlands attain age of sexual maturity slower than highland. Average age at puberty of sheep in the current study area is shorter than the report of Mukasa and Lahlou (1995) who reported that Menze sheep in central highland of Ethiopia attain puberty at 300 days and weight of 16.9±0.1 kg or 56% of mature body weight. But longer age at puberty is also reported by Assen and Aklilu (2012), who reported 8.99 ± 2.5 months.

**Age at first lambing:** Age at first lambing of sheep is significantly ( $P < 0.05$ ) different between agro-ecologies. Age at first parturition was the shortest in highland (400.7±8.11 days), while significantly longer time is taken by sheep age at first parturition in lowland (412.3±3.0505 days) relative to midland (411.4±4.23 days). This shows that the highland condition, that is, availability of feed and favorable environmental temperature might be the prominent factors that made the highland sheep to have the shortest age at first lambing. Similar to the current finding, Assen and Aklilu (2012) observed that the age at first parturition of sheep in highland is significantly shorter than midland and lowland agro-ecological zones. The average mean (408.0± 3.31 days) age at first parturition of the current study is very close to the age at first parturition reported by Belay and Hile (2009) and Assen and Aklilu (2012) who reported 404±65.4 days and 13.2±3.1 months or 418 days for native sheep managed traditional in Jimma and Tigray zones in respective order. However, Sisay et al. (2014) and Gebregiorgis et al. (2016) reported age at first lambing of approximately two times, that is, 731.67±0.3 days of the current finding for sheep managed under government ranch, private ranch

and private farm (744±8.5 days) for Menze sheep, respectively. Whereas Mengiste et al. (2011) reported 1.3 times of the current age at first lambing (464.2 ± 140.0 days) for Washara sheep. On the other hand, as compared to the current finding, shorter age at first lambing of 354 and 360 days was reported for Arsi and Horro sheep in order (Solomon et al., 2010).

**Lambing interval (LI):** Lambing interval of ewe in the current study does not vary significantly across agro-ecological zones. But, a trend of lengthy in a LI was observed as someone go from highland to lowlands which might be due to differences in feed condition, health, season of lambing, etc. The overall mean of LI (269.0 ± 2.89 days) is very close to LI reported for traditionally managed sheep in Ethiopia and order than others methods in Ethiopia (Berhanu and Aynelam, 2009; Assen and Aklilu, 2102; Jahan et al., 2013; Sisay et al., 2014; Gebregiorgis et al., 2016). In addition, for various native sheep from different countries, 252.3 days, Assen and Aklilu (2012) for Ethiopian native sheep (196.5 days), Hassen and Tesfaye (2011) for native Bangladesh sheep (247.7 ± 49 days), Poon (2008) for Indian indigenous sheep which is shorter than the current LI, were also reported. On the contrary, very long LI that reaches up to 365 days is also reported for different sheep (Seabo et al., 1996). Obviously, variation in LI cannot be out of the environment and animal factors. Thus, there is variation in feed availability, management and mothering ability and breed of sheep across parts of the country and the world too. Overall, the results in this study is in agreement with some estimates in Africa which has been estimated under village conditions that ranged from 254 to 366 days in the semi-arid zone and 214 to 322 days in the humid zone (Abass, 1995).

### **Reproductive performance of goat**

**Weaning age (WA):** Weaning age is the age at which kid stops suckling of its mother (doe). It is commonly affected by ability of mother to nurse her young and environments revealed that the WA of the kid significantly ( $P > 0.05$ )

**Table 2.** Reproductive performance goat in the study area.

Parameter (days)	Agro ecological zones			Overall (Mean $\pm$ SE)	p value
	Lowland* (Mean $\pm$ SE)	Midland* (Mean $\pm$ SE)	Highland* (Mean $\pm$ SE)		
Slaughter age	83 (217.6 $\pm$ 3.95) <sup>b</sup>	79 (259.3 $\pm$ 1.05) <sup>a</sup>	83 (291.9 $\pm$ 1.05) <sup>a</sup>	255.6 $\pm$ 2.49	0.00
Weaning age	83 (136.0 $\pm$ 2.88) <sup>b</sup>	83 (151.8 $\pm$ 2.10) <sup>a</sup>	82 (149.0 $\pm$ 2.29) <sup>a</sup>	145.5 $\pm$ 1.48	0.00
Age at puberty	73 (230.0 $\pm$ 6.34) <sup>a</sup>	83 (227.8 $\pm$ 2.63) <sup>a</sup>	85 (211.6 $\pm$ 4.38) <sup>b</sup>	222.6 $\pm$ 2.67	0.00
AFK	73 (408.6 $\pm$ 7.75) <sup>a</sup>	83 (385.6 $\pm$ 4.31) <sup>b</sup>	85 (386.2 $\pm$ 0.83) <sup>b</sup>	393.5 $\pm$ 3.05	0.00
KI	86 (281.7 $\pm$ 3.70) <sup>a</sup>	87 (264.0 $\pm$ 5.89) <sup>b</sup>	79 (263.5 $\pm$ 6.0) <sup>b</sup>	269.9 $\pm$ 3.08	0.02

<sup>a-b</sup>Mean with row having different supper script is significantly different at  $p < 0.05$ ; AFK: Age at first kidding; KI: kidding interval; SE: standard error. \*Number of respondents.

affected by agro-ecological zones, that is, goat in lowlands (136.0  $\pm$  2.88 days) hurriedly prevent kids suckling as compared to midland (151.8 $\pm$ 2.10 days) and highland (149.0  $\pm$  2.29 days) goats that allow kids to suckle her for longer time (Table 2). The shorter or earlier weaning of desert or lowland goat might be due to low milk yields or mechanism used by doe to sustain her life that might be harmed or lost due double effect, that is, low availability of feed and suckling by kids. Most probably high mortality of kids in lowland is due to early weaning age. In general, the current average WA (145.5  $\pm$  1.48 days) is similar with the weaning age reported by Assen and Aklilu (2012) who reported weaning age of 4.75  $\pm$  1.21 months for indigenous goat in Tigray zone, Northern Ethiopia.

**Age at puberty:** Age at puberty in doe kid is the age at which doe kid ovaries and reproductive hormones starts to communicate through order of hypothalamus and pituitary hormone or simply it is the time at which first heat is seen in doe kid or female goat. The present study revealed that in the study districts, on average, female goat reaches age of sexual maturity around 222.6 $\pm$ 2.67 days. The age at puberty is insignificant ( $P > 0.05$ ) among agro ecological zones (Table 2). Statistically, age of puberty trend seems to increase with decrement of altitude. Current finding is shorter than the report of Weldeyesus and Rohotash (2018) who reported that about 12.7 months for Maefur goat breed managed under traditional management in Erob district, East Tigray. Most of the goats may often reach puberty without having achieved an adequate physical growth to support reproduction and first ovulation may not necessarily coincide with first estrus depending on nutritional status and breed (Greyling, 2010).

**Age at first kidding (AFK):** Mean of AFK of the study area goat is shown in Table 2. As indicated in Table 1, AFK of lowland goat (408.6  $\pm$  7.75 day) is significantly higher than AFK of midland (385.6  $\pm$  4.31 days) and highland (386.3  $\pm$  0.837), but insignificant between midland and highland agro-ecological zones (Table 2). Longer AFK, in lowland might be due to longer age at puberty and delay to conceive pregnancy and lighter

weight which may result predominantly due to feed shortage. Overall, mean AFK of the current study (393.4  $\pm$  3.05 days) is comparable with mean AFK of central highland goat (407.9 days) (Mengistie et al., 2013), but longer than AFK of crossbred Abergelle goat (8.22 months or 246.6 days) (Shumuye et al., 2014), and Arsi-Bale goat (19.94 months) (Dadi et al., 2008). Most of sub-Saharan Africa goats reach AFK with a range of 303 and 556 days (Wilson, 1984). Thus, the goats in the study area are averagely productive. Because goat that starts kidding at younger age can produce more offspring than goat that starts kidding at older age, hence more productive and economical. Kidding makes the beginning of production (Zarkawi and Al-Daker, 2013). Age at first kidding is an important indicator in determining sexual maturity and life time productivity in does (Deribe and Taye, 2014).

**Kidding interval (KI):** Kidding interval is one of the major components of reproductive performance that influences productivity (Daribe and Taye, 2014). Current result revealed that the KI is statistically significant between agro-ecological zones, that is, lowland goats have longer KI when compared with midland and highland goats (Table 2). In close agreement with the overall current mean of KI (270  $\pm$  3.08 days or 9 months), Daribe and Taye (2014) reported 289  $\pm$  17.03 days of KI for Abergelle goat managed under traditional management. Mengistie et al. (2013) reported 307.9  $\pm$  14.20 days for central highland goats managed under traditional management. Contrary to current finding, higher (greater or equal to one year) KI for goats managed under traditional management were reported from different areas of the country by many scholars (Assenet et al., 2012; Yishaket et al., 2013; Mohammed et al., 2015). In addition, shortest kidding interval that ranges 3.84 to 8.5 months was reported for native Ethiopian goat breed (Jemal, 2008; Belay and Greet, 2012; Netsanet et al., 2016).

### Slaughter age of sheep and goat

Slaughter age is the age at which animal can give average yield and quality meat. The slaughter age can

vary from country to country and even within a given country due to variation in culture, religion, reason of slaughter, and market weight of a given area. As a result, it is difficult to give range of age of slaughter. These might be the result why slaughter age was significantly different between agro-ecological zones in the current study. As shown in tables 1 and 2, people in lowland area slaughter sheep and goat at age (200.9±2.06 and 217.6±3.95 days) as compared to people living in midland and highland who slaughter goat and sheep relatively at younger age. The increment in days of slaughter as someone go from lowland to highland might be the preferences of highland people to white (fat) meat as compared to lowland people who seem to prefer lean (red) meat. In addition, the reasons why in lowland goat slaughter at younger age might be to limit shortage of feed that commonly occur in drought season in separate conditions. In comparison with the current result for slaughter age of sheep and goat, Assen et al. (2012) reported shorter mean slaughter age of 7.55 ± 2.27 and 7.55 ± 2.39 months for sheep and goat in order. Different from the present survey study, the same author observed that the average slaughter age of sheep and goat in Tigray zone, Northern Ethiopia is not significant between AEZ. But a trend of slaughter age increase from lowland to highland in his study was observed.

## CONCLUSION AND RECOMMENDATION

The study shows that in the study area, local sheep productive performance is lower particularly in age at puberty, age at first lambing and better relatively in weaning age and lambing and kidding interval. Overall, productive performance of sheep and goat in lowland area was lower in relation to midland and highland. Thus, encouraging the positive productive performance and improvement of deficiency in other productive, particularly, in lowland area through feed and other related management improvement and implementing strategic breed improvement is the area that needs further work in the future.

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