Reproductive performance of Abergelle goats under traditional management in Sekota Woreda, Ethiopia

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Abstract

Reproductive performance of Abergelle goat was studied at Sekota Woreda of Amhara National Regional State. The results of this study are based on on-farm monitoring data collected from 700 kids born in two years in the semi arid parts of the woreda. The mean litter size and annual kidding rate were 1.04 and 1.22±0.17. The mean age at first kidding and kidding interval were 447.93 and 339.3 days. Therefore, to increase the validity of conclusion based on on-farm study, it is important to undertake well planned on-station study to predict the genetic potential of the breed.

Key words: Abergelle, On-farm, Reproductive performance, Semi arid, Sekota

Introduction

The goat population of Ethiopia is estimated to be 18.5 million (CSA, 2007). It is maintained with a very little resource input under the traditional subsistence management system. Goats are important for diversifying production, increasing income, contributing to human nutrition and reducing risk during crop failure, property security and investment. Goats are generally found in all agro-ecological zones from arid to humid and over the whole range of production systems from intensive smallholder production to very extensive nomadic pastoralism (Payne and Wilson, 1999).

Goat production is characterized by minimum profit resulting from poor management of the grasslands and seasonal fluctuations in feed resources. Periodic droughts and extensive dry seasons cause severe feed shortages resulting in undernourishment and low productivity among the animals. Grazing alone may not be sufficient for optimum body weight gain. Abergelle goat types are categorized under the Rift Valley family. They are extensively reared and found widely distributed in the mid altitude of Southern Tigray, North Wollo,

and Waghimra Zone and along Tekeze River Valley. Goats in the Sekota woreda are managed mainly under mixed crop livestock production system in relatively large flocks. Goat rearing in this woreda is predominantly for milk and meat production (Nigatu, 1994).

Despite their significance, goat research in the past has been scanty. Assessing the potential of available genetic resources, and identifying and prioritizing the major constraints limiting the traditional goat production system are urgent in order to carry out research and development strategies. Without adequate evaluation of the genetic merit of adapted local breeds, the formulation of sound breeding plans and improvement of genetic potential is not possible. Therefore, this experiment was conducted with the objectives to evaluate the reproductive performance of Abergelle goats under traditional management systems

Materials and methods

The study area

The study was conducted in Sekota Woreda, which is located in the Amhara Region, Waghimra Administrative Zone. It is located about 720 km North from Addis Ababa. The Altitude varies from 1340-2200 meters above sea level (ZAD, 1995). Annual rainfall ranges between 350 - 700 mm, falling mainly from July to September. The pattern and distribution of the rainfall is erratic and uneven. Average temperature ranges from 16-27^{o}C (ZAD, 1995). The vegetation can be characterized as being semi-arid shrubs dominated by various *Acacia* species with a sparse ground cover of annual grasses. The farming system of the area is a mixed crop-livestock production system dominated by livestock production.

Physical characteristics of Abergelle goats

Abergelle goats are among the major indigenous goat types in Ethiopia. They have developed specific adaptations to survive and produce under extremely adverse environmental conditions (poor feed quality and quantity, water shortage) that make them suitable for use in the traditional low-external input production system (Nigatu, 1994).

Abergelle goats as described by Nigatu (1994) have compacted bodies, short height at withers (females 59-66 cm; males 65-73 cm). Weight of females ranges from 21-30 kg and that of mature males ranges from 27-39 kg. They have slightly to markedly concave facial profile. Males have spiral shaped obliquely backward horns, while the horns of females point upward. Their coat type is smooth, fine and short with 45% plain color, 36% patchy (have mixed color) and 17% with spotted patterns. The reddish-brown color predominates (29%) and others are black, white and gray. Wattles are less than 5% in both sexes (FARM Africa, 1996).

Management system

Goat production in agro-pastoral and sedentary farming systems depend on native pasture grazing on communal lands and fallow plots, occasionally provided with straws, crop residues and stubble (aftermath) depending on seasons and household by-products (Nigatu, 1994). During the cropping season, they are largely dependant on hillsides, field margins and roadside grazing. Even if the climate of the woreda is characterized by long dry season for the purpose of this study, seasons were categorized into three by considering the availability of feed and temperature. Category 1 (July to September) is characterized by rainy season and green natural pasture is available. Category 2 (October to January) has relatively cool temperature with aftermath grazing available. The quantity and quality of natural pasture is depleted in this time. Category 3 (February to June) has a very hot temperature and both the natural pasture and aftermath grazing is scanty.

On-farm flock monitoring

For this study, two peasant associations were purposively chosen for monitoring purpose in semi arid part of the woerda based on the goat population. 14 households from the semi arid area that possessed goats were randomly selected. The age and parity of does of the flock were determined by dentition and interviewed the owners at the beginning of the monitoring.

For monitoring activities all animals were ear tagged at the beginning of the study and individual were established and data were collected by trained enumerators recruited from

the locality and supervision was carried out on 15 day basis by the researcher on reproduction, growth for two years from June 2004 to June 2006.

Reproductive data (age at first kidding, kidding interval, parity, birth type, litter size and kid sex) were taken. Kidding interval was calculated as the difference (in day) between two successive kidding for all does with more than one kidding record. Age at first kidding was calculated as the difference (in days) between birth and first kidding date of does. Litter size was computed as number of kids born/doe/kidding. Annual kidding rate (AKR) was calculated as: AKR = litter size × 365 per subsequent kidding interval.

Statistical analysis

Age at first kidding, kidding interval, average litter size and annual kidding rate were analyzed by GLM analysis of variance (SAS, 1999). Age at first kidding was analyzed using the following fixed effect model: $Y_{jklm}=\mu + T_j + M_k + \varepsilon_{jklm}$

Where, Y_{jklm} = observation (Age at first kidding) on j^{th} type of birth in the k^{th} season of birth

μ = overall mean common to all animals in the study

T_j = fixed effect of j^{th} type of birth of doe (1=single, 2= twin)

M_k = fixed effect of the k^{th} season of birth of doe (1-3)

ε_{jklm} is the random error term which is assumed to be normally distributed with a variance equal to δ^2 and a mean = 0.

Kidding interval was analyzed using the following fixed effect model:

$Y_{jkln} = \mu + P_j + M_k + N_l + \varepsilon_{jkln}$

Where, Y_{ijklm} = observation (kidding interval) on j^{th} type of birth in the k^{th} season of birth and l^{th} post partem weight of does.

μ = overall mean common to all animals in the study.

P_j = fixed effect of j^{th} birth type (1 = single, 2 = twin)

M_k = fixed effect of the k^{th} season of birth of kid (1 = wet (July to September.), 2 = cool dry (October to January) and 3 = hot dry (February to June)

N_l = fixed effect of the l^{th} post partem weight of doe (l = ranked postpartum body weight).

ε_{jkln} is the random error term which is assumed to be normally distributed with a variance equal to δ^2 and a mean = 0.

Results and discussion

Litter size

The total of 700 doses of Abergelle kidded, out of this 24 does kidding were as twin and , the rest 676 does kidding were as single (Table 1). This means 96.6% were single births, 3.4% were twin births. This is comparable to 98.7 and 1.3% single and twin births, respectively reported by FARM Africa (1996) for same breed. Dereje (2004) also reported 10% twining for goats in Ziquala woreda. The author attributed low twining rate to poor nutrition since farmers reported that the ability of does to give twin births was higher before one-two decades.

The overall mean litter size was 1.04±0.03 (Table 1). These were lower than that of Arsi Bale (1.21) and Central Highland goats (1.42) reported by Tatek *et al*. (2005) and Tesfaye *et al*. (2006), respectively, and comparable with that reported for indigenous goats of Swaziland (1.18) (Lebbie *et al*., 1989) and Borana Somali (1.00) (Tesfaye *et al*., 2000). The lower litter size of the breed in the present study probably might be related to the scarcity of forage in the study area at the time of breeding. Litter size showed significant difference ($P<0.001$) for parity five. In general, twin birth was higher in later parities than the first or second parity. Wilson and Light (1986) explained that the lower litter size of younger does might be associated with an underdeveloped state of the reproductive features required for successive litter bearing compared with older does that have reached physiological maturity. A relatively higher ($P<0.01$) litter size during hot dry season as compared to other season might be related with better feed availability during the wet season, i.e., at time of conception.

Table 1. Least squares means (± SE) of litter size of Abergelle goats in Sekota woreda.

Variable	N	Litter size
Overall	701	1.04 ± 0.03
Parity of dam		***
1	155	1.01 ± 0.03[b]
2	173	1.00 ± 0.03[b]
3	155	1.06 ± 0.03[b]
4	135	1.03 ± 0.02[b]
5	51	1.14 ± 0.03[a]
>5	32	1.06 ± 0.04[b]
Season of birth		NS
Hot dry	132	1.08 ± 0.02
Cool dry	560	1.05 ± 0.01
Wet	9	1.02 ± 0.06

*and*** indicate significant difference at $p<0.05$ and $p<0.001$and NS indicates non significant difference. Means followed by the same letters are not significantly different. CV= Coefficient of variance; LSW = Least square mean, N = Number of observation, SE = Standard error.

Annual kidding rate

The overall mean of annual kidding rate of Abergelle goats were 1.22±0.17 litters (Table 2). The analysis of variance showed that annual kidding rate was affected ($P<0.001$) by birth type and season of birth. Does that gave twin births and kidded in the hot dry and wet season had larger litters. Does that gave birth during the wet season had higher ($P<0.001$) litters than cool dry season kidding. This might be explained similar to that of the litter size in that does that kidded in the hot dry season may have had better quality feed at the time of breeding.

Table 2. Least squares means (±SE)

Table 3. Least squares means (±SE) of age at first kidding of Abergelle goats in Sekota woreda.

Variables	N	Age at first kidding (days)
Overall	25	447.93 ± 29.42
parity of dam		NS
1	4	483.27 ± 25.10
2	7	445.06 ± 26.41
3	8	413.62 ± 25.19
4	5	419.14 ± 31.25
5	1	478.54 ± 50.19
TBD		NS
Single	22	457.07 ± 18.62
Twin	3	438.78 ± 34.04
SBD		NS
Hot dry	2	433.62 ± 37.53
Cool dry	23	462.24 ± 16.46
Wet	-	-

*and*** indicate significant difference at $p<0.05$ and $p<0.001$and NS indicates non significant difference. Means followed by the same letters are not significantly different. N = Number of observation, SBD = Season of birth of does, SE = Standard error, TBD = Type of birth of does.

Kidding interval

Kidding interval is one of the major components of reproductive performance that influences production systems. The mean kidding interval of Abergelle goats were 339.3±21.21days (Table 4). These results were higher than reported kidding interval for most Small East African goats' that ranges from 236-265 days (Wilson and Durkin, 1988). Type of birth and parity of does did not affect ($P>0.05$) kidding interval of Abergelle goats. Season of previous kidding had effect ($P<0.001$) on kidding interval of two breeds. Does that kidded the first kids in the cool dry season had a relatively longer kidding interval than does that gave birth of first kids either in wet or hot dry season for Abergelle does. This might be due to the fact that does having first kidding in the cool dry season, had to face shortage of fodder availability for a longer period of time as compared to does kidding in the other seasons. This might delay the induction of estrus.

Dams that had their previous kid during the rainy season had shorter kidding interval as reported by Wilson and Murayi (1988). Does' previous postpartum weight had effect (P<0.01) on kidding interval of Abergelle goats, in that does that had lower weight (15-20 kg) at the previous parturition had longer kidding interval, whereas Central Highland goats were not affected by their previous postpartum weight. Sulieman *et al*. (1990) found that lambing interval decreases by 4.4 days for every 1 kg increase in postpartum live weight. Doe that have larger post partum body weight take less time to induce estrus.

Table 4. Least squares means (±SE) of kidding interval (days) of Abergelle goats in Sekota woreda.

Variable	N	Kidding interval (days)
Overall	221	339.3 ± 21.21
previous birth parity of dam		NS
1	53	292.9 ± 21.64
2	70	275.6 ± 19.39
3	50	265.5 ± 18.37
4	34	297.1 ± 18.07
5	8	280.6 ± 28.77
>5	6	258.8 ± 33.35
TB		NS
Single	211	286.4 ± 12.26
Twin	10	270.4 ± 26.11
CDPPW		**
15-20	27	320.4 ± 22.28[b]
20.1-25	91	277.2 ± 16.41[a]
25.1-30	70	269.6 ± 18.20[a]
30.1-35	33	246.6 ± 21.65[a]
>35	-	-
Season of previous birth		***
Cool dry	169	361.1 ± 12.63[c]
Hot dry	45	316.0 ± 14.01[b]
Wet	7	243.1 ± 28.97[a]
CV		21.6%

*and*** indicate significant difference at p<0.05 and p<0.001and NS indicates non significant difference. Means followed by the same letters are not significantly different. N = Number of observation, SE = Standard error.

Conclusion

In this study age at first kidding were not affected by does own birth type and parity for both breeds. Season of previous kidding had significant (P<0.001) effect on kidding interval. Does that kidded the first kids in the wet season had short kidding interval (243.1±28.97) than does that gave birth of first kids in cool dry season (361.1±12.63). From the results of evaluation of reproductive performance of Abergelle goats reproductive performance is influenced by kid birth of parity, birth type and season of birth. The result of the current study revealed that litter sizes are very low compared to other tropical breeds. Therefore, to increase the validity of conclusion based on on-farm study, it is important to undertake well planned on-station study to predict the genetic potential of the breed.

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