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Reproductive Performance of Abergelle Goats Raised under Traditional Management Systems in Sekota District, Ethiopia

Research Article

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ABSTRACT

A study to evaluate the reproductive performance of Abergelle goat was carried out at Sekota District of Amhara National Regional State. On-farm flocks from two peasant associations were monitored for two years to collect data. Data collected included identification number of doe and kid, birth / kidding date, kid birth weight, sex of kid, post partum doe weight, litter size, parity of doe. Data analysis was using the General Linear Model procedures of the Statistical Analysis System. The overall least squares mean litter size and annual kidding rate were 1.04 and 1.45, respectively. Parity of doe, season of kidding and doe postpartum weight affected (P<0.01) litter size that parity five, dry season kidded and heavy does had the highest litter. Annual kidding rate was affected (P<0.001) by birth type and season of birth. Does that gave twin births and kidded in the dry and wet season had larger litters. The overall least squares mean age at first kidding and kidding interval were 448 and 290 days, respectively. Age at first kidding was not affected by the fixed effects considered. Kidding interval was affected by season of previous kidding. Does with kidding in the wet season have short kidding interval than does that gave birth in cool season. Does' previous postpartum weight had effect (P<0.01) on kidding interval of Abergelle goats, in that light weight does had longer kidding interval than their heavy and medium weight contemporaries. The result of the current study shown that litter sizes are very low compared to other tropical breeds. The effect of parity could be avoided by improving the management level. In general, improving the general management level and breeding methods of goats will improve reproductive performance and productivity of this breed of goat.

KEY WORDS age at first kidding, kidding interval, kidding rate, litter size.

INTRODUCTION

Goat production is an integral component of agriculture in Ethiopia. The goat population of Ethiopia is estimated to be 18.5 million (CSA, 2007) maintained with a very little resource input under the traditional subsistence management system. Goats are important for diversifying production, creating employment, increasing income, building capital, contributing to human nutrition and reducing risk during crop failure, property security and investment (Legesse, 2008).

According to goat breed characterization based on physical characteristics by FARM-Africa (1996), Ethiopian indigenous goat types were identified and classified into four major families namely; Nubian, Small Rift Valley, Somali and Small East African. 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 (FARM-Africa, 1996; Yami and Merkel, 2008). Abergelle goat is believed to be a relative of the Afar and Worre goats.

It is found along the Tekeze River and some parts of Alamata of the Tigray Region, and Wag Hamra (Sekota) and East Gondar zones of the Amhara Region. Abergelle goats are stocky, compact and well-built. Mean height at the shoulders is 71.4 cm and 65 cm for adult bucks and does, respectively. Abergelle goats are milked for domestic consumption. Their skin is also used to make aprons, containers, etc. Reproductive characteristics are among the productive traits of goat production affecting perpetuation of the breed and even productivity of the breed (Legesse, 2008). The level of reproductive performance is dependent on the interaction of genetic and environmental factors (Duygu, 2010). Knowledge on the reproductive characteristics and the factors affecting the traits of breeds of goats is therefore very important to improve productivity. This trial was conducted to evaluate the reproductive performance of Abergelle goats under traditional management systems in Sekota district, Ethiopia.

MATERIALS AND METHODS

The study was conducted in Sekota district which is located between 12˚ 23' and 13˚ 16' north longitudes and 38˚ 44' and 39˚ 21' east latitudes. Sekota district is in eastern part of Waghimra zone, 435 km north east of Bahir Dar (capital of the Amhara region) and 720 km north of Addis Ababa. Altitude ranges from 1340 to 2200 m. 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 ˚C. Generally, the topography of the district is rugged and chain of mountain terrains which limits seriously access to the various parts of the district. The agricultural production system of Sekota district is mixed livestock crop production system dominated by livestock production. The productivity of the land is low emanating from very low rainfall. The main agricultural crops are sorghum, barley, wheat, teff and leant (Yiheyis *et al*. 2012; ZAD, unpublished).

Flock management

The most important sources of feed for goats in the study areas are communal grazing land and fallow land grazing. Farmers occasionally provide straw, crop residues and stubble (aftermath) for their goats depending on season. During the cropping season, goats are largely dependent on hillsides, field margins and roadside grazing. Breeding is uncontrolled. There is year round breeding and there is no selection of breeding animals.

Data source and management

On-farm flock monitoring was carried out in two peasant associations (PAs) of Sekota district which were selected purposively based on the availability and population of Abergelle goat breed in the PAs. Accordingly fourteen flocks were selected and monitored for about two years. At the beginning and during the course of the monitoring activity all the flocks included in the monitoring were identified by plastic ear tags applied at birth or purchase. The age and parity of does of the flock were determined by dentition and information from the owners. Data were collected by trained enumerators supervised by researchers in a monthly interval. Reproductive data collected within 24 hours of kidding include identification number of doe and kid, birth / kidding date, kid birth weight, sex of kid, post partum doe weight, litter size, parity of doe.

Statistical analysis

Data collected on reproductive characteristics was analyzed using the General Linear Model procedures of the Statistical Analysis System (SAS, 2003). The response variables used in the analysis were age at first kidding (AFK), kidding interval (KI), litter size (LS) and annual kidding rate (AKR). The AKR was calculated as:

AKR= litter size × 365 per subsequent kidding interval.

The fixed factors fitted in the model were season of kidding, type of birth, doe post-partum body weight (DPPwt), parity of doe. DPPwt was categorized as light (those with weight less than one standard deviation (SD) from the mean), medium (those with weight between mean plus or minus one SD) and heavy (those with weight greater or equal to mean plus one SD). Season of birth was categorized into three by considering the availability of feed and temperature. 1.

Wet season-July to September, characterized by rainy season and green natural pasture is available. 2. Cool season-October to January, has relatively cool temperature with aftermath grazing available. The quantity and quality of natural pasture is depleted in this time. 3. Dry season-February to June, has a very hot temperature and both the natural pasture and aftermath grazing is scanty. The interaction effect of parity with DPPwt was tested and was not significant, therefore removed from the model. The model used for the analysis was:

$$Y_{ijklm} = \mu + S_i + T_j + P_k + W_l + E_{ijklm}$$

Where:

Y_{ijklm}: observation on AFK, KI, LS and AKR.

μ: overall mean.

S_i: fixed effects of the i^{th} season of birth (1=wet season, 2=cool season, 3=dry season).

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

P_k: fixed effects of the k^{th} parity (p=1, 2, 3, 4, >5).
W_l: fixed effect of the l^{th} post partum weight of doe (l=heavy, medium, light).
E_{ijklm}: 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 and kidding rate

The overall least squares mean litter size and kidding rate of Abergelle goats in Sekota district is presented in Table 1.

Table 1 Least squares means of litter size and annual kidding rate of Abergelle goats in Sekota district

Variable	Litter size		Annual kidding rate	
	N	LSM±SE	N	LSM±SE
Overall	701	1.04±0.02	217	1.45±0.07
Parity of dam		*		*
1	155	1.03±0.03^{ab}	52	1.26±0.10^{ab}
2	173	1.02±0.03^{a}	68	1.38±0.09^{a}
3	157	1.06±0.03^{bc}	49	1.50±0.09^{bc}
4	137	1.03±0.02^{ab}	34	1.39±0.09^{ab}
≥5	83	1.08±0.03^{c}	14	1.73±0.13^{c}
Season of birth		**		***
Dry season	136	1.08±0.02^{b}	41	1.60±0.07^{b}
Cool season	560	1.02±0.01^{a}	166	1.12±0.07^{a}
Wet season	9	1.02±0.06^{ab}	7	1.63±0.17^{b}
DPPwt		*		NS
Heavy	102	1.08±0.03^{b}	34	1.54±0.11
Medium	477	1.04±0.02^{ab}	148	1.51±0.07
Light	126	1.01±0.03^{a}	35	1.30±0.10

* P<0.05 and *** P<0.001.
DPPwt: doe post-partum body weight.
N: number of observation; NS: non significant; LSM: least squares means and SE: standard error.
The means within the same column with at least one common letter, do not have significant difference (P>0.05) and (P>0.001).

Out of the total of 700 Abergelle does kidded 24 (only 3.4%) does kidded twin and the rest 676 (96.6%) does kidded single. FARM-Africa (1996) reported 98.7 single and 1.3% twin births for same breed. Dereje (2004) also reported 10% twining rate for goats in Ziquala district. 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 mean litter size obtained in the current study (1.04±0.02) is lower than the values reported for Arsi Bale and Central Highland goats 1.42; (Tesfaye *et al.* 2006).

However it is in comparison with Borana Somali goats (Tesfaye *et al.* 2006). The lower litter size of the breed in the present study probably might be related to the scarcity of forage in the study area. Parity affected (P<0.001) litter size in Abergelle goats that parity five does had the highest litter than other parity does. There was a general increasing trend in litter size with increasing parity of doe. Some studies 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.

Season of kidding showed a significant influence on litter size of Abergelle goats that those does kidded in the dry season had larger litter might be related to better forage availability during conception, wet season. Doe post-partum body weight affected litter size. Heavy does gave larger litter than lighter does which agrees with the result of Mengistie *et al.* (2010).

This might be because better body conditioned animals can shed more number of ova and fertilized (Mellado *et al.* 2006). The least squares mean annual kidding rate of Abergelle goats obtained in the current study was 1.45 ± 0.07 litters (Table 1).

Parity had an effect on kidding rate, does with fifth parity had higher (P<0.01) kidding rate which agreed with previous report by (Adu *et al.* 1979).

Season affected (P<0.001) annual kidding rate that those does kidded in the cool seas-on had lower litter as compared to those kidded in the dry and wet seasons. 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.

Age at first kidding

Age at first kidding is a good indicator of sexual maturity in does. The mean age at first kidding of Abergelle goats was found to be 448 days (Table 2). This is in agreement with that reported by Wilson (1984) for goats of most Sub-Sahara Africa that stated the mean ages at first kidding was between 303 and 556 days.

Workneh (1992) reported that 36% of the does had their first kidding by eruption of their first incisor teeth among the goat types of southern Ethiopia; it is lower age as compared to the current result.

However, the obtained result is much lower than the report for Arsi Bale goats.

The effect of parity at which the doe was born and her birth type did not influence (P>0.05) the age at first kidding of does which is the case in other breeds of goats.

Kidding interval

Kidding interval is one of the major components of reproductive performance that influences productivity. The least squares mean kidding interval of Abergelle goats were 289 ± 17.03 days (Table 2).

This result is in comparison with the report of for Arsi Bale goats; but hig-her than reported kidding interval for most Small East African goats' that ranges from 236-265 days (Wilson and Durkin, 1988).

Table 2 Least squares means of age at first kidding and kidding interval of Abergelle goats in Sekota district

Variables	Age at first kidding (d)		Kidding interval (d)	
	N	LSM±SE	N	LSM±SE
Overall	25	448±29.4	217	290±17.0
Parity of doe		NS		NS
1	4	483±25.1	52	321±18.9
2	7	445±26.4	68	295±25.2
3	8	413±25.2	49	252±21.1
4	5	419±31.3	34	325±29.6
5	1	478±50.2	14	255±23.4
Type of birth		NS		NS
Single	22	457±18.6	207	297±13.3
Twin	3	438±34.0	10	282±26.9
Season of birth/kidding		NS		***
Dry season	2	433±37.5	44	281±16.5[b]
Cool season	23	462±16.5	166	362±15.4[c]
Wet season	-	-	7	227±33.3[a]
DPPwt	-	-		*
Heavy			34	253±22.8[a]
Medium			148	279±15.7[a]
Light			35	340±26.7[b]

* P<0.05 and *** P<0.001.
DPPwt: doe post-partum body weight.
N: number of observation; NS: non significant; LSM: least squares means and SE: standard error.
The means within the same column with at least one common letter, do not have significant difference (P>0.05) and (P>0.001).

Similar with the report of other scholars, type of birth and parity of does had not an effect (P>0.05) on the kidding interval of Abergelle goats. Season of previous kidding had effect (P<0.001) on kidding interval. 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 post-partum weight had effect (P<0.01) on kidding interval of Abergelle goats, in that does that had lower weight at the previous parturition had longer kidding interval. 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.

CONCLUSION

The result of the current study shown that litter sizes are very low compared to other tropical breeds. Different fixed factors affected the performance levels indicating the potential of improving environmental factors to improve productivity. The effect of parity and season of kidding could be avoided by improving the management level of does like supplementary feeding during reproduction and parturition. In general, improving the general management level and breeding methods of goats will improve reproductive performance and productivity of this breed of goat. In addition, since the result is based on on-farm data, undertaking well planned on-station study is imperative both to predict the phenotypic and genetic potential of the breed.

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REFERENCES

Adu F., Buvanendran V. and Lakpini C.A.M. (1979). The reproductive performance of Red Sokoto goats in Nigeria. *J. Agric. Sci*. **93(3),** 563-566.

CSA. (2007). Central Statistical Agency. Federal Democratic Republic of Ethiopia, Agricultural sample survey, reports on livestock and livestock holding characteristics. Statistical Bulletin No. 388, Addis Ababa Ethiopia. **2,** 12-16.

Dereje A., (2004). Preliminary survey of livestock production systems in Ziquala Woreda, Waghimira zone of Amhara regional state. MS Thesis. Alemaya Univ., Ethiopia.

Duygu I. (2010). Reproduction performance of Saanen goats raised under extensive conditions. *African J. Biotechnol*. **9(48),** 8253-8256.

FARM Africa. (1996). Goat types of Ethiopia and Eritrea. Physical Description and Management Systems. International Livestock Research Institute.

Legesse G. (2008). Productive and economic performance of small ruminants in two production systems of the Highlands of Ethiopia. Ph D. Thesis. Univ., Hohenheim, Stuttgart, Hohenheim.

Mellado M., Valdez R., Garcia J.E., Lopez R. and Rodriguez A. (2006). Factors affecting the resproductive performances of goats under intensive conditions in a hot arid environment. *Small Rumin. Res.* **63,** 110-118.

Mengistie T., Girma A., Solomon G., Sisay L., Abebe M. and Markos T. (2010). Reproductive performances and survival of Washera sheep under traditional management systems at Yilmanadensa and Quarit districts of the Amhara National Regional State, Ethiopia. *J. Anim. Vet. Adv*. **10(9),** 1158-1165.

SAS. (2003). Statistical Analysis. SAS user's Guide, statistic. SAS Institute Inc. Cary, North Carolina, USA.

Sulieman A.H., Sayers A.R. and Wilson R.T. (1990). Evaluation of Shugor, Dubasi and Watish subtypes of Sudan Desert sheep at the EI-Huda National Sheep Research Station, Gezira Province, Sudan. International Livestock Centre for Africa) Research Report.

Tesfaye G., Sisay L., Dereje T., Abebe M. and Solomon G. (2006). Growth and reproductive performance of central highland goats in North Shoa and South Wollo. Proc. 1th Ann. Conf., Comp. Livest. Res. Act. Amhara Region Agriculture Research Institute. Bhar Dar, Ethiopia.

Wilson R.T. and Murayi T. (1988). Productivity of the small East African goat and its crosses with Anglo Nubian and the Alpine in Rwanda. *Trop. Anim. Health Prod*. **20,** 219-228.

Wilson R.T. and Durkin J. (1988). Livestock production in central mali: reproductive components in traditionally managed sheep and goats. *Livest. Prod. Sci*. **19,** 523-529.

Wilson R.T. (1984). Indigenous goats: productivity in traditional livestock systems of semi-arid Africa. *Int. Goat Sheep Res*. **2(3),** 243-251.

Workneh A. (2000). Do smallholder farmers benefit more from crossbred (Somali×Anglo-Nubian) than from indigenous goats?. Ph D. Thesis. Georg-August Uni., Gottingen.

Yami A. and Merkel R.C. (2008). Sheep and Goat Production Handbook for Ethiopia, Brana Printing Press, Addis Ababa, Ethiopia.

Yiheyis A., Tegegn F., H/Melekot M. and Taye M. (2012). Preweaning growth performance of Sekota sheep breed in Waghimra zone, Ethiopia. *Online J. Anim. Feed Res*. **2(4),** 340-343.