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Evaluation of Growth Performance of Abergele Goats under Traditional Management Systems in Sekota District, Ethiopia

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Abstract: The study was conducted at Abergele in the semi arid parts of Sekota district to evaluate growth performance of Abergele goats managed under traditional management systems. Data on growth and growth rates were collected from 724 kids for two years. The least squares mean birth, three months, six months and yearling weight of kids obtained were 1.91 ± 0.04 , 6.84 ± 0.19 , 9.13 ± 0.31 and 16.42 ± 1.20 kg, respectively. Parity of doe and birth type of kid significantly affected birth weight and three months weight while sex of kid and season of birth of kid affected birth, three months, six months and yearling weight consistently. Kids from first parity does were lighter at birth, three months and six months of age than kids from higher parity does. Twin born kids were lower in weight at birth and three months of ages than their single born counterparts. Female kids and kids born during the dry season had lower weight at all ages considered. The least squares mean pre-weaning and post-weaning growth rates obtained were 53.4 ± 2.30 and 29.3 ± 4.32 g day⁻¹, respectively. Parity of doe, type of birth and season birth of kid affected pre-weaning growth rate. Kids from first parity does, twin born kids and kids born during the dry season had lower growth rate. The significant effect of fixed factors needs to be considered in an effort to improve productivity of goats in the study areas.

Key words: Abergele goat, birth weight, growth rate, Sekota, traditional management

INTRODUCTION

Goat production is an integral component of agriculture in Ethiopia. Ethiopia is endowed with a large number of goats estimated to be 21.7 million heads (CSA, 2011) which are found distributed in all agro-ecological zones of the country. Goats in Ethiopia are maintained under farmers management system used as source of food (meat and milk), skin, manure and direct cash income (Zelege, 2007).

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. Abergele 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). The physical characteristics of Abergele goat is well documented in the characterization document.

Growth is the most important trait in small ruminant production affecting the contribution of the sector to the farm household thru live animal sale and meat production. This paper reports the growth performances of Abergele goats under the traditional management systems of Sekota district.

MATERIALS AND METHODS

Study area: 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 found 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.a.s.l. 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 lentil (Yiheyis *et al.*, 2012).

Description of the breed: Abergele 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 (Alemayehu, 1994).

Abergele 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. Abergele goats are stocky, compact and well-built. Mean height at the shoulders is 71.4 and 65 cm for adult bucks and does, respectively. Abergele goats are milked for domestic consumption. Their skin is also used to make aprons and containers (Yami and Merkel, 2008).

Flock management: Goat production in the study areas 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. During the cropping season, they are largely dependent on hillsides, field margins and roadside grazing.

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 Abergele 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.

Data collected on growth include: birth date, birth weight, postpartum doe body weight, type of birth, sex of kid and doe parity taken within 24 h of birth/kidding. Body weight was taken every 15 days using the Salter scale (50 kg capacity with 200 g precision) for kids until six months of age and on a monthly interval thereafter.

Growth rate (Average Daily Gain, ADG) was computed as: Pre-weaning ADG (gram) = (three months weight-birth weight)/90 and Post weaning ADG (gram) = (yearling weight-three months weight)/275. All data were coded and recorded in to excel sheet.

Statistical analysis: The collected data was analyzed using the General Linear Model procedures of the Statistical Analysis System (SAS, 2003). Response variable in the analysis were birth weight, weight at different ages and pre-and post-weaning growth rate.

The fixed effects considered were sex of kid, birth type, parity of doe and season of birth. 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 model used was:

$$Y_{ijkln} = \mu + S_i + B_j + P_k + T_l + \epsilon_{ijkln}$$

Where:

- Y_{ijkln} = Observation on birth weight, three months weight, six months weight, yearling weight and pre-and post-weaning growth rate
- μ = The overall mean
- S_i = Fixed effects of the i th sex (1 = male, 2 = female)
- B_j = Fixed effects of the j th birth type (1 = single, 2 = twin)
- P_k = Fixed effects of the k th parity ($p=1, 2, 3, >4$)
- T_l = Fixed effects of the l th season of birth (1 = Wet season, 2 = Cool season, 3 = Dry season)
- ϵ_{ijkln} = Random error term

RESULTS AND DISCUSSION

Birth weight and weight at different ages: The overall least-squares mean birth weight and weight at different ages of Abergele goat is presented in Table 1.

Birth weight: The overall least-squares mean birth weight of Abergele kids (1.91 ± 0.04 kg) was lower than the value reported (2.29 kg) for the same breed (Zeryhun, 2006). It was also lower than reported value (2.34 kg) for Boran Somali (Tucho *et al.*, 2000) and Somali goats in Eastern

Table 1: Least squares means birth, weaning, six month and yearling weight of Abergele goats in Sekota district

Factor	Birth weight (kg)		Three months weight (kg)		Six months weight (kg)		Yearling weight (kg)	
	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall	724	1.91±0.04	639	6.84±0.19	427	9.13±0.31	195	14.15±1.20
Parity of doe		***		***		*		NS
1	153	1.77±0.01 ^b	130	5.99±0.19 ^b	74	9.33±0.32 ^b	40	13.65±1.15
2	173	1.92±0.01 ^a	157	6.76±0.19 ^a	100	9.99±0.30 ^{ab}	53	14.33±1.18
3	167	1.91±0.04 ^a	148	6.79±0.18 ^a	111	10.12±0.29 ^a	49	14.69±1.18
>4	142	1.93±0.04 ^a	121	6.69±0.18 ^a	86	9.61±0.30 ^{ab}	29	14.72±1.22
Birth type		***		***		NS		NS
Single	676	2.02±0.04	599	7.08±0.14	399	9.89±0.22	177	14.71±1.11
Twin	48	1.80±0.05	40	6.21±0.23	28	9.49±0.37	18	13.60±1.23
Sex of kid		***		***		**		***
Female	384	1.88±0.04	335	6.49±0.17	230	9.45±0.27	122	13.50±1.14
Male	340	1.96±0.04	304	6.80±0.17	197	9.92±0.28	73	14.80±1.17
Season of birth		***		***		***		***
Cool season	569	1.96±0.02 ^a	531	6.56±0.10 ^b	365	8.60±0.18 ^b	162	15.10±1.17
Dry season	146	1.80±0.03 ^b	99	5.30±0.14 ^c	53	9.21±0.28 ^c	33	13.21±1.16
Wet season	9	1.96±0.10 ^a	9	8.07±0.40 ^a	9	11.3±0.59 ^a	-	-

***p<0.001; **p<0.01; *p<0.05; ^{ab}Means with different letters within the same column are significantly different at the indicated level; N: No. of observation; NS: Not significant

Ethiopia (Zelege, 2007). However, it was higher than the value of 1.5 kg for Mid Rift Valley kids (Tucho *et al.*, 2000).

Parity of doe had significant effect ($p<0.01$) on kid birth weight that kids born from first parity dams had lower weight than kids born from other higher parity dams. This type of effect is reported in the literature (Ahuya *et al.*, 2009; Jimenez-Badillo *et al.*, 2009). This might be related to the doe weight at kidding. It was stated that an advance in age of doe up to fourth parity was accompanied by increased kid weight at birth and up to weaning (Negi *et al.*, 1987; Gurmej *et al.*, 1987).

Single born kids were heavier ($p<0.001$) at birth than those born as twins which might be related to absence of intra-uterine nutritional and space competition in single born kids unlike that of twin born kids. As the number of fetuses increases in utero, the number of caruncles attached to each fetus decreases, as a result the feed supply to the fetuses thus reduces (Robinson *et al.*, 1977). This effect of sex is similar with literature (Ahuya *et al.*, 2009; Jimenez-Badillo *et al.*, 2009; Zelege, 2007).

Sex of kid showed significant difference ($p<0.001$) on birth weight. Similar with literature (Ahuya *et al.*, 2009; Jimenez-Badillo *et al.*, 2009; Zelege, 2007; Liu *et al.*, 2005), males were heavier than their female contemporaries.

Kids born in the wet and cool dry season were heavier ($p<0.001$) than those born in the hot dry season. This is probably due to doe's nutritional status during the late stage of pregnancy. Doe's kidding during the wet season have got better browses and green pasture at late stage of pregnancy than doe's kidding during the dry season. El-Tawil *et al.* (1970) stated that seasonal influence on birth weight functions through its effect on the dam's uterine environment mostly in late gestation.

Similarly, Dum and Moss (1992) explained that rapid rate of fetal growth occurs at late stage of pregnancy, nutritional stress during this time resulted to birth weight losses and increased the risk of reproductive wastage due to abortion, retardation of fetal growth and reduced birth weight.

Weight at different ages: The overall mean three months weight of Abergele kids obtained in the current study (6.84 ± 0.19 kg) was comparable with the value of 6.32 and 6.72 kg for reported for Mid Rift Valley kids and Highland goats, respectively (Tucho *et al.*, 2000). Abergele kids weaning weight was however lower than that of Arsi Bale (8.4 kg) (Tatek *et al.*, 2004), Boran Somali kids (7.2 kg) and Highland kids (9.02 ± 0.18 kg) (Tucho *et al.*, 2000).

Parity of doe affected three months weight that kids born from first parity does have lower weight than those from later parities. This is because as parity increases mothering ability and milk production increases therefore shown up in kid growth. Effect of parity on weight at weaning is reported in the literature (Jimenez-Badillo *et al.*, 2009; Dadi *et al.*, 2008; Zelege, 2007; Liu *et al.*, 2005).

Single born and male kids were heavier ($p<0.001$) than twin and female kids. After birth, single kids had an advantage over twins as twins had to compete for the milk from their dam. This result is in line with literature (Jimenez-Badillo *et al.*, 2009; Dadi *et al.*, 2008; Zelege, 2007; Liu *et al.*, 2005).

Kids born during wet season have heavier ($p<0.01$) three months weight followed by cool season born kids. This is related to dam nutrition at lambing which in turn can be reflected in kid growth. Jimenez-Badillo *et al.* (2009) and Dadi *et al.* (2008) reported similar effect of season on kid weight.

Table 2: Least squares means (LSM±SE) pre-weaning and post-weaning average daily body weight gain of Abergele goats in Sekota district

Variables	Pre-weaning ADG (g day ⁻¹)		Post-weaning ADG (g day ⁻¹)	
	N	LSM±SE	N	LSM±SE
Overall	639	53.4±2.30	176	29.3±4.32
Parity of doe		***		NS
1	127	47.7±2.38 ^b	34	31.0±4.20
2	158	54.8±2.25 ^a		29.6±4.30
3	148	54.9±2.15 ^a	41	31.5±4.31
>4	122	53.5±2.18 ^a	28	30.3±4.44
Type of birth		***		NS
Single	601	58.8±1.67	161	29.1±4.02
Twin	38	48.1±2.82	15	29.4±4.57
Sex of kid		NS		**
Female	337	52.5±2.02	111	27.6±4.11
Male	302	54.4±2.07	65	30.9±4.25
Season of birth		***		NS
Cool season	537	48.9±1.26	147	29.2±4.24
Dry season	93	37.2±1.72	29	29.4±4.23

***p<0.001; **p<0.01; *p<0.05; ^{a,b}Means with different letters within the same column are significantly different at the indicated level; N: No. of observation; NS: Not significant

Yearling weight of Abergele goats obtained in the current study (14.2 kg) was comparable with that for Borana Somali goats and more than the yearling weight reported for Mid Rift Valley goats (Tucho *et al.*, 2000).

Male Abergele goats had heavier yearling weight than female goats. It is natural that males are heavier than female after puberty. Cool season born kids had heavier weight at yearling age.

Growth rate: Pre-and post-weaning growth rate of Abergele kids is presented in Table 2.

The mean daily pre-weaning body weight gain of Abergele kids obtained (53.44 g day⁻¹) are lower than the values reported for Somali goats (Zelege, 2007).

Parity of does affected (p<0.001) pre-weaning growth rate. First parity does born kids grow less than other higher parity does because as does parity increases their ability to provide milk and nurse their young increases. The pre-weaning growth rate of kids depends on the dam's milk yield and nutrition status of the dams (Gurmej *et al.*, 1987; Wilson, 1987). This is in agreement with literature (Jimenez-Badillo *et al.*, 2009; Ahuya *et al.*, 2009).

Single and cool season born kids had faster (p<0.001) growth rate than their multiple and dry season born counterparts, respectively. The effect of type of birth and season of birth of kid on pre-weaning growth rate is reported by other scholars (Ahuya *et al.*, 2009; Jimenez-Badillo *et al.*, 2009; Zelege, 2007). The effect of type of birth is due to relatively higher amount of milk consumed per kid as there is no competition for dam's milk when single.

The mean daily post-weaning daily body weight gain of Abergele kids was 29.26 g day⁻¹. Sex and season of birth had significant effect on post weaning growth of

Abergele kids. Das *et al.* (1996) explained that the rate of growth of kids after weaning was partly determined by the genetic potential of the kids and the level of environmental influences.

The mean daily post weaning body weight gain of kids born in the wet season was lower (p<0.001) than the kids born in other seasons might be because kids born during dry season had low growth rate at the pre-weaning growth stage due to the restriction of milk yield of their does, may compensate, growth in the post weaning growth period. Similarly, Hary *et al.* (2003) explained that kids born to low milking does were able to compensate (g day⁻¹) for restriction in milk availability by starting to graze on pasture forage at early stage.

CONCLUSION

The result obtained in the current study, in general, showed that the growth performance of Abergele goats is medium as compared to other Ethiopian indigenous goat breeds. Different fixed environmental factors like parity of doe, season of birth of kid, sex of kid and type of birth of kid affected weight at different ages and growth rates. The lower performance of kids from first parity does and those born in the dry season need special attention. In general, in an effort to improve the productivity of Abergele goat these fixed factors need to be considered.

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