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Growth Performance of Dorper and its F_1 Crossbreds at Debre-Birhan Agricultural Research Center

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Abstract:

The current work was conducted at Debre-Birhan Agricultural Research Center to evaluate the growth performance of pure Dorper sheep and their F_1 crosses from Menz and Afar indigenous sheep. A total of 527 lambs (233 pure Dorper, 294 Dorper X Menz 50% and 30 Dorper X Afar 50%) were born at Debre-Birhan Research Center between 2011 and 2014. The overall birth weight in the current study was 3.04±0.04 kg ranging between 1.00 and 5.60 kg. In the present study pure Dorper lambs were heavier at birth than the F_1 crosses ($P<0.05$) with Afar and Menz breeds with the mean birth weight of 3.39 vs 2.57 and 2.77 kg, respectively. Pure Dorper lambs were 32 and 22% heavier than the Afar x Dorper 50% and Menz x Dorper 50% lambs, respectively, at birth. Single born lambs were significantly ($P<0.0001$) heavier at birth compared to their twin counterparts; they had 29% more weight at birth than twins. Parity had also significant effect ($P<0.0001$) on the lambs birth weight. There was a trend of improvement in birth weight as parity advances. It was noticed that lambs born from the first parity were 16.77 % and 15.13% lighter in birth weight than lambs born from 2nd and 3rd parities, respectively. Lambs born in main rainy season and cold dry season had the higher birth weight compared to those born in the dry season and short rainy season. This tells us the difference in pasture availability in terms of quality and quantity among the different seasons of the year. Weaning weight at 90 days of age had significant ($P<0.001$) effect on most variables considered. Pure Dorper lambs were significantly ($P<0.0001$) heavier at 90 days compared to the Dorper x Afar 50% and Dorper x Menz 50% lambs. They were 71 and 31% heavier at this age compared to the F_1 crosses of Dorper x Afar and Dorper x Menz lamb, respectively. Lambs born in the dry season were 33 and 31% inferior in weaning weight compared to those born in the main and short rainy season, respectively. Breed/ genotype, sex, birth type, year and season of birth of the lambs had significant (<0.05) effect on the body weight of lambs at 6- months of age. Pure Dorper and Dorper x Afar 50% and Dorper x Menz 50% lambs weighed 24.30, 13.18 and 17.25 kg, respectively. Male lambs weighed 17.53 while females 16.33 kg at 6-months of age. More than one kg difference was observed on average between male and female lambs; this may be due to the effects of male hormone as age advances. Lambs born in the main rainy and short rainy seasons demonstrated to have good 6 month weight compared to those born in the cold dry and dry seasons. The adjusted yearling weight for the lambs from the current study was 32.43±0.46 kg. Comparable yearling weight (34.43 vs 31.33 kg) was obtained from Dorper x Menz 50% lambs to pure Dorper lambs. However, Dorper x Afar 50% lambs were 27.5 lighter (24.96 vs 34.43 kg) than the pure Dorper lambs at yearling age. There was significantly ($P<0.0001$) better pre-weaning growth pattern for the pure Dorper compared to the Dorper x Afar 50% and Dorper x Menz 50% lambs (142.93 vs 73.19 and 106.24 g/h/d, respectively), that accounted 95% and 35% more weight from pure Dorper compared to Dorper x Afar and Dorper x Menz 50% lambs at weaning age. This may be the dam effect since pure Dorper lambs were raised by the pure Dorper dam while the Dorper x Afar and Menz 50% lambs were reared by indigenous ewes. From the present study it can be concluded that both the pure Dorper and its f_1 crosses with the Menz sheep adapted very well and had higher body weight and better gain than indigenous sheep breeds. It is suggested to observe the performances of different blood levels of cross breeds with Dorper sheep and also investigate the finishing capacity of Dorper cross breeds at different age and feeding levels.
Key words: Dorper, Menz and Afar sheep, cross breeding, year of birth, season of birth, and birth type

1. Introduction:

Agriculture has been the mainstay of livelihood in Amhara region for millennia. However, agricultural production yet needs to be improved further to ensure farmers food security and economic development. There are still considerable food-insecure woredas in the region, particularly in eastern Amhara. Crop production in food-insecure part of the region is unreliable. Livestock production is virtually the major source of food security in eastern subalpine highlands and lowlands, where crop production is constrained by insufficient/unreliable rainfall, frost and degraded soil, among other factors.

Sheep are particularly vital livestock for supporting food security because of their high reproductive capacity and low initial investment suiting them for resource-poor farmers including landless youth and women. There is an immense opportunity for increased livestock production in Ethiopia with growing human population,

urbanization, economic development, domestic and export markets. However, sheep are virtually maintained as scavengers, resulting in low productivity. Furthermore, the available land resource is under increasing pressure from the large livestock population resulting in negative feed balance and hence low livestock productivity as well as land degradation. This is the result of growing human population, expanding cropping land and shrinking grazing land.

Intensification of livestock production involves keeping small flocks of highly productive animals. Use of improved exotic breeds is an option advocated for long. However, decades of sheep crossbreeding efforts in the country yielded insignificant impact on farmers' livelihoods (Gizaw, 2008). Crossbreeding has also been a controversial issue with contrasting views of conserving the adapted indigenous livestock resources vis-à-vis the need to speed-up economic growth and farmers' livelihoods. Designing a compromising conservation-based sustainable livestock production strategy and programs is required in order to exploit the huge livestock resources for improving farmers' food security and overall economic development.

There has been a recent introduction into Ethiopia of the highly productive meat breeds of Dorper sheep (Mekonen et al., 2013). Dorper is generally recognized as one of the most popular breeds in South Afrifca (Foure et al., 2009). Dorper are efficient meat breeds. Dorper sheep can attain 36 kg at the age of 3–4 months (compared to 16-20 kg for local sheep) with average daily weight gain in feedlot of 160 g (http://www.ansi.okstate.edu/breeds/sheep/dorper/). Small nucleus flocks of Dorper sheep are found elsewhere in the country, but there is no such flock in Amhara region. Establishment of these nucleus flocks in the region will facilitate the sustainable utilization of the resources. Besides, evaluation of their performance under Ethiopian conditions is vital to have full insight about the breed before going for large scale dissemination of the genotype in the country.

Objectives

- *To evaluate the growth performance of pure Dorper and 50% Dorper x Local cross breed lambs at Debre-Birhan Agricultural Research Center*

- *To gather information that are useful for designing sustainable breeding and management strategies*

2. Methodologies

2.1. Animal management

The effect of year of lamb birth, season of lamb birth, sex, birth type and blood level on the growth performance of lambs for the pure Dorper and 50% Dorper x Local lambs were evaluated at Debre-Birhan agricultural Research Center, Ethiopia.

All ewes in this experiment were sired by pure Dorper rams in a group of 20-25 ewes per ram. The indigenous sheep breeds employed in the current study were Menz and Afar sheep. In a mating system that lasted between 42 and 60 days, all rams and ewes were kept indoor being supplied hay prepared from natural pasture; *ad libitum* (basal diet). Ewes were flushed for about 21 days before rams were joined with commercial concentrate at the rate of 200-300 gram per head per day (g/h/d). They were also supplemented 300 g/h/d concentrate at the 3rd trimester of the pregnancy period. At lambing, lambs were identified with numbered plastic ear tags and birth date, weight at birth, dam number, sire number, sex of the lamb, post partum dam weight were also collected.

The management system in the herd was such that lambs born all year round were raised together with their parent dams until weaning (85-95 days). After weaning, lambs were managed as a flock separately from their dams grazed on natural pasture with 100-150 g/h/d supplementation of commercial concentrate; consisting of 33% noug (*Guizotia abyssinica),* cake 65.5% wheat bran, 1% limestone and 0.5% salt. All ewes, rams and lambs were treated for internal parasites with appropriate anthelminthics as per the center's recommended parasite control strategies.

At six months of age, male and female lambs were managed separately to control unwanted breeding. They were allowed to drink tap water twice a day.

2.2. Data collection and statistical analysis

Current study comprises data on growth and survival for pure Dorper lambs and 50% Dorper x local lambs generated at Debre-Birhan Agricultural research center. Live weight of all lambs were weighed for the first time at birth and thereafter regularly at fortnightly interval and monthly thereafter until yearling age. All determinations of weight were carried out to the nearest 0.1 kg using a weighing scale. Data for this research

consisted of 527 records for birth weight, 264 records for 90 days weight, 254 records for 180 day weight, 145 records for 360 day weight over three years period (2011 – 2014) at DBARC (Breeding, evaluation, conservation and distribution center).

Pre and post weaning growth performances were adjusted by the following formulae (Inyangala et al., 1992).

$$\text{Adjusted weaning weight (kg)} = \frac{90(w2-w1)}{D} + w1$$

$$\text{Adjusted 6 month weight (kg)} = \frac{180(w3-w1)}{D} + w1$$

$$\text{Adjusted yearling weight (kg)} = \frac{365(w4-w1)}{D} + w1)$$

Where, W2, W3 and W4 = weight at a given age

W1 = birth weight

D = number of days between weighing date and date of birth

$$\text{Average daily BW gain up to weaning (g)} = \frac{(AWWt - BWT)}{90}$$

$$\text{Average daily BW gain from weaning up to 6 Month (g)} = \frac{(A6MWT - AWWT)}{90}$$

$$\text{Average daily BW gain from weaning to yearling (g)} = \frac{(AYWT - AWWT)}{275}$$

Where, BWT = Birth weight

AWWT = Adjusted weaning weight at 90 days

A6MWT = Adjusted 6 month weight at 180 days

AYWT = Adjusted yearling weight at 365 days

2.3. Statistical analysis

Data on Birth weight, weaning weight, six month and yearling weight and gains at different ages were analyzed using GLM procedures of SAS (2002).

For all traits analyzed, effects fitted to statistical models are summarized as under:

Model :

$Y_{ijklm} = \mu + b_i + s_j + t_k + y_l + Sn_m + p_{n+} e_{ijklm}$

Where;

Y_{ijklmn} = the body weight and average daily weight gain of the n^{th} lamb

μ= the overall mean

b_i= the fixed effect of the i^{th} **breed** (i = 1, 2 , 3. 1 = Pure Dorper, 2 = Dorper x Afar cross (50%), 3=Dorper x Menz (50%)

s_j = the fixed effect of the j^{th} **sex** (j = 1 or 2, 1 = male, 2 = female)

t_k = the fixed effect of the k^{th} **type of birth** (k = 1 or 2, 1 = single, 2 = twin)

y_l = the fixed effect of the l^{th} **year of birth** (L = 1, 2 or 3, 1 = born in 2011, 2 = born in 2012 etc)

sn_m = the fixed effect of the m^{th} **season of birth** (m=1-4, 1=born in main rainy season(June-August), 2= born in the cold dry season (September-November), 3= Dry season (December-February), 4= Short rainy season (March – May).

P_n = the fixed effect of the n^{th} **parity** (m = 1, 2, 3)

e_{ijklm} = the random error attributed to the n^{th} lamb.

3. Results and discussion

3.1. Growth and weight gain

3.1.1. Birth weight

Birth weight is an indicator of the size and vigor of the lamb at the beginning of postnatal development and an important factor influencing later growth. Larger lambs at birth, having greater capacity for growth, will have an improved chance to be heavier at weaning.

Birth weight of pure Dorper and its F_1 crosses was indicated in table (1) below. The overall birth weight in the present study was 3.04±0.04 kg ranging between 1.00 and 5.60 kg. In the present study pure Dorper lambs were heavier at birth than the F_1 crosses ($P<0.05$) with Afar and Menz breeds with the mean birth weight (3.39 vs 2.57 and 2.77 kg, respectively). Pure Dorper lambs were 32 and 22% heavier than the Afar x Dorper 50% and Menz x Dorper lambs at birth. The result of birth weight as indicated in the present study was better than 2.50 and 1.90 kg for Awassi x Menz 50% crosses and Corriedale x Menz 50% crosses, respectively, at Sheno Research Center (Demeke et al., 1995). Current results on birth weight for F_1 Dorper crosses with indigenous sheep was slightly lower than the reports by Gizaw et al.(2012) for F_1 (2.83kg), Awassi x Menz lambs at Debre-Birhan Research Center. Similarly, the mean birth weight results obtained in the present study for pure Dorper lambs (3.39 kg) was lower than the birth weight of pure Dorper in South Africa, their native places which was reported by Neser et al.(2001) (3.98 kg) and Snyman and Olivier (2002) (4.06 kg). Results of birth weight obtained in the present study (3.39 kg vs 2.96 and 2.97 kg) for 50 and 75% Dorper x Local cross bred lambs, respectively, at Sirinka Research Center was better in favor of the pure Dorper (Mekonen 2013,in press). The differences between the minimum and maximum birth weights both for pure Dorper and F_1 crosses with indigenous sheep breeds in the highlands of Ethiopia, Debre-Birhan was high. This shows the possibility of having lambs with good birth weight if management interventions are improved. Improving flock management at DBARC could increase the birth weight of pure Dorper and Dorper crossed lambs.

Single born lambs were significantly ($P<0.0001$) heavier at birth compared to their twin born counterparts. Single born lambs had 29% more weight at birth than twins. Results in the present study are similar with the findings of Abegaz and Hedge (2012) reported for Gumuz sheep. Our work also goes in line with that reported by Christley et al. (2003). Lower body weight of twin lambs may be due to limited uterine space and inadequate availability of nutrients during pregnancy and competition between the twins for limited quantity of milk available from the dam.

Parity had also significant effect ($P<0.0001$) on the lambs birth weight. There was a trend of improvement in birth weight as parity advances. As in the works reported by Gemeda et al. (2003), the birth weight of lambs is better in the latter parities; our result is also in line with the observations of these authors. Kassahun (2000) also reported similar results with the second parity ewes delivering heavier lambs than first parity ewes. In the present study, lambs born from the 1^{st} parity were 16.77% and 15.13% inferior in birth weight than lambs born at 2^{nd} and 3^{rd} parities, respectively. The trend was similar with the observations of Gaafar et al. (2012) who reported that lambs born from dams in their first parity were lighter by 3.68, 6.56 and 8.31% as compared to lambs born from the 2^{nd}, 3^{rd} and 4^{th} parities, respectively.

Sex of the lamb, year of birth and season of birth of the lamb had significant ($P<0.05$) effect on the birth weight of the lambs. Males were superior to females. Lambs with good birth weight were born in the years 2011,

2012 and 2014 compared to those born in the year 2013, and this could be attributed to variability in climatic factors in different years leading to differences in pasture production. Lambs born in main rainy season and cold dry season had also higher birth weight compared to those born in the dry season and short rainy season. This also tells us the difference in pasture availability in terms of quality and quantity among the different seasons of the years.

Table 1. Least squares means (± SE) for birth weight of pure Dorper and Dorper X Local sheep at DBARC.

Source of variation	N	Birth weight (kg)			*P*-value
		LSM±SE	*Minimum*	*Maximum*	
Overall mean	**527**	**3.04±0.04**	**1.00**	**5.60**	**<0.0001**
CV (%)	**527**	**22.01**			
Breed of the lamb		***			**<0.0001**
Pure Dorper	*233*	*3.39±0.08^{a}*	*1.46*	*5.60*	
Dorper x Afar (50%)	*30*	*2.57+0.06^{b}*	*1.50*	*5.60*	
Dorper x Menz (50%)	*294*	*2.77±0.04^{b}*	*1.00*	*4.60*	
Lambs' Birth Year		***			**0.0021**
2011	30	3.03±0.12^{a}	1.50	4.75	
2012	194	2.91±0.05^{a}	1.00	4.50	
2013	176	2.68±0.05^{b}	1.22	4.85	
2014	127	3.01±0.09^{a}	1.40	5.60	
Lambs' birth season		***			**0.0028**
Main rainy season	25	3.11±0.14^{a}	2.00	4.50	
Cold dry season	74	3.02±0.08^{ab}	1.50	4.50	
Dry season	275	2.86±0.05^{b}	1.22	5.60	
Short rainy season	153	2.64±0.07^{c}	1.00	4.85	
Lamb birth type		***			**<0.0001**
Single	*420*	*3.28±0.04*	*1.28*	*5.60*	
Twin	*107*	*2.54±0.07*	*1.00*	*4.40*	
Lamb Sex		*			**0.0274**
Male	*255*	*2.97±0.06^{a}*	*1.00*	*5.60*	
Female	*272*	*2.84±0.04^{b}*	*1.25*	*4.92*	
Parity of dam		***			**<0.0001**
1st	*273*	*2.58±0.05^{b}*	*1.00*	*4.80*	
2nd	*155*	*3.10±0.06^{a}*	*1.78*	*5.76*	
3rd	*99*	*3.04±0.90^{a}*	*1.22*	*4.92*	

*Values within each sub-class with different superscript letters are significantly different at *=P<0.05, **P<0.01, ***=P<0001, NA= Data not Available*

3.1.2. Adjusted weaning weight

As indicated in table (2) below, weaning weight at 90 days of age had significant (P<0.0.001) effect on most variables considered. The overall weaning weight of pure Dorper and Dorper x Local 50% cross breed lambs was 14.32±0.23 kg (n=370). Pure Dorper lambs were significantly (P<0.0001) heavier at 90 days compared to the Dorper x Afar 50% and Dorper x Menz 50% lambs. They were 71 and 31% heavier at this age compared to the F1 crosses of Dorper x Afar and Dorper x Menz lamb, respectively. Adjusted weaning weight at 90 days obtained for the pure and F_1 crossbred Dorper is lower than reported by Gavojdian *et al.*(2013) who reported 23.8 and 21.5 kg for pure Dorper and F1 Dorper x Turcana.

Year and season of birth have also significant (P<0.0001) effect on the weaning weight of the pure Dorper and 50% Dorper crossbred lambs. Lambs born in the dry season were lower by 33 and 31% in weaning weight

compared to those born in the main and short rainy seasons. Planning mating in the main and short rainy seasons had a great significant contribution in achieving better weaning weights. In the current study, sex of the lambs and parity of birth of lambs have no significant (P>0.05) effect on the weaning weight of lambs.

3.1.3. Adjusted 6-month weight

The overall adjusted 6-month weight of lambs in the present study was 21.42±0.35 kg (n=254). Breed/genotype, sex, birth type, year and season of birth of the lambs had significant (P<0.05) effect on the body weight of lambs at 6- months of age. Pure Dorper and Dorper x Afar 50% and Dorper x Menz 50% lambs weighed 24.30, 13.18 and 17.25 kg, respectively. Male lambs weighed 17.53 while females 16.33 kg at 6-months of age. More than 1 kg difference was observed on average between male and female lambs; this may be the effects of male hormone as age advances. There was 52% more advantage in 6-month body weight from single born lambs. Lambs born from the 3rd parity were significantly (P<0.05) heavier at 6- months of age compared to lambs born in from the 1st and 2nd parities. Lambs born in the main rainy and short rainy seasons demonstrated to have good 6 month weight compared to those born in the cold dry and dry seasons. It can be suggested that lambing in the highlands could be planed to be in the main and short rainy seasons to obtain good 6 month weight form lambs.

3.1.4. Adjusted yearling weight

The adjusted yearling weight of lambs in the current study was 32.43±0.46 kg (n=206). Results obtained in the current study for 50% Dorper x Menz sheep was superior to the 50 and 75% Dorper x Local sheep reported by Mekonen et al. (2013) at Sirinka Research Center (31.33 kg vs 26.95 and 29.13 kg, respectively). As lambs reached yearling age, slight difference (P<0.05) in weight at yearling (34.43 vs 31.33 kg) for pure Dorper and Dorper x Menz 50%, respectively, was attained. But much difference was observed at yearling age between pure Dorper and Dorper x Afar lambs compared to Dorper x Menz 50%.lambs. The pattern of growth from pure Dorper at pre-weaning and post-weaning didn't continue up to yearling age. Growth was advanced by 42% and 82% from 6-month to yearling age by pure Dorper and Dorper x Menz 50% lambs, respectively, indicating the growth and adaptability of crossbreds under Debre-birhan condition. In this study male lambs were heavier (P<0.05) than female gaining 14% more weight at yearling, the larger weight gain of males in comparison to female lambs could be due to the hormonal differences in their endocrinological and physiological functions (Ebangi et al., 1996 as sited in Gaafar, Youssf and El-Din, 2012). Singles were also heavier (P<0.001) than twins at yearling demonstrating a weight advantage of 23% over females. Lambs born in the main rainy season followed by those born in the short rainy season and cold dry seasons had the better (P<0.05) yearling weight compared to lambs born in the dry season. Lambs bon in the dry season were 18% lighter than born in main rainy season. In the highlands of Ethiopia (DBARC) planning to get birth of pure Dorper and F1 crosses of Dorper with Afar and Menz ewes in the main season help get better growing lambs demonstrating better yearning weight.

Table 2. Least squares means and standard errors of Weaning, 6 month and yearling weight of pure Dorper and 50% Dorper X Local (kg).

Source of Variation	Weaning weight		Six month weight		Yearling weight	
	N	LSM±SE	N	LSM±SE	N	LSM±SE
		***		***		***
Over all mean	**370**	**14.32±0.23**	**254**	**21.42±0.35**	**206**	**32.43±0.46**
Breed		***		**		*
Pure Dorper	*168*	*16.18±0.35^{a}*	*86*	*24.30±0.59^{a}*	*79*	*34.43±0.79^{a}*
Dorper X Afar 50%	*9*	*9.45+0.87^{c}*	*8*	*13.18+0.97^{c}*	*3*	*24.96±3.77^{b}*
Dorper X Menz 50%	*193*	*12.34±0.25^{b}*	*168*	*17.25±0.30^{b}*	*124*	*31.33±0.56^{a}*
Sex		**ns**		*		***
Male	*185*	*12.87±0.34*	*125*	*17.53±0.53^{a}*	*100*	*30.85±0.71^{a}*
Female	*185*	*12.64±0.31*	*129*	*16.33±0.46^{b}*	*106*	*27.13±0.57^{b}*
Birth litter size		***		***		***
Single	*306*	*14.43±0.30^{b}*	*225*	*20.23±0.37^{a}*	*181*	*32.01±0.49^{a}*
Twin	*64*	*11.08±0.64^{a}*	*29*	*13.34±0.91^{b}*	*25*	*25.98±1.03^{b}*
Parity		**ns**		*		*
1st parity	*192*	*12.32±0.37*	*164*	*16.21±0.48^{b}*	*144*	*27.35±0.58^{b}*

2nd parity	*114*	*12.73±0.43*	*61*	*16.76±0.58^{b}*	*33*	*28.32±1.02^{b}*
3rd parity	*64*	*13.22±0.33*	*29*	*17.82±0.62^{a}*	*29*	*31.31±0.86^{a}*
Lamb Year of Birth		***		***		*
2011	*16*	*12.46±0.81^{a}*	*15*	*14.85±0.92^{c}*	*14*	*27.06±2.46^{b}*
2012	*164*	*13.15±0.34^{a}*	*159*	*17.51±0.40^{b}*	*136*	*28.26±0.51^{b}*
2013	*114*	*12.07±0.43^{b}*	*80*	*18.44±0.64^{a}*	*56*	*31.66±0.90^{a}*
2014	*76*	*13.34+0.44^{a}*		*NA*		*NA*
Lamb Season of Birth		***		***		*
Main rainy season	*19*	*14.70+0.71^{a}*	*18*	*18.35+1.05^{a}*	*18*	*34.46±0.97^{a}*
Cold dry season	*57*	*12.34+0.36^{b}*	*47*	*14.61+0.48^{b}*	*45*	*31.54±0.91^{ab}*
Dry season	*171*	*9.78+0.29^{c}*	*72*	*15.61+0.40^{b}*	*37*	*28.39±1.33^{b}*
Short rainy season	*123*	*14.19+0.42^{a}*	*117*	*19.16+0.57^{a}*	*106*	*32.13±0.62^{a}*

*Values within each sub-class with different superscript letters are significantly different at *=P<0.05, **P<0.01, ***=P<0001, NA= Data not Available*

3.1.5. Pre-weaning growth of lambs

The overall pre-weaning weight gain of lambs was 123.89±2.46 g/h/d. There was significantly (P<0.0001) better growth pattern for the pure Dorper compared to the Dorper x Afar 50% and Dorper x Menz lambs (142.93 vs 73.19 and 106.24 g/h/d), respectively, that accounted 95% and 35% more weight from pure Dorper compared to Dorper x Afar and Dorper x Menz 50% lambs at this age. This may be the dam effect, pure Dorper lambs were reared by the pure Dorper dam while the Dorper x Afar and Menz 50% lambs were reared by indigenous ewes. Similarly, birth type, year of birth and parity of lambs' birth had significant (P<0.0001) effect on the pre-weaning gain of lambs. Nevertheless, male and female lambs in the present study grew similarly up to weaning age. Birth year and season of lambs' birth had significant (p<0.05) effect on gain to 90 days. Lambs born in the dry season were 40 and 39 % lighter than lambs born in the main rainy and short rainy seasons.

3.1.6. Post-weaning growth of lambs

As indicated in table (3) below, post weaning growth of lambs was affected by lambs' genotype, sex of the lamb, birth type of the lamb, lambs year and seasons of birth. However, no significant difference in gain birth up to 6 months of age by parity (P>0.05). Lambs gained 102.05 and 80.73 g/h/d up to 6-month and up to yearling age, respectively. Pure Dorper lambs gained better (P<0.0001) than Dorper x Afar 50% and Dorper x Menz 50% up to 6-months and 12 months of age, respectively. However, the difference in weight gain up to yearling between the pure Dorper lambs and Dorper x Menz 50% in the present study was slight; this may be the need for better management in terms of feed for the pure Dorper compared to the Dorper x local 50% as age advances. Ram lambs grew faster than females up to 6 month and yearling age (81.44 vs 74.76 g/h/d) and (76.72 vs 66.76 gm). The pattern for birth type is also similar to the sex. Single born lambs gained 53 and 21% more weight at 6 month and yearling, respectively, compared to the twin born lambs. Year and season of birth of the lambs had slight effect on gain of lambs up 6 month and to yearling age.

Table3. Least squares means and standard errors of gain to 90, 180 and 365 days of pure Dorper and its crosses with local sheep (g/d).

Source of Variation	Gain to 90 days	Gain to 180 days	Gain to 365 days	Source of Variation	Gain to 90 days	Gain to 180 days
	N	LSM±SE	N	LSM±SE	N	LSM±SE
		***		***		***
Over all mean	**370**	**123.89±2.46**	**254**	**102.05±1.89**	**205**	**80.73±1.24**
Breed of the Lamb		***		***		*
Pure Dorper	*168*	*142.93±3.89^{a}*	*86*	*127.44±3.23^{a}*	*79*	*86.45±2.18a*
Dorper X Afar 50%	*9*	*73.19+10.89^{c}*	*8*	*73.78±5.98^{c}*	*3*	*60.18+11.75^{c}*
Dorper X Menz 50%	*193*	*106.24±2.61^{b}*	*160*	*89.92±1.61^{b}*	*123*	*77.55±1.41^{b}*
Sex		**ns**		*		***
Male	*185*	*108.28±3.66*	*125*	*81.44±2.82^{a}*	*100*	*76.72±1.96^{a}*
Female	*185*	*106.62+3.30*	*129*	*74.76+2.51^{b}*	*105*	*66.76+1.48^{b}*
Birth litter size		***		***		***
Single	*306*	*121.68±2.78^{a}*	*225*	*94.38±1.99^{a}*	*180*	*78.46±1.34^{a}*
Twin	*64*	*93.23±4.43^{b}*	*29*	*61.82±4.71^{b}*	*25*	*65.02±2.58^{b}*
Parity		ns		*ns*		*
1st Parity		*192*	*104.813±3.79*	*164*	*75.79±2.57*	*143* *67.45±1.59^{b}*
2nd Parity	*114*	*106.28±3.75*	*61*	*77.94±3.15*	*33*	*69.87±2.71^{b}*
3rd parity	*64*	*111.28±3.87*	*29*	*80.56±3.42*	*29*	*77.89±2.27^{a}*
Lamb Year of Birth		*		*		*
2011	*16*	*103.17±8.12^{a}*	*15*	*65.40±4.74^{b}*	*14*	*66.88±7.95^{b}*
2012	*164*	*115.23±3.89^{a}*	*159*	*81.73±2.28^{a}*	*135*	*70.47±1.34^{b}*
2013	*114*	*103.03±5.08^{b}*	*80*	*87.16±3.62^{a}*	*56*	*77.86±2.33^{a}*
2014	*76*	*108.38±4.56^{a}*				
Lamb Season of Birth				***		*
Main rainy season	*19*	*127.38±7.81^{a}*	*18*	*87.44±6.53^{a}*	*18*	*78.21±2.59^{a}*
Cold dry season	*57*	*101.19±3.78^{b}*	*47*	*64.66±2.49^{b}*	*45*	*70.27±2.42^{b}*
Dry season	*171*	*76.13±2.82^{c}*	*72*	*69.66±2.18^{b}*	*36*	*65.42±4.06^{b}*
Short rainy season	*123*	*125.21±4.32^{a}*	*117*	*90.64±2.91^{a}*	*106*	*73.05±1.58^{b}*

*Values within each sub-class with different superscript are significantly different at *=P<0.05, **P<0.01, ***=P<0001*

Conclusion:

From the current results obtained at Debre-Birhan Research Center, the straight bred pure Dorper and its F_1 crossbreds had comparable yearling weight. Menz ewes sired by Dorper rams produced lambs that could attain more than 30 kg fulfilling the minimum requirement for export to the Middle East (25-30 kg) at yearling age. Pure Dorper lambs gained better than the F_1 up to weaning and 6-months of age under grazing with minimum concentrate supplementation. However, the crossbreds of Dorper x Menz ewes gained slightly lower from birth to yearling age suggesting the need for better management for the pure Dorper lambs compared to the Dorper x Menz crosses. From the current study, use of Afar ewes at Debre-Birhan for cross breeding with Dorper sire had the lowest performance in the all growth traits suggesting the choice of dam line that are adapted to the highlands of Ethiopia. By crossbreeding Menz sheep with the Dorper, it could be possible for sheep producers in the highlands of Ethiopia to increase meat production. Results from current study suggested the good adaptation ability of pure Dorper and its F_1 crossbreds of Dorper x Menz 50% to the highland conditions of Ethiopia. Further research is needed to determine the potential of the pure Dorper and its crosses under different management and feeding conditions at different ages of the crossbreds under highland and low land conditions.

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