Morphological characters and body weight of Menz and Afar sheep within their production system

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Abstract

Morphological characters and body weight of Menz and Afar sheep breeds were recorded under mixed crop-livestock and pastoral systems, respectively. Menz sheep are fat tailed and the tail is curved upward at the tip. Plain red, white and black coat colours were the commonest colours observed in Menz sheep with proportions of 29.3%, 21.6% and 15.8%, respectively. Menz ewes are polled whereas most of the rams were horned. About 18.5% of the males had ruff whereas females had no ruff. Menz rams had no wattle while 6.1% of the ewes were with wattle. About 15% of the Menz sheep had rudimentary ear, 35% had short ear showing a tendency to incline downward and the remaining half (49.3) of the sheep had larger and dropping/semi-pendulous ears. Afar sheep breed is fat tailed and the tail is curved upward having a wider tail both at the base and at the tip. The major (90%) coat colour of Afar sheep ranged from white to light red. Almost all of the sheep had straight head profile. Both sexes of Afar sheep breed are polled. About 2.4% of the female had wattle while males had no wattle. The breed has no ruff, but dewlap is present in both sexes. Majority (78.6%) of the Afar sheep were short eared showing a tendency of inclination downwards and about 19.7% were with rudimentary ear. Menz Sheep breed showed higher variability than Afar sheep breed in most of the qualitative characters. The age of the sheep at which the body weight change became maximum was at 2.3 pairs of permanent incisor for Menz and 2.2 pairs of permanent incisor for Afar sheep (approximately equal to 22.5 months). Sex and age of the sheep had a significant ($p<0.01$) effect on body weight and many of the body measurements. Body weight of mature (2 and above PPI) Menz ram and ewes were 24.9 ± 0.67 kg and 22.3 ± 0.13 kg, respectively. The corresponding values for Afar rams and ewes were 29.0 ± 0.84 and 24.5 ± 0.14 kg, respectively. The results of the study indicated the morphological description and performance level of the

two breeds and could help in designing sheep utilization strategy.

Keywords: *body measurement, crop-livestock system, pastoral system, qualitative characters*

Introduction

Ethiopia is home for about 14 traditional sheep breeds (Solomon *et al.*, 2007$_b$) and has an estimated 25 million sheep population (CSA, 2007). Menz and Afar sheep breeds are well adapted to the low input production systems of the country. Menz sheep breed is adapted to the very cold climate of the cool highlands and are tolerant to drought and variable seasonal feed availability, tolerant to endo-parasite infection, produce meat, coarse wool, skin and manure (Haile, 1999; Tibbo, 2006). The Afar sheep breed, to the contrary, is well adapted to the arid and semi arid environment of the pastoral management system (Galal 1983). Information on morphological characters and performance of the breeds under traditional management is required for designing community-based breeding strategy. Unfortunately, information available on Ethiopian sheep breeds is scanty (Workneh *et al.,* 2004) for Afar sheep and most of the available information so far for Menz sheep has been based on on-station managed flocks and some on-farm studies on Menz sheep was done many years ago. Therefore, the objective of this study was to characterize the general morphology, body weight and other qualitative characters of the Menz and Afar sheep breeds under traditional management systems.

Materials and Methods

Description of the study area

The study was conducted on Menz and Afar sheep breeds of Ethiopia. In Menz area the study was conducted in Menz Mamma and Menz Gera woredas of North Shewa of the Amhara National Regional State at altitude range from 2800 to 3200 m.a.s.l. Based on the meteorological data obtained from Debre Berhan Agricultural Research Centre for the years 1985 to 2005, the annual rainfall at Mehal Meda town (the capital of the Menz Gera woreda) was about 900 mm and the minimum and maximum average temperatures were 6.8 °C and 17.6 °C, respectively. In Afar area the survey was conducted in Amibara woreda, part of the zone 3 of the Afar National Regional State. The study was conducted at altitude ranging from 750 to 812 m.a.s.l. Based on the meteorological data from Werer Research Centre for the years 1965 to 2006, the annual rainfall is 588 mm and average daily temperature is about 27.6 ºC with a maximum approaching 38 ºC in June and a minimum of 15.4 ºC in November.

Selection of the study sites

A rapid field survey was conducted by a team of researchers and the respective woreda Agricultural office professionals in each of Menz and Afar areas to locate appropriate site for the establishment of community-based sheep breeding strategy. Two kebeles in Menz area (Sina Amba and Yecha) and three kebeles in Afar (Ambash, Hallidegi and Awash Arba) were selected based on their suitability for sheep production, influence of crossbreeding, market and road access and willingness of the farmers or pastoralists to participate in the program.

Methods of data collection

Qualitative and quantitative morphological characters were collected from a total of 1888 (1095 Menz and 793 Afar) sheep. The sheep were sampled within approximately 50 km radius of the selected sites. Each sampled animal was identified by sex, site and estimated age group. Adult sheep were classified into five age groups based on the number of pairs of permanent incisors (PPI) following the finding of Wilson and Durkin (1984) for African sheep breed as follows: 0 PPI= less than 15 months, 1 PPI= 15.5 to 22.0 months, 2 PPI = 22.5 to 27.0
months, 3 PPI = 28.0 to 38 months and 4 PPI= above 39.0 months. Qualitative characters: coat color pattern, coat color type, hair type, head profile, ears, wattle, horn, ruff and tail were observed. For linear body measurements sheep were put in standing position on a level and hard floor and held by personnel. All measurements were taken by the same personnel while sheep were in an up-right plane during measurement. The following 8 body measurements were measured using measuring tape calibrated in centimeters (cm): chest girth (CG - taken as the circumference of the body immediately behind the shoulder blades in a vertical plane perpendicular to the long axis of the body); body length (BL- measured as the horizontal distance from the point of shoulder to the base of the tail); wither height (WH- taken to be the height of an animal from the bottom of the front foot to the highest point of the shoulder between the withers); pelvic width (PW- measured as the distance between pelvic bones across the dorsum); horn length (HL- length of the horn on its exterior side from its root at the poll of the tip); scrotum circumference (SC- taken by pushing the testicles to the bottom of the scrotum and the greatest circumference was measured); tail length (TL- distance from the base to the tip of the tail on

the outer side of the tail); tail circumference (TC- circumference of the base of the tail) while body weight was measured using suspended spring balance having 50 kg capacity with 0.2 kg precision. Body condition (BC) scoring was done subjectively using scoring from 1 (emaciated) to 5 (obese or extremely fat).

Data analysis

Body weight increased at higher rate till 2 PPI and then after body weight increased at lower rate. The age of the sheep at which the body weight change become maximum (at about 2 PPI) were obtained from the quadratic equation using body weight change of each breed as response variable and dentition class as explanatory variable. Thus, for the analysis of least squares means of body weight and other body measurements, sheep were classified in to 3 age groups; young (0 PPI = less than 15 months), intermediate (1 PPI = 15.5 to 22.5 months) and oldest (2 and above PPI = above 22.5 months). Measurements on qualitative characters were analyzed for male and female sheep within breed using frequency procedure of SAS (SAS, 2003). The coefficient of unalikeability (u_2) was used to measure the variability of qualitative characters within the breed. As described by Kader and Perry (2007) Coefficient of Unalikeability (u_2) was calculated using the formula: $u_2 = 1 - \sum pi^2$, where pi is the proportion of each response within a category. Body weight and quantitative linear body measurements were analyzed using the Generalized Linear Model (GLM) procedures of the Statistical Analysis System (SAS, 2003). For adult animals, sex and age group of the sheep were fitted as fixed independent variables while body weight and linear body measurements except scrotum circumference and horn length were fitted as dependent variables. Scrotum circumference was analyzed for each breed by fitting age group as fixed factor. Horn was specific character of male Menz sheep only and therefore analysis of horn length was employed for male Menz sheep only by fitting age group as fixed effect. When analysis of variance declares significance, least square means were separated using adjusted Tukey-Kramer test.

Results

Qualitative morphological characters

Menz sheep: Menz sheep is fat tailed and the tail is curved upward at the tip. Nearly 69% of the sheep had plain coat color pattern followed by patchy pattern (28%). Sheep with spotty pattern (2.8%) were rarely observed. Almost all (98.8%) of Menz sheep had long and coarse wool/hair. Coat color types of plain red, white and black were observed with proportions of 29.3, 21.5 and 15.8%, respectively. The mixtures of red and white; and black and white accounted for 16.4% and 6.3%, respectively. Black with white head, dark grey locally known as '*jibma*' and black color with white or red belly accounted for 3.0, 6.0 and 1.7%, respectively. Majority (98%) of the sheep had straight and slightly concave head profile. Almost all (99.1%) of the ewes were polled whereas most (92.3%) of the rams were horned. Horn shape and orientation of Menz ram were also variable. Out of the horned rams, 95.7% had spiral horn shape and the remaining 4.3% had short and straight horn. Out of the total rams having spiral shape, almost half (52.9%) of the ram had back ward oriented horns and the remaining 47.1% had laterally oriented horns. About 19% of the males had ruff (long hair around the neck region of the inner part) whereas females had no ruff. Menz rams had no wattle while 6.1% of the ewes were with wattle. About 15% had rudimentary ear, 35.3% had short ear showing a tendency to be inclined downward and the remaining 49.3% of the sheep had larger and dropping/semi-pendulous ears. Menz ram and ewe are shown in Figure 1.

Figure 1. A mature Menz ram (left) and ewe (right)

Afar sheep: Afar sheep breed is fat tailed and the tail is curved upward having a wider tail both at the base and at the tip. Coat colour pattern was patchy (58.1%), plain (40.6%) and spotty (1.3%). Almost all (99.7%) had short and coarse hair. Coat colour type of the breed was white with red patch along the back (41.9%), plain light red (30.9%), plain white (17.2%) and plain dark red (7%). This showed that majority (90%) of the sheep are found in between white and red colours. Other colors were found rarely; plain black (1.2%), black and white (1.1%) and dark grey (0.7%). Almost all of the sheep (99.2%) had straight head profile. Both sexes of Afar sheep breed were polled. About 2.4% of the female had wattle while all of the males had no wattle. The breed had no ruff, but dewlap is present in both sexes. Majority (78.6%) of the Afar sheep were short eared showing a tendency to be inclined downwards and about 19.7% were with rudimentary ear. Figure 2 shows the physical appearance of Afar ram and ewe.

Figure 2. A mature Afar ram (left) and ewe (right)

Variability of qualitative characters

Generally Menz Sheep breed showed higher variability than Afar sheep breed in most of the qualitative characters. Menz sheep have shown more variability in coat color type, ear form, head profile and coat color pattern among other qualitative characters with coefficient of unalikeability (u_2) of 0.81, 0.61, 0.52 and 0.44, respectively. Afar sheep breed showed more variability on coat color type with u_2 of 0.69 followed by ear form and coat color pattern with u_2 of 0.40 and 0.34, respectively.

Body Weight and body condition score

Figure 3 shows a plot of body weight against dentition class for Menz and Afar ewes. Body weights of both Menz and Afar sheep breeds increased at increasing rate from milk tooth stage (dentition class 0) to the eruption of 1 pair of permanent incisor (dentition class 1) and also from dentition class 1 to the eruption of 2 pairs of permanent (dentition class 2). The age of the sheep at which the body weight change became maximum was at an average of 2.3 pairs of permanent incisor for Menz and 2.2 pairs of permanent incisor for Afar sheep (approximately equal to 22.5 months). Body weight of both Menz and Afar sheep started to decline at old age (dentition class 5) when sheep started to wear their permanent incisors (approximately above 5 years old).

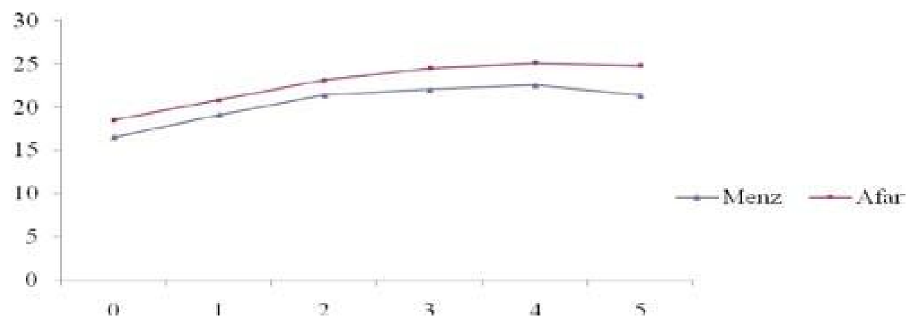

Figure 3. Growth curve of Menz and Afar sheep

Least squares means ± standard errors of body weight (kg), body condition score for the effects of sex, age and sex by age interaction for Menz and Afar sheep breed are presented in Tables 1 and 2, respectively. Sex and age of the sheep had significant ($p<0.01$) effect on body weight (BW) of both Menz and Afar sheep breeds. Body condition (BC) was affected ($p<0.01$) by sex and age for Menz sheep whereas for Afar sheep breed it was affected ($p<0.01$) by sex of the sheep but not by the age ($p>0.05$). In all age groups of Menz and Afar sheep, males were heavier ($p<0.01$) than females. Body weight in Menz and Afar sheep significantly increased as the age increased from the youngest (0 PPI) to the oldest (≥ 2 PPI) age group. The interaction of sex and age group was significant ($p<0.01$) for BW and BC of Menz sheep but for Afar sheep it was significant for BC ($p<0.01$) only.

Table 1. Least squares means ± standard errors of body weight (kg), body condition score for the effects of sex, age and sex by age interaction for Menz sheep

Effects and level	Body weight		Body condition score	
	N	**LSM±SE**	**N**	**LSM±SE**
Overall	1072	20.6±0.15	1095	1.9±0.03
CV%	1072	15.0	1095	29.8
R^2	1072	36.0	1095	6.0
Sex		**		**
Male	217	22.0±0.27	224	2.1±0.05
Female	858	19.3±0.13	872	1.8±0.02
Age group		**		**
0 PPI	264	17.2±0.19[a]	271	1.7±0.03[a]
1 PPI	202	21.0±0.23[b]	204	2.0±0.04[b]
≥ 2 PPI	609	23.6±0.32[c]	621	2.1±0.06[b]

Effects and level	Body weight		Body condition score	
	N	LSM±SE	N	LSM±SE
Sex by age group		**		**
Male, 0 PPI	127	18.0±0.28[a]	133	1.7±0.05[a]
Male, 1 PPI	65	22.9±0.39b[e]	66	2.3±0.07[b]
Male, ≥ 2 PPI	25	24.9±0.67[b]	25	2.3±0.11[b]
Female, 0 PPI	137	16.5±0.27[c]	138	1.7±0.05[a]
Female, 1 PPI	137	19.1±0.27[d]	138	1.8±0.05[ac]
Female, ≥ 2 PPI	584	22.3±0.14[e]	596	1.9±0.02d[c]

[a,b,c,d,e]Means with different superscripts within the same column and class are statistically different. **signifi-cant at 0.01. 0 PPI = 0 pair of permanent incisors; 1PPI = 1 pair of permanent incisor and ≥ 2 PPI = 2 or more pairs of permanent incisors.

Table 2. Least squares means ± standard errors of body weight (kg), body condition score for the effect of sex, age and sex by age for Afar sheep

	Body weight		Body condition	
Effects and level	N	LSM±SE	N	LSM±SE
Overall	779	22.76±0.26	793	2.04±0.04
CV%	779	14.0	793	27.4
R^2	779	33.0	793	9.0
Sex		**		**
Male	46	24.3±0.50	46	2.3±0.08
Female	733	21.2±0.16	747	1.8±0.02
Age group		**		NS
0 PPI	102	19.4±0.40[a]	102	2.1±0.06
1 PPI	117	22.1±0.53[b]	121	1.9±0.08
≥ 2 PPI	560	26.8(0.42[c]	570	2.1±0.06
Sex by age group		Ns		**
Male, 0 PPI	21	20.3±0.71	21	2.2±0.11[a]
Male, 1 PPI	10	23.5±1.02	10	2.2±0.15[a]
Male, ≥ 2 PPI	15	29.0±0.84	15	2.4±0.12[a]
Female, 0 PPI	81	18.5±0.36	51	2.1±0.05[a]
Female, 1 PPI	107	20.8±0.31	111	1.7±0.05[b]
Female, ≥ 2 PPI	545	24.5±0.13	555	1.7±0.02[b]

[a,b,c] Means with different superscripts within the same column and class are statistically different (at least $p<0.05$). Ns = non significant; **significant at 0.01. 0 PPI = 0 pair of permanent incisors; 1PPI = 1 pair of permanent incisor and ≥ 2 PPI = 2 or more pairs of permanent incisors

Linear body measurements

Least squares means ± standard errors of body measurements (cm) for the effect of sex, age and sex by age for Menz and Afar sheep breeds are presented in Tables 3 and 4, respectively. For Menz breed, sex had significant effect on CG ($p<0.01$), WH ($p<0.01$) and PW ($P<0.05$) but had no ($p>0.05$) effect on BL. For Afar sheep, BL, CG, WH were significantly ($p<0.01$) affected by sex, whereas PW was not affected ($p<0.05$). All body measurements (BL, CG, WH and PW) were significantly ($p<0.01$) affected by age group for both Menz and Afar sheep breeds. In body measurements affected by sex, males had larger values than females. Chest girth of Menz breed and WH of Afar sheep were affected ($p<0.01$) by the interaction of sex and age group.

Table 3. Least squares means ± standard errors of body measurements (cm) for the effect of sex, age and sex by age for Menz sheep

Effects and level	Body length		Chest girth		Wither height		Pelvic width	
	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall	1095	53.5±0.17	1095	65.1±0.22	1095	58.4±0.16	1095	18.1±0.07
CV%	1095	6.3	1095	7.1	1095	5.7	1095	8.3
R^2	1095	27.0	1095	28.0	1095	19.0	1095	22.0
Sex		NS		**		**		*
Male	224	53.9±0.29	224	65.7±0.39	224	59.6±0.28	224	18.2±0.13
Female	871	53.7±0.15	871	64.5±0.20	871	57.1±0.14	871	17.9±0.06
Age group		**		**		**		**
0 PPI	271	51.3±0.22[a]	271	61.4±0.28[a]	271	56.1±0.20[a]	271	17.0±0.09[a]
1 PPI	204	54.3±0.26[b]	204	66.1±0.35[b]	204	59.0±0.25[b]	204	18.4±0.11[b]
≥ 2 PPI	620	55.9±0.35[b]	620	67.7±0.48[c]	620	60.0±0.34[b]	620	18.9±0.16[b]
Sex by age group		Ns		**		Ns		Ns
Male, 0 PPI	133	51.7±0.31	133	62.2±0.40[a]	133	57.4±0.29	133	17.1±0.13
Male, 1 PPI	66	54.7±0.43	66	67.7±0.57[b]	66	60.8±0.41	66	18.6±0.19
Male, ≥ 2 PPI	25	55.5±0.71	25	67.3±0.93[bc]	25	60.8±0.67	25	18.9±0.30
Female, 0 PPI	138	50.8±0.30	138	60.7±0.40[a]	138	54.8±0.28	138	16.8±0.13
Female, 1 PPI	138	53.9±0.30	138	64.5±0.40[c]	138	57.3±0.28	138	18.2±0.13
Female, ≥ 2 PPI	595	56.4±0.14	595	68.2±0.19[b]	595	59.2±0.14	595	18.8±0.06

[a,b,c,d] Means with different superscripts within the same column and class are statistically different (at least $p<0.05$). Ns = non significant; * significant at 0.05; **significant at 0.01. 0 PPI = 0 pair of permanent incisors; 1PPI = 1 pair of permanent incisor and ≥ 2 PPI = 2 or more pairs of permanent incisors

Table 4. Least squares means ± standard errors of body measurements (cm) for the effect of sex, age and sex by age for Afar sheep

Effect and level	Body length		Chest girth		Wither height		Pelvic width	
	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall	792	60.58±0.28	792	66.50±.31	792	61.37±0.23	793	0.55±0.13
CV%	792	5.5	792	5.7	792	4.6	793	7.4
R^2	792	22.0	792	30.0	792	21.0	793	23.0
Sex		**		**		**		Ns
Male	46	61.3±0.52	46	67.3±0.58	46	62.1±0.44	46	20.5±0.24
Female	746	59.9±0.17	746	65.7±0.19	747	60.7±0.14	747	20.7±0.08
Age group		**		**		**		**
0 PPI	102	57.3±0.41[a]	102	62.4±0.46[a]	102	58.6±0.35[a]	102	19.3±0.19[a]
1 PPI	121	61.2±0.56[b]	121	66.5±0.62[b]	121	61.6±0.47[b]	121	20.8±0.26[b]
≥ 2 PPI	570	63.2±0.44[c]	570	70.5±0.49[c]	570	63.9±0.37[c]	570	21.6±0.21[c]
Sex by age group		Ns		Ns		*		Ns
Male, 0 PPI	21	57.3±0.74	21	62.5±0.82	21	58.6±0.62[a]	21	19.2±0.34
Male, 1 PPI	10	62.4±1.07	10	67.6±1.20	10	62.4±0.90[bcd]	10	20.9±0.50
Male, ≥ 2 PPI	15	64.2±0.87	15	71.9±0.97	15	65.3±0.74[b]	15	21.3±0.41
Female, 0 PPI	81	57.2±0.38	81	62.4±0.42	81	58.6±0.32[a]	81	
Female, 1 PPI	111	60.1±0.32	111	65.4±0.36	111	60.9±0.27[c]	111	20.7±0.15
Female, ≥ 2 PPI	555	62.3±0.14	555	69.2±0.16	555	62.6±0.12[d]	555	21.8±0.07

[a,b,c,d,] Means with different superscripts within the same column and class are statistically different (at least p <0.05). Ns = non significant; * significant at 0.05; **significant at 0.01. 0 PPI = 0 pair of permanent incisors; 1PPI = 1 pair of permanent incisor and ≥ 2 PPI = 2 or more pairs of permanent incisors

Least squares means ± standard errors of tail length and tail circumference (cm) for the effect of sex, age and sex by age; and horn length and scrotum circumference (cm) for the effect of age for Menz and Afar sheep breed are presented in Tables 5 and 6, respectively. For both Menz and Afar sheep, sex had significant ($p<0.01$) effect on tail length (TL) and tail circumference (TC). Tail length, TC and SC were significantly ($p<0.05$) affected by the age of the sheep in both Menz and Afar sheep breed except for TL which was not different ($P>0.05$) among the age groups for Afar sheep. The interaction of sex and age group was significant ($p<0.05$) only for TC in Menz sheep.

Table 5. Least squares means ± standard errors of tail measurements (cm) for the effect of sex, age and sex by age; and horn length and scrotum circumference (cm) for the effect of age for Menz sheep

Effect and level	Tail length		Tail circumference		Scrotal circumference		Horn length	
	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall	1078	18.67±0.15	1096	15.47±0.15	219	23.16±0.24	295	20.15±0.46
CV%	1078	17.2	1096	23.3	219	12.2	295	39.5
R2	1078	10.0	1096	25.0	219	25.0	295	19.0
Sex		**		**		Na		Na
Male	216	20.0±0.27	224	18.1±0.270				
Female	862	17.4±0.13	872	12.8±0.140				
Age group		**		**	**	**		**
0 PPI	269	18.1±0.19a	271	13.9±0.20a	131	20.9±0.24a	127	15.3±0.68a
1 PPI	198	19.3±0.23b	204	15.9±0.24b	66	24.0±0.33b	90	21.7±0.81b
≥ 2 PPI	611	18.6±0.34ab	621	16.6±0.33b	22	24.5±0.58b	78	23.5±0.87b
Sex by age group		Ns		**		Na		Na
Male, 0 PPI	131	19.0±0.27	133	15.4±0.28a				
Male, 1 PPI	64	20.9±0.38	66	19.1±0.40b				
Male, ≥ 2 PPI	21	19.9±0.67	25	20.0±0.64b				
Female, 0 PPI	138	17.2±0.26	138	12.4±0.27c				
Female, 1 PPI	134	17.8±0.26	138	12.8±0.27c				
Female, ≥ 2 PPI	590	17.3±0.13	596	13.2±0.13c				

[a,b,c,d] Means with different superscripts within the same column and class are statistically different (at least $p<0.05$). Ns = non significant; Na = not applicable. **significant at 0.01. 0 PPI = 0 pair of permanent incisors; 1PPI = 1 pair of permanent incisor and ≥ 2 PPI = 2 or more pairs of permanent incisors.

Table 6. Least square means ± standard error of tail measurements (cm) for the effect of sex, age group and sex by age; and scrotum circumference (cm) for the effect of age for Afar sheep

Effect and level	Tail length		Tail circumference		Scrotal circumference	
	N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall	792	16.68±0.24	791	41.16±0.51	43	25.69±0.39
CV%	792	19.1	791	16.4	43	9.8
R2	792	4.5	791	7.8	43	29.0
Sex		**		**		Na
Male	45	17.8±0.46	46	45.0±0.97		
Female	747	15.6±0.15	745	37.3±0.32		
Age group		Ns		**		**
0 PPI	101	16.3±0.38	102	39.0±0.77a	19	23.9±0.57a
1 PPI	121	17.3±0.49	121	41.6±1.04ab	10	25.7±0.79a

Effect and level	Tail length		Tail circumference		Scrotal circumference	
	N	LSM±SE	N	LSM±SE	N	LSM±SE
≥ 2 PPI	570	16.4±0.38	568	42.9±0.82b	14	27.5±0.67b
Sex by age group		Ns		Ns		Na
Male, 0 PPI	20	16.9±0.66	21	42.2±1.40		
Male, 1 PPI	10	18.9±0.93	10	45.2±2.00		
Male, ≥ 2 PPI	15	17.7±0.76	15	47.6±1.60		
Female, 0 PPI	81	15.8±0.33c	81	35.8±0.70		
Female, 1 PPI	111	15.8±0.28	111	38.1±0.60		
Female, ≥ 2 PPI	555	15.1±0.12	553	38.2±0.27		

[a,b,] Means with different superscripts within the same column and class are statistically different (at least p < 0.05). Ns = non significant; Na = Not applicable. **significant at 0.01. 0 PPI = 0 pair of permanent incisors; 1PPI = 1 pair of permanent incisor and ≥ 2 PPI = 2 or more pairs of permanent incisors.

Presence of horn was sex and breed dependent and was observed in Menz rams only. Horn length was affected by the age of the ram. Horn length at the youngest age group was 15.3 cm which was significantly shorter (p<0.01) than the intermediate age group (21.7 cm) and oldest age group (23.5 cm) while the later age groups were not different (p>0.01) from each other.

Discussion

In this study we describe Menz and Afar sheep breeds based on their body weight and other body measurements in their production systems. The proportion of white coloured sheep observed in Menz was larger than that of black colour. The results are contrary to the report of Galal, (1983) who reported black and brown as the dominant colors of Menz sheep while white color was rarely observed. On the other hand, on-station characterization of Menz sheep by Tibbo *et al.* (2004) found white colored sheep in larger proportion. Examining the results of the present study against the earlier ones indicated that the proportion of white is increasing and that of black is decreasing through time. This is strongly supported by the preference of farmers of white and red colors against the black color for which the farmers are exercising some kind of selection for the preferred ones. In general the qualitative morphological description of Afar sheep breed obtained in this study is in agreement with those of Galal (1983) and Sisay (2002) who described Afar sheep breed at Werer Research Center and in eastern Amhara Regional State, respectively. Lower value of coefficient of unalikability were observed for qualitative morphological characters of Afar than Menz sheep breed suggesting the Afar breed was more close to bred true (able to produce offspring of the same phenotype). Higher heterogeneity of coat color obtained for Menz sheep was supported with the finding of Sisay (2002). Higher variability in coat colour and pattern of Menz sheep, small size and presence of horn, short fat tailed makes them similar with the primitive Soay sheep breed (Marrs, 2006). Higher variability in qualitative characters like coat color, ear size and head profile of Menz sheep indicated the existence of different types and thus when designing breeding strategy for Menz sheep one might consider the possibility of developing different lines within the breed.

The effect of sex on body weight and other measurements obtained in this study is in agreement with previous results (Abebe, 1999; Tibbo *et al.,* 2004). Body weight and most of the body measurements of Menz sheep reported in this study are comparable with the previous recent report on the same breed from on-station (Tibbo *et al.,* 2004) and on-farm (Abebe, 1999) management conditions. However, the value of body weight obtained at the oldest age group of male and female Menz sheep was lower than those reported by Galal (1983). Wither height of Afar sheep is comparable with the result of Galal (1983) who reported 66 cm and 61 cm for mature ram and ewe, respectively. Body weight of Afar sheep at the youngest age group was lower than the on-station yearling weight (Yebrah, 2008) of Afar sheep reported as 25.6 kg and 23.5 kg for male and female, respectively. Body weight of Afar ram and ewe (29.0 ± 0.84 and 24.5 ± 0.13 kg, respectively) in the oldest age group were lower than the previous report of Galal, (1983). The comparatively lower body weight for both Menz and Afar sheep breeds recorded compared with previous reports might be attributed to the difference in the level of management. This is so because the on-station management of the other studies increased the growth of the sheep and resulted in higher weight. The difference might also be related to the year/ time effect. Due to the fact that the values, for instance of Galal (1983), were estimated before 25 years and the feed situation and genetic make up of animals is not expected to be the same over the long years.

Generally, live weight of Menz and Afar sheep breeds is far lower than the recommended live export body weight of 30 kg at yearling age (Tibbo, 2006). Menz and Afar sheep breeds are also lower in live weight and other body measurements when compared with other sheep breeds found in the country. For example, in north western Ethiopia, body weight of 32.5 kg at 13 to 18 months age were recorded for Gumuz ram under on-farm management (Solomon, 2007); and 33.1 kg for Washera ram and 26.1 kg for Washera ewe were reported (Mengiste, 2008) at the age when sheep had 3 PPI, under farmers management. Under station management at Bako Research Center, 34 kg body weight was reported for Horro sheep breed (Yohannes *et al.,* 1998). Small body size and reduced productivity in Menz and Afar sheep breeds might be attributed to the fact that these attributes could be used as means of survival in the harsh environmental situation (Silanikove, 2000) prevailing in the Afar and Menz areas. However, research findings indicated the possibility of genetic improvement on these sheep breeds due to the existence of within breed variability and moderate to high heritability for body weight (Solomon *et al.,* 2007_a; Yebrah, 2008). Indigenous Menz sheep improved through selection could reach 30 kg live weight at yearling under better management (Solomon *et al.,* 2006).

Mean body condition for male Menz and Afar sheep were found to be thin. This might be due to the existing feed situation in the areas. Unpublished report from Debre Berhan Agricultural Research Center indicated that poor body condition has contributed to meat darkening after slaughter. Low body weight of Menz and Afar sheep breeds obtained in this study might be partly due to poor body condition score implying the possibility of improvement in body weight by improving the condition of animals through better management.

The overall tail length of Afar sheep was 16.7 cm which was lower than tail length of Menz sheep (18.7 cm). The tail lengths of Menz and Afar sheep were lower than that of Horro sheep (36 cm) (Kasahun, 2000). Tail circumference of Afar sheep breed (41.2 cm) is much higher than tail circumferences of Menz sheep (15.5 cm), and was also higher than earlier reported value of 15.0 cm for Menz and Horro sheep (Kasahun, 2000). Large tail circumference of Afar sheep recorded in this study is in agreement with the report that the breed has a wide tail base (Galal, 1983). The small tail length for Afar sheep is unexpected as it seemed large visually. This was because of the large width of Afar sheep tail both at the base and the tip, the tail fat hang on the tail down wards and some times reached below the hock. But the actual measurement of tail length was measured following the tail bone from the base to the tip of the tail which is lower than visually observed.

Conclusions

In this study we described morphological characters and body weight of Menz and Afar sheep breeds. Higher variability in qualitative characters of Menz sheep indicated the existence of different types and thus when designing breeding strategy for Menz sheep one might consider the possibility of developing different lines within the breed. This study revealed that Menz and Afar sheep breed showed lower body weight and body measurements than results of the on-station management of the same breeds and compared with other breeds found in the country. Low body weight of Menz and Afar sheep breeds obtained in this study might be partly due to management and could provide an opportunity for improvement in body weight through better management. The observed difference might also be partly due to genetics and could be improved using appropriate breeding strategy. Generally, growth traits have moderate to high heritability implying the possibility of improving through pure breeding.

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