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MORPHOLOGICAL CHARACTERISTICS OF FARTA SHEEP IN AMHARA REGION, ETHIOPIA

T. BIMEROW[1], A. YITAYEW[1], M. TAYE[2] and S. MEKURIAW[1]

[1]*Andassa Livestock Research Center, P.O.Box 27, Bahir Dar, Ethiopia*
[2]*Bahir Dar University, College of Agriculture and Environmental Sciences, P.O.Box 830, Bahir Dar, Ethiopia*

*E-mail: mengistietaye@yahoo.com

ABSTRACT: *A study to describe the physical body characteristics of Farta sheep was undertaken in south Gonder zone of the Amhara Regional State, Ethiopia. Three districts (Estie, Farta and Lai-Gaint) were selected purposively based on sheep population and accessibility. Both qualitative and quantitative measurement data was collected on 1050 (878 Female and 172 male) sheep. Three coat patterns - plain (54.9%), spotted (29.5%) and patchy (15.6%) were observed. Farta sheep have many color types to which white coat color was relatively frequent (35.3%; 40.4% for males and 34.3% for females) in both males and females and black was the next dominant coat color only for males. Almost all sheep had coarse fleece (96.6%) and horizontal ear form (99.7%). Farta sheep is short fat tailed. 67% of males and 10% of females were horned. The overall mean body weight, wither height, heart girth, body length and pelvic width obtained were 25.8±0.26 kg, 63.6±0.31 cm, 70.4±0.38 cm, 55.4±0.30 cm and 12.7±0.11 cm, respectively. Fixed effects age and sex had affected all the traits considered. Male and older age sheep were consistently larger (P<0.01) for all the traits over female and younger sheep respectively. Generally, it is possible to conclude that Farta sheep is relatively of smaller body size as compared to other breeds of the country. Efforts to improve the performances of Farta sheep should consider the harsh environmental condition to which the breed is maintained.*

ORIGINAL ARTICLE

Keywords: *Body weight, Farta sheep, linear body measurements, phenotypic characterization*

INTRODUCTION

Ethiopia has a large number of sheep estimated at 25.9 million (CSA, 2010) with more than 18 populations and nine breeds (Gizaw et al., 2007) which are found distributed in different agro-ecological zones and different production systems of the country. A molecular characterization work by Gizaw et al. (2007), indicate that Farta sheep is among the sheep breeds found distributed in the central highlands of Ethiopia. Farta sheep is said to be hardy which can produce and reproduce under feed shortage conditions and are resistant to some internal and external parasites, small in size with mature body weight of 25.4 kg (Gizaw et al., 2007; Shigdaf et al., 2010).

Identification and characterization of indigenous breeds of animals which are thought to have some valuable attributes that could be used at present or sometime in the future is a fundamental component of livestock improvement and conservation programs. With this respect detailed morphological description is required to physically identify, describe and recognize distinct animal populations. Therefore, the objective of this study was to analyze and describe the phenotypic characteristics of Farta sheep in south Gonder zone of Amhara Region.

MATERIALS AND METHODS

Site selection and description of the study area

The study was conducted in south Gondar zone of the Amhara region, where Farta sheep is widely distributed. The area is characterized by scarce vegetation cover, serious natural resource degradation, erratic rainfall and recurrent drought (Sisay, 2009; Shigdaf et al., 2010).

Three districts known to rear this breed of sheep were purposively selected based on their high number of sheep population and road accessibility. The first district, Farta district, is located about 100 km north-east of Bahir Dar, capital of the Amhara National Regional State. Farta district lies within an altitude range of 1920-4135 m a.s.l.

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The district receives an average annual rain fall of 900-1099 mm and a mean-range temperature of 9-25 C° (Farta District OoARD, annual report). The second district, Lai-Gaint district, is located 175 km from Bahir Dar and lies between an altitude ranges 1300-3500 m.a.s.l. Lai-Gaint receives an annual average rain fall of 600-1100 mm and mean minimum and mean maximum temperature of 9 and 19 C°, respectively. The third district, Esite district, is located 157 km North West of Bahir Dar city having an altitude range of 1500-4000 m.a.s.l. The minimum and maximum mean annual rainfall of the area is 1307-1500 mm and the mean annual minimum and maximum temperature is 8.3^{0}C - 25^{0}C (ENMA, unpublished).

Data collection

Data were collected on 1050 sheep of all age and sex groups in the flock. Data collected on physical body characteristics include linear body measurements on body form and size, live body weight and qualitative morphological traits as per the descriptor lists recommended by FAO (1986). Dentition was used to estimate/classify sheep in to age groups.

Qualitative characters collected were coat color, coat color pattern, head profile, presence or absence of wattle, presence or absence horn, presence or absence beard, tail type and presence or absence ruff. Linear body measurements such as: Chest Girth (CG) - the circumference of the chest posterior to the forelegs at right angles to the body axis; Body Length (BL)–horizontal length from the point of shoulder to the pin bone; Height at Wither (HW)–the highest point measured as the vertical distance from the top of the shoulder to the ground (bottom of forelegs); Ear Length (EL)–length of the external ear from its root to the tip; Tail Length (TL)-from the point of attachment to the tip; and Horn Length - from the base of the horn at the skull along the dorsal surface to the tip of the horn were also measured using flexible metal tape (3 meter length) to the nearest 0.5 cm after restraining and holding the animals in an unforced position. Body weight was taken using suspended Salter balance (50 kg capacity with 200 gram precision).

Data Analysis

The data collected from the field were entered, cleaned, managed and analyzed using Statistical Program for Social Sciences version 12.0 (SPSS Software, 2003) descriptive statistics and General Linear Model (GLM) procedures. Sex and dentition were considered as fixed effects for the analysis of quantitative traits. For the analysis of traits that can be manifested at later ages (e.g., presence or absence of horn and other horn traits, and linear body measurements), sheep with age of about nine months and above were used (sheep with spread apart milk teeth.

Dention was classified as: 0 pairs of permanent incisors (PPI) - these are sheep with no permanent incisors but approximately of yearling age; 1 PPI – sheep with one PPI; 2 PPI – sheep with two PPI; ≥3 PPI – sheep with three PPI and above.

The model used to analyze body measurements was;

$Y_{ijk} = \mu + S_i + T_j + (ST)_{ij} + e_{ijk}$

Where

Y_{ijk} = The observation on body weight and other linear body measurements;

μ = Overall mean;

S_i = Fixed effect of sex (i = Female, Male);

T_j = Fixed effect of dentition (j = 0, 1, 2, ≥3);

$(ST)_{ij}$ = the interaction effect of sex with dentition;

e_{ijk} = effect of random error

RESULTS AND DISCUSSION

Qualitative physical characteristics

The physical body characteristics for Farta sheep obtained in the present study are presented in Table 1. Figures 1 and 2 shows flock of sheep with typical color characteristics. Most (54.1%; 53.8 for males and 54.2% for females) of the Farta sheep had plain coat color pattern followed by spotted (30.6%). There were different coat color types in Farta sheep populations to which white coat color was relatively frequent (35.3%; 40.4% for males and 34.3% for females) in both males and females and black was the next dominate coat color only for males. Almost all sheep had coarse fleece (96.6%) and horizontal ear form (99.7%). Farta sheep is short fat tailed with curled (57.8%) and twisted (32%) shape. Toggle is not a characteristic of Farta sheep, only 2% had toggle. Horn described from sheep of about yearling age was a characteristics of male Farta sheep (67%) while only ten percent of the females had horn. Most of the horn shape was curved and backward oriented. On average, the morphological characteristics obtained in this study agree with the report of Sisay (2009) for the same breed.

Body weight and linear body measurements

The least squares mean ± standard errors of body weight and linear body measurements of Farta sheep are shown in Table 2.

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The overall least squares mean body weight obtained in the present study (25.8 kg) was similar with the values reported by Gizaw et al. (2007) for a similar breed of sheep and Tesfaye et al. (2009) for Menz and Afar sheep. However, it is lower than the values reported for Washera (Mengistie et al., 2010), Horro and Bonga sheep (Zewdu et al., 200). The smaller size might be because; Farta sheep is developed under harsh environmental conditions of the highlands of Amhara region. Animal sex and dentition exerted a significant (P<0.001) effect on body weight of Farta sheep. Males were heavier than their female counterparts. Body weight has significantly (P<0.001) increased from milk teeth to the fourth dentition group (≥3PPI). The growth curve for Farta sheep (Figure 3) indicates that the weight of Farta sheep increases up to the age when they produce the third pair of permanent incisor and declines after the fourth pairs of permanent incisor. The effect of sex and dentition on body weight of sheep is well stated in the literature (Tibbo et al., 2004; Mengistie et al., 2010; Tesfaye et al., 2009; Zewdu et al., 2009).

Table 1 - Qualitative physical body characteristics of Farta sheep

Variable	Trait	Male		Female		Total	
		N	%	N	%	N	%
Coat color pattern	Patchy	32	18.70	128	14.60	160	15.30
	Plain	92	53.80	476	54.20	568	54.10
	Spotted	47	27.50	274	31.20	321	30.60
	Total	171	100.00	878	100.00	1049	100.00
Coat color	Black	4	23.00	35	4.00	39	3.70
	Black and White	10	5.80	89	10.10	99	9.40
	Black, White, Brown	20	11.70	96	10.90	116	11.10
	Brown	21	12.30	129	14.70	150	14.30
	Brown and Black	27	15.80	157	17.90	184	17.50
	Brown and White	20	11.70	71	8.10	91	8.70
	White	69	40.40	301	34.30	370	35.30
	Total	171	100.00	878	100.00	1049	100.00
Hair type	Coarse	165	96.50	849	96.60	1014	96.60
	Smooth	6	3.50	30	3.40	36	3.40
	Total	171	100.00	879	100.00	1050	100.00
Head Profile	Concave	0	0.00	3	0.40	3	0.30
	Convex	28	24.30	144	18.60	172	19.30
	Slightly convex	6	5.20	52	6.70	58	6.50
	Straight	81	70.40	576	74.30	657	73.80
	Total	115	100.00	775	100.00	890	100.00
Ear form	Horizontal	171	100.00	876	99.70	1047	99.70
	Rudimentary	0	0.00	3	0.30	3	0.30
	Total	171	100.00	879	100.00	1050	100.00
Presence/ absence of horn	Present	66	57.40	42	5.40	108	12.10
	Scur	11	9.60	39	5.00	50	5.60
	Absent	38	33.00	694	89.50	732	82.20
	Total	115	100.00	775	100.00	890	100.00
Horn shape	Curved	40	60.61	26	61.90	66	61.11
	Spiral	15	22.73	7	16.67	22	20.37
	Straight	11	16.67	9	21.43	20	18.52
	Total	66	100.00	42	100.00	108	100.00
Horn orientation	Back ward	48	72.73	26	61.90	74	68.52
	Lateral	18	27.27	16	38.10	34	31.48
	Total	66	100.00	42	100.00	108	100.00
Tail type	Short fat	169	100.00	879	100.00	1048	100.00
Tail shape	Curled	93	54.40	514	58.50	607	57.80
	Straight	10	5.80	97	11.00	107	10.20
	Twisted	68	39.80	268	30.50	336	32.00
	Total	171	100.00	879	100.00	1050	100.00
Presence/ absence of Toggle	Present	2	9.10	20	2.30	22	2.10
	Absent	169	98.90	859	97.70	1028	97.90
	Total	171	100.00	879	100.00	1050	100.00

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Figure1 - Flock of Farta sheep grazing on a communal grazing land

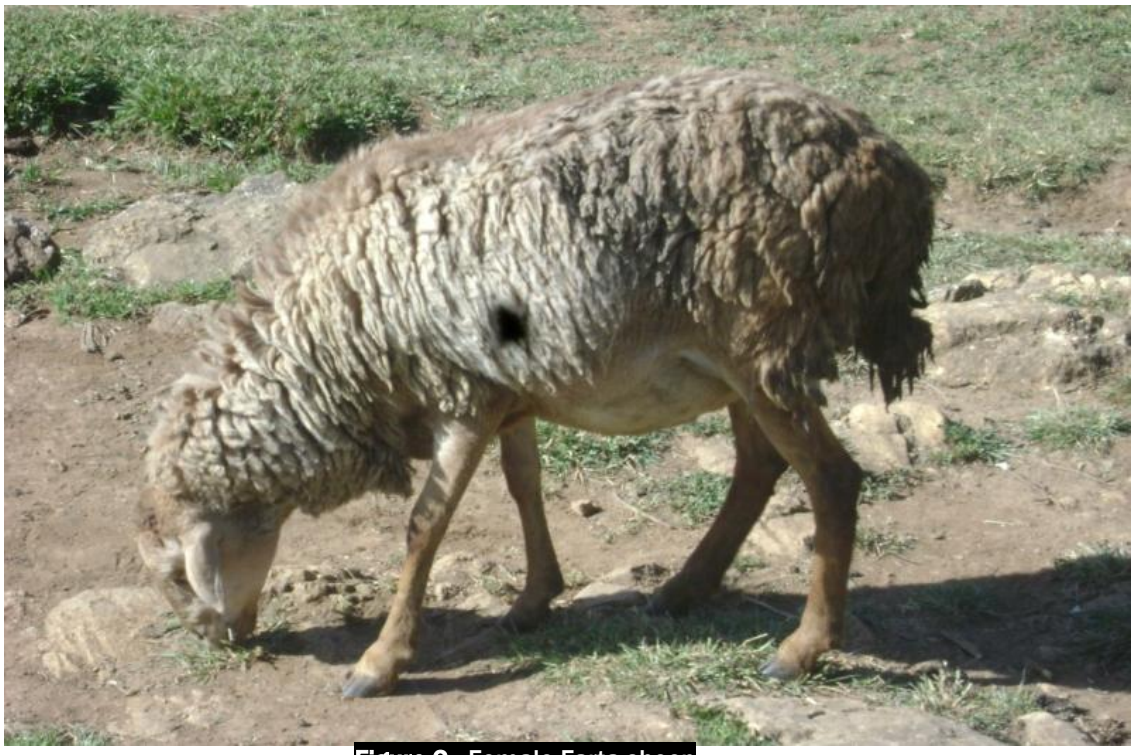

Figure 2 - Female Farta sheep

The least squares mean wither height obtained for Farta sheep in the current study (63.6±0.31 cm) was higher than the values reported for Menz and Afar sheep (Tesfaye et al., 2009), while it was lower than for Washera sheep reported by Mengistie et al. (2010). Males were taller than females (65.2±0.58 vs. 62.1±0.23; P<0.001). Dentition exerted a significant difference on wither height of Farta sheep that animals with dentition 0PPI were shorter, and those with ≥3PPI were taller (P<0.001) from the dentition groups which might be because animals with dentition group 0PPI are still growing and do not attain maturity. Different Scholars has reported the effect of sex and dentition on wither height (Mengistie et al., 2010; Tesfaye et al., 2009).

Body length (55.4±0.30 cm) was significantly affected by sex of animals; males had higher body length than female sheep (56.5±0.56 vs. 54.3±0.22; P<0.001). The effect of dentition was also significant (p<0.001). The body length of Farta sheep is lower than Washera, Bonga, Horro and Afar sheep (Mengistie et al., 2010; Tesfaye et al., 2009; Zewdu et al., 2009) while it is larger than Menz sheep (Tesfaye et al., 2009). The effect of sex and dentition was also reported in the literature for Washera, Menz and Afar sheep in Ethiopia (Mengistie et al., 2010; Tesfaye et al., 2009).

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Table 2 - Body weight and linear body measurements of Farta sheep

Variable	Body Weight kg		Wither Height cm		Body length cm		Heart Girth cm		Pelvic Wedth cm		Ear Length cm	
	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE	N	LSM±SE
Overall	865	25.8±0.26	886	63.6±0.31	892	55.4±0.30	892	70.4±0.38	892	12.7±0.11	890	9.3±0.11
Sex		***		***		***		**		NS		***
Male	115	28.0±0.51	113	65.2±0.58	115	56.5±0.56	115	71.4±0.71	115	12.5±0.20	115	8.9±0.21
Female	750	23.6±0.21	773	62.1±0.23	777	54.3±0.22	777	69.4±0.28	777	12.8±0.08	775	9.8±0.08
Dentition		***		***		***		***		***		NS
0 PPI	221	17.8±0.27^{a}	219	58.3±0.30^{a}	222	50.2±0.29^{a}	222	61.5±0.37^{a}	222	11.1±0.10^{a}	222	9.3±0.11
1 PPI	67	26.0±0.63^{b}	67	63.4±0.71^{b}	67	55.7±0.69^{b}	67	70.9±0.87^{b}	67	12.9±0.24^{b}	67	9.3±0.25
2 PPI	62	28.3±0.64^{c}	63	65.4±0.71^{bc}	64	56.3±0.69^{b}	64	73.1±0.88^{c}	64	12.8±0.24^{b}	64	9.5±0.26
≥3 PPI	515	31.1±0.58^{d}	537	67.5±0.65^{c}	539	59.4±0.64^{c}	539	76.1±0.81^{c}	539	13.9±0.22^{c}	537	9.3±0.23
Dent *Sex		***		***		***		NS		NS		NS
0 PPI*Male		18.2±0.42		58.9±0.48		50.3±0.46		61.7±0.59		11.1±0.16		9.1±0.17
0 PPI*Female		17.4±0.33		57.8±0.36		50.2±0.35		61.4±0.45		11.1±0.12		9.5±0.13
1 PPI*Male		28.5±1.15		64.4±1.30		57.3±1.26		72.2±1.60		13.0±0.44		8.9±0.46
1 PPI*Female		23.5±0.51		62.3±0.57		54.2±0.56		69.6±0.71		12.8±0.19		9.7±0.21
2 PPI*Male		30.9±1.15		67.4±1.29		57.0±1.26		74.0±1.60		12.2±0.44		9.0±0.46
2 PPI*Female		25.7±0.53		63.4±0.60		55.6±0.58		72.3±0.73		13.3±0.20		9.9±0.21
≥3 PPI*Male		34.3±1.15		70.2±1.29		61.5±1.26		77.9±1.60		13.9±0.44		8.8±0.46
≥3 PPI*Female		27.9±0.17		64.8±0.19		57.3±0.18		74.3±0.23		13.9±0.06		9.8±0.07

N = Number of observations; 0PPI – sheep with 0 pairs of permanent incisors (PPI); 1 PPI – sheep with one PPI; 2 PPI – sheep with two PPI; ≥3 PPI – sheep with three PPI and above. ^{a,b,c}Means in a column with different superscripts are significantly different; NS – Not significant (P>0.05); **P<0.01; ***P<0.001

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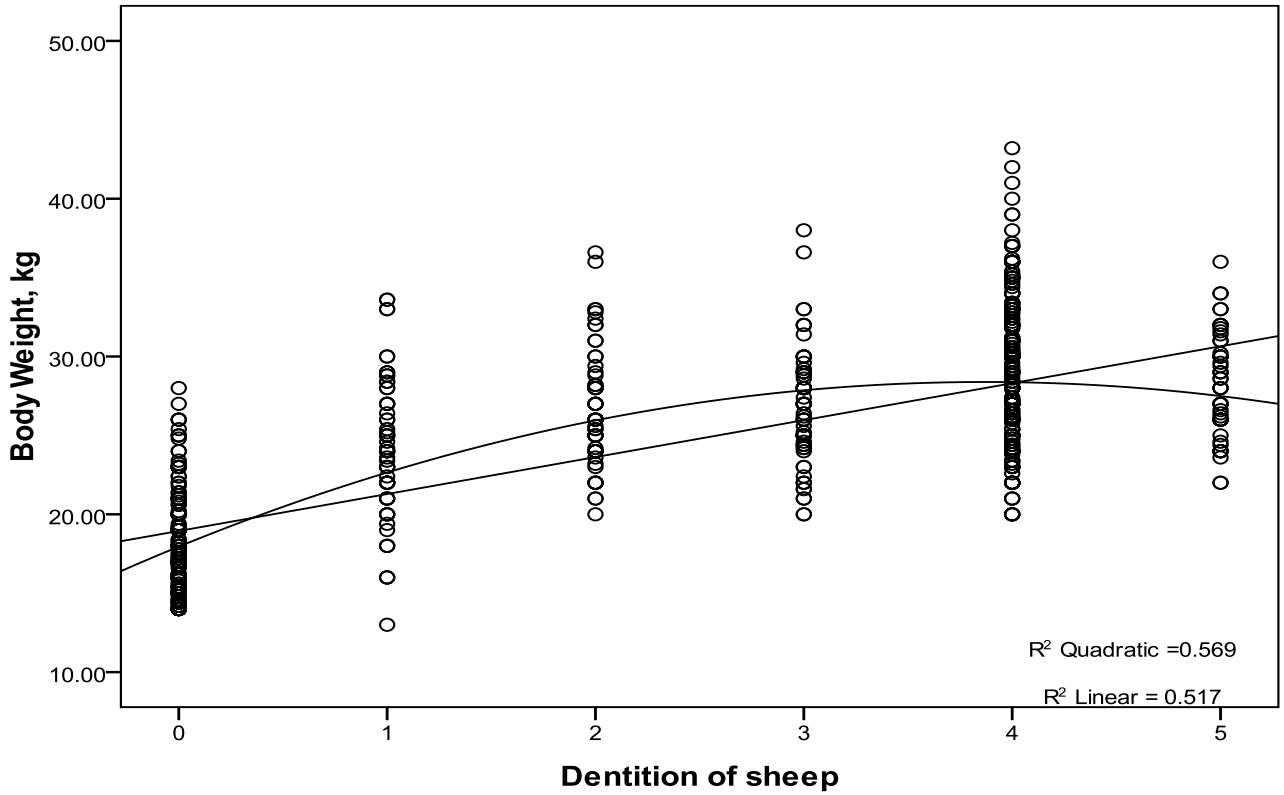
The least squares mean heart girth obtained was 63.6±0.31 cm. Farta sheep had lower chest girth than other indigenous sheep breeds of Ethiopia (Mengistie et al., 2010; Tesfaye et al., 2009; Zewdu et al., 2009). Male sheep and sheep with dentition ≥3 PPI had higher heart girth than female and lower dentiton groups, respectively. The result is in agreement with literature (Mengistie et al., 2010; Tesfaye et al., 2009; Zewdu et al., 2009).

The Pelvic width of farta sheep in the current study (12.7±0.11 kg) is lower than reported for other sheep in the country (Mengistie et al., 2010; Tesfaye et al., 2009; Zewdu et al., 2009). Older animals had wider pelvic ($P<0.01$) than younger sheep. However, unlike other findings (Mengistie et al., 2010; Tesfaye et al., 2009), sex didn't show significant difference ($P>0.05$) in pelvic width of Farta sheep.

Ear length of Farta sheep in the current study is similar with that of Washera sheep (Mengistie et al., 2010) while it is smaller than Bonga and Horro sheep reported by Zewdu et al. (2009). Female sheep had longer ear than male sheep.



Dentition: 0 - those of about yearling age before erupting their milk teeth; 1 - those with one pairs of permanent incosors (PPI); 2 - those with two PPI; 3 - those with three PPI; 4 - those with four PPI; 5 - sheep starting to drop their permanent incisors

Figure 3 - Growth curve of Farta sheep

CONCLUSIONS

Farta sheep one of the sheep breeds with its own physical characteristics. It is relatively of smaller body size from other indigenous sheep breeds of the country. Farta sheep is developed for the harsh environmental adaptation like feed shortage of the highlands of south Gonder zone. The fixed effects considered were a significant source of variation for almost all of the response variables (linear body measurements). Management practices which aim at developing and improving the productivity of Farta sheep breed should target in exploiting the hardy environmental adaptation of the breed.

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