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PERFORMANCE AND PHYSICAL BODY MEASUREMENT OF *ABERGELL* SHEEP BREED IN TRADITIONAL MANAGEMENT SYSTEM OF TIGRAY REGIONAL STATE, NORTHERN ETHIOPIA

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ABSTRACT
The study was conducted to observe the performance and physical characteristics of Abergell sheep breed. The survey was made by selecting 110 households found in six peasant association from the Tanqa Abergelle Tigray regional state district using systemic random sampling procedure. Each household was interviewed by semi-structured questioner developed to gather information on feed and feeding, disease and parasite, reproduction and breeding. The physical characteristics of the breed was identified by selecting 222 sheep for the measurements of height at withers, girth circumference, ear length, body weight and physical observation for hair color and horn was recorded. Prior to analysis the sampled sheep are classified in to three groups based on availability of permanent incisors as one, two, and three pair of permanent teeth. Simple and multiple linear regression analyses were applied to develop and predict equations for body weight of animals using each of the linear body measurements separately or in combination. The Study result showed that in the district on average 14.02 sheep 3.4, cattle and 11.65 goats are owned by the sampled households and in the last 10 years the average livestock per household is decreasing. the sampled farmers hold relatively greater female (72.5%) sheep than male sheep and the ratio of male to female animals having age greater than 12 months was 1:4.87. breeding in most of the case is uncontrolled breeding and sheep give birth on average 2 lambs per year and first lambing was found to be occur at 13 – 16 month of age. The study on morphological characteristics of the breed showed that 66.2 %have dark red hair color 13.1 % white and the remaining 20.7 % have a color of spotted with red white and black. The average height at withers and live body weight of males is greater than females in all age categories, but the variability is not statistically significant. A positive correlation coefficient of body weight and linear body measurement (height at withers and girth length) was obtained in this breed.

KEYWORDS: Abergelle Sheep, linear measurement, wither, girth etc.

INTRODUCTION

Sheep are widely distributed, from arid semi-desert to humid rainforest regions and represent 28.9% of the total population of the ruminant livestock in the Tropics and sub Tropics (Lebbie and Ramsay, 1999). Africa has the largest population, with 27.44 million followed by Asia and the Pacific region (FOA, 2000). In sub Sahara Africa (SSA) 62% of the total domestic ruminants are small ruminants with goat and sheep accounting for 34%and 28% respectively. About 90% of small ruminant genetic resources (SRGR) in SSA are indigenous and are predominantly associated with traditional farming system. East and West Africa together hold the largest number of SRGR in SSA with east dominating in sheep (Lebbie and Ramsay, 1999). According to FAO (2000) 11.2% numbering 147 of the sheep breed of the world are found in Africa. Ethiopia has diversified genotypes and largest sheep population estimated to be 26.1 million (CSA, 2005). These animals are distributed in all part of the nation with the highest population (75%) found in the highland area of the country (Yacob, 1999). But despite of the wide traditional importance, availability of large population and genetic resource, the productivity of the sub sector is very low. Both genetic and non genetic factors are widely accepted to be responsible for the low level of livestock production. From animal breeding point of view, it is important to stress the fact that livestock improvement comprises the genetic and non genetic constraints simultaneously so that a breed of animal can be developed for the given set of production environment and objectives (Merha, 2007). To achieve this first information on the performance, characteristics and merits of the local breed is required. So far very little work has been done to evaluate and characterize the genotypes of livestock existing in the country (Beyene and Yemen, 1992; Awegachew 2000). Hence identifying and characterizing the local breed is very important to integrate animals into various production systems and to make effective use of their potential. And also information on unique attributes of the breed is important to develop strategies to the improvement of the local breeds and to save animals which are at risk of extinction (Lebbie and Ramsey, 1999). This research will be carried out to obtain information on physical characteristics, reproduction performances and management of the second dominant Abergelle sheep breeds of Tigray region, north Ethiopia.

MATERIAL AND METHODS

Study area

The study was carried out in Tanq Abergelle district which is located in central zone of Tigray region about 110km

south east Mekelle (capital city of the region). Geographically the district is located between 10^o 27 'N latitude and 39^o 01'E longitude with an altitude ranging from 1200 - 1500 asl. Based on seven-year rainfall data the area has an average rainfall of 496.8mm. The major crop grown in the area are Sorghum, maize, and teff.

Sampling procedure and data collection

The study area Tanqa Abergelle, were selected based on potential availability of Abergelle sheep breeds as the information obtained from the regional bureau of agriculture and natural resources. From the district six peasant associations were selected based on higher concentration of the sheep breed. A total of Hundred twenty households were selected from the district 20 households from each peasant association using systemic sampling. The selected households were interviewed using semi-structured questioner which was developed to gather information on the production, reproduction performance and management of the sheep breed. To identify the distinguishing features of the sheep breed. A total 236 sheep were selected randomly form the selected house hold for interview. Measurements of height at withers, girth circumference, and ear length were taken using a meter tape while body weight was recorded using Salater weighing scale by hanging up. All the measurements were made in the morning before the animals left for grazing.

Statistical analysis

Data analysis was made using JMP5 (2002), a Business unit of SAS. Descriptive statistics were used to describe the quantitative and qualitative results of the survey. Prior to analysis the sampled sheep are classified in to three groups based on availability of permanent incisors as 1 pair of permanent teeth, 2 pair of permanent teeth and three pair of permanent teeth. Simple linear and multiple linear regression analyses were applied to develop and predict equations for body weight of animals using each of the linear body measurements (Girth circumference, and height at withers) separately or in combination. Accuracy of prediction equations was assessed using the coefficients of determination (R^2) for each analysis.

RESULTS AND DISCUSSION

1. Livestock holding

The total livestock and livestock holding of the sampled farmers are presented in table 1. On average 14.02 sheep 3.4, cattle and 11.65 goats are owned by the sampled households. Similar result for sheep holding was reported for highland sheep in Lallo Mama Midir in the central highlands (Abebe 1999) and Gumuz Amhara region (Abegaz, 2011) of Ethiopia. However, the figure is larger than the sheep flocks in the mixed crop livestock production system of the country (Mengistie *et al*., 2010) and the average found in the study region. According to the survey work, the trend of livestock population is increased over the last 10 years, but livestock holding per household is declining. Some of the reasons for the reduction of livestock holding in the households as mentioned by the interviewed farmers are feed shortage, prevalence of disease and parasite, recurrent drought, land degradation and deforestation, fragmented and small land holding size (Table 2). Disease was ranked as a major constraint followed by feed shortage in the study district.

TABLE 1. Total livestock and livestock holding of the sampled farmers

Livestock Spp.	T LV	LV/HH
Sheep	1682	14.02
Poultry	886	7.38
Cattle	408	3.40
Goat	1398	11.65
Bee colony	50	0.42
Equines	102	0.85
Total	4526	

No.LV. = Number of livestock; LV/HH = livestock holding per household

TABLE 2. Sheep production constraints in study area

Descriptions	No	%	Rank
Feed	40	33.3	2
Disease	42	35	1
Land shortage	14	11.7	3
Back ward management	6	5	4
Drought	4	3.3	5
Capita and labor shortage	14	11.7	3
Total	120	100	

In spite of the reduction livestock holding in the household, the increased livestock population in the district might be explained by human population growth in rural community that each members of the household might have each class of animal so that the total livestock population could be increased (Tessema *et al.,* 2003).

2. Management of the breed

2.1. Feed and feeding

The main feed resources in the study area are natural pasture, crop residues, crop aftermath, and weeds. Among those feed resources, natural pasture contributes the largest proportion followed by crop residue in the district. The critical feed shortage season in the area is from April-mid June which is dependent on the onset of rainfall Straw is the most important feed resources for livestock from December - July. But as the cultivable land holding size is becoming small and fragmented the quantity of crop residues available becomes limited. The contribution of weeds and green grasses to feed farm animals is limited by the short duration of the rainfall. The feed calendar of the study district is given in Table 3.

To mitigate the feed shortage in the study area farmers use different coping strategies. About 70 % of the sampled farmers conserve feed during surplus production time by making hay to fed their animals during acute feed shortage period. Most of the farmers provided the conserved hay to cattle only during drought season; sheep and goats are not provided feed in most of the cases at home or provided only when there are ample feed resources. This is mainly due to the belief of farmers that cattle are more affected by feed shortage than small ruminants. In addition, small ruminants are able to efficiently graze or browse the available feed sources on the field. Tikabo (2004) also reported similar finding in Enderta district.

2.2. Diseases and parasites

Diseases and parasites are the major constraints that contribute to the low production and productivity of

animals in the study areas. Economic losses due to livestock disease and parasites have become severe especially with interaction of different factors such as feed shortage, poor management practices and environmental factors. In the study area anthrax, pasteurellosis carpine, PPR, Taeniasis and black leg were recognized as the most important diseases of small ruminant (Table 4). To minimize the economic lost caused by diseases and parasites farmers used different traditional control and prevention methods (Table 4).

Even though, veterinary services are provided by Bureau of Agriculture Veterinary Section, it is not satisfactory in relation to the total livestock population present in the area. Availability of medicine, transportation, and communication facilities, shortage of skilled manpower in veterinary and animal sciences and budget constraint are mentioned as limiting factors that reduces the performance of the section.

TABLE 3. Feed calendar of Tanqa Abergelle district

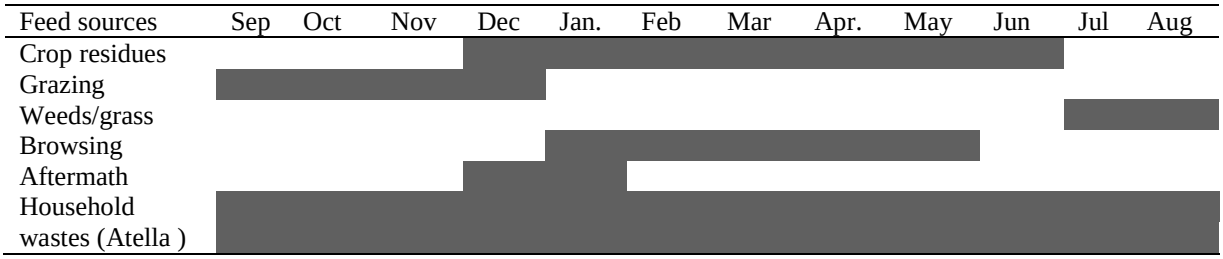

TABLE 4. Major diseases of sheep and traditional control methods

Common name	Local name	Age affected	Clinical sign	Traditional control /prevention /
Mange mites	Abeke	All	Sore in skin	Washing with plants
Anthrax	Megerem	All	Sudden death, bleeding through orifices and the blood is not colt.	
Pasteurellosis	Mieat	Adults	Dullness, reluctant to move, swelling in throat region neck and brisket	Cutting the swelling and the content let out.
PPR	Shelimi	All	Nasal discharge, salivation, diarrhea, and die with one week	
Fasciolosis	Tselime kebdi	All	Sudden death, bloody of liver and other internal organs	
Taeniasis	Zare	Adults	Convolution, dullness	
Internal parasite	Efeal/ Tsehsae		diarrhea, increase in size of the rumen	

3. Breeding and reproduction

3.1. Flock structures

The sampled farmers hold relatively greater female sheep than male (table 5). About 33.6 %, flocks are males and 40.7 % of the flocks have an age of less than 12 months. The ratio of male to female animals having age greater than 12 months was 1:4.87. This ratio of ram to ewe found in this study was far greater than 1:29 and 1:7 ratio found in Dire Dawa villages (Aden, 2003) and in Amhara region (Abegaz, 2011) respectively. A ram to ewe ratio of 1:30 and 1:50 said to be satisfactory rate to ensure efficient conception rate (Gatenby and Humbert, 1991).

3.2. Breeding

Farmers in the district do not have fixed period of breeding season of their sheep. Mating usually occurs everywhere at the time of feed availability. Sheep usually mate during the months of October – December and sometimes from May – June if "Belge[i]" rain is available. The uncontrolled breeding is a management tradition with the hope to have lambing distributed throughout the year in order to provide output year round and reduces risk. Uncontrolled breeding is usually practiced in African traditional farming system and it is more productive than station condition (Cappock, 1994). According to Odubote, (1992) first parturition of WAD ewes (351 - 492) was lower under village production system than under station management (408 - 638 days), which is in line with the early mating due to uncontrolled breeding in such system.

The majority of the sampled farmers (90 %) select male (ram) to improve the performances of their flock. Physical appearances, dam and sir performances (Table 6) were used as selection criteria of rams as a parent of the next generation. The majority of the sampled farmers (64.86%) select rams based on physical appearances.

3.3. Reproduction

Good reproductive performance is a prerequisite for any successful livestock production program. Undoubtedly, there is no milk if birth does not occur, no meat and fiber if survival cannot be ensured. In this study reproduction, performance of sheep is assessed by their litter size, lambing interval, lambing rate and age at first lambing. Lambing in the study area occurred throughout the year. However, the peak lambing was reported to be during June - July and Oct – Nov. Similar finding also reported by Tembly *et. al.* (1996) in central highland of Ethiopia. Lambing rate for the flocks studied was 95.4 % and male to female ratio at birth was 47.8:52.1. According to the majority (45%) farmers studied sheep give birth on

average 2 lambs per year and first lambing was found to be occur at 13 – 16 month of age and similar result (12.7 months) and between 16.2 and 16.9 months was reported by Tsedeke (2007) in Alaba district southern Ethiopia and by FAO (2002) in mixed farming systems of sub Sahara African. The estimated average litter size 1.29 at birth found in this study was lower than that of WAD sheep (Odubote, 1992) and comparable to sheep of Dire Dawa (1.11) (Aden 2003), (1.13) Menz and (1.14) Horro highland sheep of the country (Mukasa-Mugerwa *et al.* 2002).

TABLE 5. Flock structures of sampled farmers

Sex	< 12 month old	12 - 24 month old	24 - 36 month old	36 - 48 month old	> 48 month old	Total
Male %	17.4	5.2	3.4	0.8	0.6	27.5
Female%	23.3	16.3	15.9	10.3	6.7	72.5
Total%	40.7	21.6	19.3	11.1	7.3	100

TABLE 6. Criteria used to select ram as parents of the next generation

No.	Criteria of selection	respondent	%
1	Physical appearances	72	64.86
2	Dam and ram performance	22	19.82
3	Sir, dam and ram performance	2	1.80
4	Progeny and ram performance	12	10.81
5	Other (female, both sex)	3	2.7
	Total	111	100

4. Phenotypic characteristic of Abergelle sheep

4.1. Hair color

Out of 222 sampled sheep, 66.2 %have dark red hair color (Table 7). 13.1 % white and the remaining 20.7 % have a color of spotted with red white and black.

TABLE 7: Hair color Abergll sheep

	Hair color	No of sheep	Percentage
1	Dark red	147	66.2
2	White	29	13.1
3	Black	2	0.9
4	Spotted	44	19.8
	Total	222	100

4.2. Linear measurement and body weight

The linear measurements characteristics and body weight of different age categories and sex are presented in table 8. The mean body weight obtained in this study was lower than the average body weight of central highland sheep, Rift Valley sheep and Menz sheep in Amhara regional state (Sisay 2002; Tibbo *et al*., 2004). The average height at withers and live body weight of males is greater than females in all age categories, but the variability is not statistically significant. Statistical analyses of girth length by sex shows significant variability at the age of two ($p < 0.05$) pairs of permanent teeth while, the variability for one ($p > 0.05$) and three ($p > 0.05$) pairs of permanent teeth is not significant.

Horn is absent in 97.1% of the males and 100% females. Tail is mostly thin and short and all of the animals have short and small ear. The average ear length for the breed is 2.93cm. Ear and tail length of the sheep breed shows significant variability by sex ($p < 0.05$). Females have greater ear length while males have grater tail length. Ear and tail length of this sheep breed shows significant variability by sex ($p < 0.05$).

3) Correlation and Regression Analyses

The correlation between body weight and liner measurements for the breed studied are presented in table 9. Height at withers is positively, significantly and strongly correlated to body weight of both sexes and all age groups of the breed. Also in most of the studied animals, girth circumferences is positively, strongly and significantly correlated to body weight but in male sheep of one and two pair of permanent teeth and female sheep of two pair of permanent teeth it is moderately correlated. In contrary to the above, the correlation of tail to body weight is low to moderate in both sex and all age groups.

The correlation values of height at withers, girth length to body weight found in this study was comparable to the reported values of Awegachew (2002) found for Menz and Herro sheep. This high correlation coefficient of body weight and body measurements suggested that either of this variable or their combinations could provide a good estimation for predicting live weight of Abergelle. The final models for the estimation of body weight by sex and age groups is reported in table 10.

CONCLUSIONS

- Like other part of the country production performances of sheep in the study area are influenced by feed shortage, disease, backward management practices.
- In the study, area there is no fixed period of breeding season. Mating usually occurred everywhere at the time of feed availability and farmers select male sex than female to improve their flock performances and first lambing for the studied sheep breeds was found to be 13 – 16 months with litter size of 1.29.
- Abergelle sheep is identified from other breeds by its small ear, thin and short tailed absences of horn in 97.1 % of male and 100% of female sheep. In general the breed has its own identifiable. morphological characteristics.

TABLE 8. Linear measurements and body weight in *Abergelle* sheep

Permane	Sex	No	Weight (Kg)			Withers height (cm)			Girth length (cm)			Ear (cm)			Tail length (cm)			% horn
			Mean (min,max)	STD	CV	Mean (min,max)	STD	CV	Mean (min,max)	STD	CV	Mean (min, max)	STD	CV	Mean (min,max)	STD	CV	
1	M	53	18.92 (10,28)	4.37	23.0	58.90 (50,66)	4.26	7.2	70.6 (58,86)	7.13	10.1	2.35 (2,4)	0.68	28.9	10.30 (5,20)	3.62	34.9	0
	F	55	17.43 (10,26)	3.78	21.6	58.48 (60,70)	3.99	6.8	70.36 (57,86)	6.79	9.6	2.90 (2,6)	1.22	41.9	8.93 (4,15)	2.64	29.4	0
2	M	28	21.90 (19,26)	2.49	11.3	61.03 (57,64)	2.13	3.4	72.7 (67,80)	4.85	6.7	2.75 (2,5)	1.00	36.5	11.74 (4,19)	4.02	34.1	3.6
	F	32	21.71 (17,28)	2.64	12.1	60.70 (67,69)	3.84	6.2	75.1 (67,88)	4.27	5.7	3.65 (2,6)	1.31	35.8	9.82 (6,14)	2.24	22.9	0
3	M	22	24.42 (15,28)	3.20	13.4	61.60 (57,64)	2.16	3.5	75.2 (61,84)	5.99	7.9	2.86 (2,4)	0.87	29.0	12.64 (6,18)	1.64	13.0	9.1
	F	32	23.13 (16,32)	4.25	18.3	60.90 (54,69)	3.18	6.2	76.56 (56,88)	6.21	8.1	3.34 (2,6)	1.42	42.7	9.93 (8,14)	1.89	19.1	

STD = standard deviation min = minimum max = maximum CV= coefficient of variances

TABLE 9. Correlation Analyses for body weight and body measurements in Abergelle sheep breed

Age group	Sex	HAW		Girth		Tail	
		Corr.	P	Corr.	p	Corr.	P
1 pair teeth	Male	0.892	0	0.801	0	0.339	0.010
	Female	0.819	0	0.883	0	0.061	0.650
2 pair teeth	Male	0.919	0	0.890	0	-0.270	0.152
	Female	0.850	0	0.787	0	0.216	0.011
3 pair teeth	Male	0.843	0	0.789	0	0.159	0.102
	Female	0.818	0	0.842	0	0.446	0.011

Corr. = correlation; HAW = height at withers; p = probability

TABLE 10. Regression models for predicting body weight of Abergelle sheep using some linear body measurements

Pair of permanent teeth	Sex	Wt by Ht	Wt by Gr.	Wt by Ht and Gr
1	M			Wt= -33.7+0.74Ht+0.12GR (R^2=0.81) (p=0.00)
		WT = -34.91 + 0.90 HT (R^2=0.79) (p=0.001)	WT = -15.72 + 0.49 GR (R^2=0.64) (p=0.00)	
	F	WT = -27.86 + 0.78 HT (R^2=0.67) (p=0.00)	WT = -17.16+ 0.49GR (R^2=0.78) (p=0.00)	Wt= -25.0+0.28Ht+0.36GR (R^2=0.82) (p=0.00)
2	M			Wt= -34.1+0.67Ht+0.2GR (R^2=0.92) (p=0.00)
		WT = -43.56+ 1.08 HT (R^2=0.84) (p=0.001)	WT = -11.2 + 0.45 GR (R^2=0.79) (p=0.00)	
	F	WT = -13.82+ 0.59 HT (R^2=0.72) (p=0.00)	WT = -14.83 + 0.48 GR (R^2=0.62) (p=0.00)	Wt = -15.2+0.47Ht+0.10GR (R^2=0.73) (p=0.00)
3	M	WT = -54.42499 + 1.28 HT (R^2=0.711) (p=0.00)	WT = -8.13 + 0.43 GR (R^2=0.6) (p=0.00)	Wt= -36.9+0.77Ht+0.18GR (R^2=0.83) (p=0.00)
	F	WT = -32.36 + 0.92 HT (R^2=0.66) (p=0.00)	WT = -20.91 + 0.58GR (R^2=0.70) (p=0.00)	Wt=-34.0+0.49Ht+0.35GR (R^2=0.81) (p=0.00)

Wt by Ht = body weight expressed by height at withers; Gr. = body weight expressed by girth length; Wt by Ht and Gr. = body weight expressed by a combinations of height at withers and girth length; R^2 = R square; p = probability

REFERENCES

Abebe Mekoya (1999) Husbandry practice and productivity of sheep in Lalo-Mama Midir woreda of central Ethiopia. M.Sc Thesis, Alemaya University of Agriculture, Dire Dawa, Ethiopia.

Abegaz S, Hegde B P and Taye M 2011: Growth and Physical Body Characteristics of Gumuz Sheep under Traditional Management Systems in Amhara Regional

State, Ethiopia. *Livestock Research for Rural Development. Volume 23, Article #117.* Retrieved May 23, 2011, from http://www.lrrd.org/lrrd23/5/abeg23117.htm

Aden Tekle. (2003). Evaluation of local sheep under traditional management around rural area of Dire Dawa. Msc thesis. Alemaya University. Ethiopia.

Beyena Kebede And Bruke Yemane (1992) Animal Genetics Resources And Breed Characterization Works In Ethiopia. In Africa Animal Genetics Resources Their Characterization Conservation and Utilization. Proceeding of The Research Planning Workshop Held At ILCA Adise Abeba , Feb. 19-21.

Coppock, D.L.(1994). The Borana Plateau of Southern Ethiopia: Synthesis of pastoral research, development and change, 1980-91.ILCA Systems Study No.5. Addis Ababa, Ethiopia.

CSA.(2005) Ethiopian agricultural sample survey. Addis Abeba. Ethiopia.

FAO (2002) Cattle and small ruminant production systems in sub-saharan Africa - A Systematic Review. Otte, M. J. and Chilonda, P. (eds). Livestock Information Sector Analysis and Policy Branch. FAO, Rome, Italy

FAO. (2000) World Watch List Domest Animal Diversity(Ed) Scherf Beate D. 3rd Edition. Italy.

Gatenby RM and HumbertJ M (1991) Sheep (1st ed.). Tropical Agriculturalist Series, Macmilan Education Ltd., London and Basingstoke.

JMP5 (2002). SAS Procedure Guide for Personal Computers, Vers. 5th Edn. SAS Institute, Cary NC. USA.

Kassahun Awgichew (2000) Comparative performance evaluation of Horro and Menz sheep of Ethiopia under grazing and intensive feeding conditions. PhD Dissertation. Humboldt University, Berlin.

Lebbie and Ramsay (1999) A Prospective on Conservation And Management Of Small Ruminant Genetic Resources In Sub Sahara Africa.

Mengistie T, Girma A, Solomon G, Sisay L, Abebe M and Markos T (2010) Traditional management systems and linear body measurements of Washera sheep in the western highlands of the Amhara National Regional State, Ethiopia. Livestock Research for Rural Development. Volume 22, Article #169. Retrieved on August 24, 2010, from http://www.lrrd.org/lrrd22/9/taye22169.htm

Merha Zerabureke Fesha (2007) Genetic Diversity in North Ethiopian Cattle Breeds: An On – Farm And Molecular Characterization. Ph.D. Dissertation In The Depertment of Animal And Aquacultureal Sciences, Norwegian University Of Life Sciences Norawy.

Mukasa-Mugerwa, E., Anindo, D., Sovani, S., Lahlou-Kassi, A., Tebely, S., Rege, J.E.O. and Baker, R.L. (2002) Reproductive performance and productivity of Menz and Horro sheep lambing in the wet and dry seasons in the highlands of Ethiopia. Small Ruminant Research 45 (2002).

Odubotes J.K. (1992) An analysis of lambing recording of west Africa Dwarf sheep kept at Lie- lfe , Nigeria . In B. Reg, SHB lebbia and L Reynolds (eds). Proceedings of the first Biennial Conference of the African Small Ruminant Research Network, AICC, Nairobi, Kenya, 10 - 14 December 1990. International Livestock Centre for Africa (ILCA), Nairobi, Kenya.

Sisay Lemma (2002) Phenotypic classification and description of indigenous sheep type in the Amhara National Regional State of Ethiopia. M.Sc. Thesis, University of Natal, Pietermarizburg.

Tesema Zewdu, Akilu Agidie and Ameha Sebsibie.(2003). Assessment of livestock production system, Available feed resources, and marketing situation in Belesa Woreda : a case study in drought prone area of Amhara region.

Tibbo M, Ayalew W, Awgichew K, Ermias E and Rege JEO (2004) On-station characterisation of indigenous Menz and Horro sheep breeds in the central highlands of Ethiopia. FAO/UNEP Animal Genetic Resources Information

Tikabo Gebremariam.(2004) Survey on cactus pear (opuntia ficus indica) utilization in Enderta woreda southern zone of Tigray and cactus inclusion on feed utilization in sheep. Msc thesis Alemaya University. Ethiopia.

Tsedeke Kocho (2007) Production and Marketing Systems of Sheep and Goats in Alaba, Southern Ethiopia. Msc Thesis. University of Hawassa, Awassa.

Yacob Arsanal (1999) The Predicament of The Ethiopian Pastoralist: Shrinking Resources And Tenures Insecurity. Proceeding Of The National Work Shop On Challenges And Opportunities For Research And Development In Pastoral And Agro Pastoral Are Of Ethiopia. December 16 – 18, 1998 DHP Ethiopia and MUC.

[1] Belige- short rainfall available during the dry season (April- May)