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Meat quality and morphology to meet the patency of Menz sheep (*Ovis aries*) in North Shewa Zone, Ethiopia

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The study was conducted to characterize meat quality and morphology of sheep in North Shewa Zone, and to generate baseline information on the patency of Menz sheep. A total of 720 sheep were purposely selected for morphological study. The result showed that age at first kidding, age at sexual maturity, weight, height, length, hair length, tail length and age at disposal were with a mean of 5.58 months, 4.55 months, 36.62 kg, 60.44, 82.49 and 4.42 cm and above 1 year, respectively. The result revealed that all sheep in the study areas were local pure breed, most of them were hornless with smooth hair and white coat color traits. The analytical result ranges from 5.68 to 6.25 (pH), 64.06 to 74.18 (moisture), 18.26 to 25.12 (protein), 3.80 to 13.71 (fat) and 1.02 to 1.46 (ash) contents of meat. Menz district sheep showed significant change in the parameters aforementioned. Menz sheep were the best in all traits/parameters, and a need of patent right to improve Menz sheep appropriately is our recommendation.

Key words: Meat quality, Menz sheep, morphology.

INTRODUCTION

Small ruminant production contributes significantly to the national and household economy in many countries. These are particular resources for their owners; because they require small investment, have shorter production cycle, faster growth rate and greater environmental adaptability than cattle (Anon, 2005).

Ethiopia has 24,000,000 heads of sheep and 23,000,000 goats (CSA, 2004). Ethiopia, with over all 42 million heads has the third largest numbers of sheep and goats among Africa nation, and ranks eighth in the world (CSA, 2008). The diversified topography and climatic conditions of Ethiopia had considerable contribution in the diversification of its livestock genetic resources (Beyne and Beruk, 1992; DAGRIS, 2006). An array of morphological and phenotypic traits has been evaluated to classify different breeds of animals into various categories. Among these are skull morphology and size, body length, wither height, ear and tail length, lumbar width, coat color etc (Solomon, 2002; Markos et al., 2004; Vargas et al., 2007; Gizaw, 2009). Studies made on indigenous sheep breeds revealed that between and within breed variation for growth is significant and

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indicated feasibility for productivity improvement through genetic means (Solomon, 2002; Ermias et al., 2002; Markos, 2006).

In Ethiopia, sheep are purchased for various purposes at different occasions. Though the criteria used for selecting sheep from a diverse population at traditional markets may vary with the purpose for which the animal is purchased, weight determination is a major concern for almost all the sheep buyers, which often is judged only by visual observation and/or palpating various body parts of the animals.

However, information on the different types of criteria used for marketing sheep, and whether these market criteria have significant association with the buying price and purpose for which they are assessed is lacking. Such information provides firsthand idea for sheep breeders so as to improve production according to market demand. It also gives indications about the market (bargaining) price of sheep to the consumers.

Traditionally, people know that Menz sheep has an excellent meat quality in a sensory test. Even merchants sell other sheep saying that this are from Menz to get more money. Therefore, to avoid this problem the recent findings gave recommendations for Menz people, the customers and other stakeholders.

The study intends to have direct market chain from Menz Districts to the customers to avoid any biases. Therefore, based on this information, the authors would like to test the quality of Menz sheep meat in comparison with four other potential sheep production areas. This study focused on traits most considered by sheep consumers/breeders during marketing, and the association of these with the price and purpose for which the animals were purchased. The researchers wish to know the meat quality and morphological characterization of Menz sheep in comparison with sheep from other selected Districts of North Shewa Zone, Ethiopia.

MATERIALS AND METHODS

Description of the study area

The research was conducted in North Shewa Zone ("North Shewa") which is one of 10 zones in the Amhara National Regional State, Ethiopia. The study area was located in 130 km North of Addis Ababa, the capital city of Ethiopia.

Procedure for sampling area selection

Menz sheep is well known for its meat quality. Four Menz Districts (Menz Mama, Menz Keya, Menz Lalo and Menz Gera) and other 4 district regions (Moret ena Jiru, Tarmaber, Efrata ena Gidim and Kewot) were selected since these districts are also potential areas in sheep production.

Method of data collection

Morphological data collection

Both quantitative and qualitative variables were recorded. A total of 720 sheep were selected with equal proportion from the study areas, and purposive sampling technique (taking the same age category from all districts) was used to characterize the sheep morphology. Both age and sex were considered in each experimental group, and have equal proportion for the study. The morphological data were collected through the parameters of coat color, weight, height/year; horn type, hair hardness, hair thickness, hair length, tail length and length/year were common. Theses parameters were used to see the characters of sheep based on age and sex.

Sensory analysis and nutritional composition of meat samples

The sensory quality of meat was determined by assessing the color, taste, odor and texture of meat by using 9-point hedonic scale as described by Sidel and Herbert (1993). One sheep from each district, which were age at maturity were selected for sensory test. Fifty persons having experience in sensory test from animal science fields of study were chosen purposively.

Nutritional composition of meat

Moisture, crude protein, fat, ash and mineral contents were analyzed according to standard procedures (AOAC International, 2007).

Data analysis

The qualitative and quantitative data sets were code and entered into statistical package for social science (SPSS version16) computer program for analysis. Descriptive statistical tools were used to analyze the quantitative data, and statistical measures were used to summarize and categorize the data.

RESULTS AND DISCUSSION

Sensory test

As indicated in Table 1 from the total of 50 respondents, 32.5% like the meat color moderately, whereas, 37.75, 47.25 and 35.5% of them like very much the meat color, taste and texture, respectively. The highest number of respondents (72%) who like very much the taste of the meat was from Menz Lalo. Whereas, around half of the respondents (46%) liked very much the color of meat from Menz Mama. 46% of odor and 54% of texture were recorded from Menz Mama, Menz Lalo and Menz Keya, respectively (Table 1). The results from the sensory test clearly show that Menz sheep are excellent in color, taste and texture and the difference from the other sheep categories were significant ($P < 0.05$).

Analytical test

Analytical result showed that the potential of hydrogen (pH) was near to neutral (5.68 to 6.25) for sheep from all the studied districts. The highest moisture content was observed in the meat of Menz Lalo (69.21), and the least

Table 1. The number of respondents for sensory test.

Districts	Parameter	Sensory score								
		1 = Dislike extremely (%)	2 = Dislike very much (%)	3 = Dislike moderately (%)	4 = Dislike slightly (%)	5 = Neither like nor dislike (%)	6 = Like slightly (%)	7 = Like moderately (%)	8 = Like very much (%)	9 = Like extremely (%)
Menz Gera	Colour	0	0	0	0	0	22	30	24	24
	Taste	0	0	0	0	0	8	44	24	24
	Odor	0	0	0	0	0	24	38	30	8
	Texture	0	0	0	0	0	24	24	38	14
Menz Mama	Colour	0	0	0	0	8	0	38	46	8
	Taste	0	0	0	0	8	0	16	68	8
	Odor	0	0	0	0	0	8	38	46	8
	Texture	0	0	0	0	8	16	8	54	14
Menz Keya	Colour	0	0	0	0	6	8	36	42	8
	Taste	0	0	0	0	6	8	14	62	8
	Odor	0	0	0	0	0	8	38	46	8
	Texture	0	0	0	0	6	18	8	54	14
Menz Lalo	Colour	0	0	0	0	8	0	38	42	12
	Taste	0	0	0	0	0	0	18	72	10
	Odor	0	0	0	0	0	8	38	46	8
	Texture	0	0	0	0	6	18	8	54	14
Moret ena Jiru	Colour	0	0	0	0	12	24	24	24	14
	Taste	0	0	0	0	18	8	24	42	6
	Odor	0	0	0	0	12	14	24	42	8
	Texture	0	0	0	0	12	12	42	10	24
Tarmaber	Colour	0	0	0	0	0	8	38	30	24
	Taste	0	0	0	0	8	30	30	24	8
	Odor	0	0	0	0	14	24	38	16	8
	Texture	0	0	0	0	14	8	24	54	8
Efrata ena Gidim	Colour	0	0	0	8	2	32	32	18	10
	Taste	0	0	0	6	0	12	32	40	10
	Odor	0	0	0	0	0	24	30	38	8
	Texture	0	0	0	6	8	8	42	12	24
Kewot	Colour	0	0	0	6	0	32	24	24	14
	Taste	0	0	0	6	0	8	30	46	6

Table 2. Contd.

	Odor	0	0	0	0	0	24	30	38	8
	Texture	0	0	6	0	8	8	46	8	24

Table 2. pH, moisture, protein, fat and ash content of meat samples.

S/N	Sample type	pH	Moisture (g/100 g)	Protein (g/100 g) (in wet basis)	Fat (g/100 g) (in wet basis)	Ash (g/100 g) (in wet basis)
1	Menz Mama	5.68±0.03	66.73±0.33	25.12±0.01	5.61±0.10	1.10±0.10
2	Menz Gera	6.25±0.02	68.24±0.33	25.38±0.06	5.51±0.21	1.03±0.02
3	Menz Lalo	6.20±0.02	69.21±0.32	25.26±0.07	5.49±0.19	1.02±0.03
4	Menz Keya	5.78±0.03	66.03±0.31	26.08±0.01	5.71±0.12	1.09±0.10
5	Moret ena Jiru	5.88±0.02	66.98±1.41	24.59±0.16	7.80±0.05	1.46±0.02
6	Tarmaber	5.89±0.02	67.18±1.39	25.64±0.18	5.82±0.04	1.45±0.01
7	Kewot	5.71±0.02	64.06±1.27	25.12±0.32	9.37±0.21	1.38±0.01
8	Efrata EnaGidim	5.71±0.02	64.06±1.29	23.99±0.29	8.39±0.23	1.39±0.02

was from Kewot (64.06) and EfratanaGidim (64.06).

In addition, protein, fat and ash content of the meat were observed. So, the highest protein content was found in the sheep from Menz Keya (26.08) and the least was from EfratanaGidim (23.99). The highest fat content was observed in Sheep from Kewot (9.37) and the least was from Menz Lalo (5.49), sheep from MoretenaJiru showed the highest (1.46) ash content and the least was from Menz Lalo (1.02) (Table 2).

Based on the analytical test and sensory test, sheep from Menz are more preferable due to good result in taste, odor, texture and color of the meat. It may be due to the feeding habit of Menz sheep (*Thymus schimperi*) having good result in sensory test.

According to Quasem et al. (2009), proximate analysis such as percentage of carbohydrate, fat, protein, ash, moisture and pH of aforementioned local sausages were 4.3, 16.7, 12.76, 2.27, 63.9429 and 6.34, respectively. Whereas, according to Hozza et al. (2014), the moisture content of meat cuts was found between 74.46 and 76.78%. The crude protein content was observed from 22.78 to 24.20%. The crude fat content ranged from 5.70 to 9.76%. The ash content was 1.77 to 1.98%. The pH content was observed as 5.80 to 5.90%. The current study also correlated with the aforementioned findings.

The result in Table 3 indicated that the amounts of minerals varied along districts. For example, the content of Mg in Menz Mama, Menz Gera, Tarmaber, Kewot, Enwari, Menz Lalo, Menz Keya and Efratta Ena Gidim were 7.79±0.21, 7.19±0.01, 6.22±0.16, 8.22±0.00, 6.20±0.18, 7.18±0.02, 7.19±0.03 and 8.21±0.03, respectively, and the highest and lowest content of Fe was also recorded in Menz mama (2.40±0.29) and Tarmaber (1.20±0.08) (Table 3).

Humans and other vertebrates need large amounts of calcium for construction and maintenance of bone and normal function of nerves and muscles. Red blood cells cannot function properly without iron in hemoglobin, the oxygen-carrying pigment of red blood cells. Iron is also an important component of the cytochromes that function in cellular respiration. Magnesium, copper, zinc, iron and manganese are important co-factors found in the structure of certain enzymes, and are indispensable in numerous biochemical pathways (Soetan et al., 2010). Similarly, the current study showed that the amount of minerals were highest in Menz

Table 3. Most minerals content in meat samples.

S/N	Sample type	Fe (mg/100 g)	Zn (mg/100 g)	Ca (mg/100 g)	Mg (mg/100 g)	Cu (mg/100 g)	Mn (mg/100 g)
1	Menz Mama	2.40±0.29	4.27±1.26	4.62±1.20	7.79±0.21	0.16±0.10	0.20±0.08
2	Menz Gera	1.72±0.02	5.83±0.35	4.95±0.00	7.19±0.01	0.09±0.00	0.07±0.00
3	Tarmaber	1.20±0.08	4.42±1.06	4.51±0.23	6.22±0.16	0.09±0.01	0.13±0.04
4	Kewot	1.74±0.00	5.40±0.00	3.13±0.00	8.22±0.00	0.24±0.00	0.10±0.00
5	Enwari	1.19±0.09	4.40±1.08	4.49±0.25	6.20±0.18	0.08±0.02	0.11±0.06
6	MenzLalo	1.71±0.03	5.81±0.32	3.93±0.01	7.18±0.02	0.09±0.00	0.08±0.00
7	MenzKeya	1.69±0.04	5.80±0.33	3.94±0.02	7.19±0.03	0.09±0.01	0.09±0.02
8	EfrattaEnaGidim	1.72±0.02	5.38±0.01	3.14±0.00	8.21±0.03	0.22±0.00	0.11±0.01

sheep compared with sheep from other districts.

Morphological characterization of sheep

From a total of 720 samples, the highest was observed in Menz Gera District with the mean of 5.68 months and the least was in Tarmaber District with a mean of 5.38 months. The highest characteristics showed in Efrata Ena Gidm with a mean of 4.63 months and the least was in Tarmaber with a mean of 4.46 months. Besides, the highest weight of sheep, height of sheep, length of sheep, hair length of sheep and tail length of sheep were observed in Kewet, Menz Keya, Menz Mama, Menz Keya and Kewet, with a mean of 41.97 kg, 72.27, 94.20, 7.40 and 23.20 cm, respectively (Table 4).

The morphological levels are particularly affected by environmental condition of the area in which sheep were grown, and hot climatic condition can enhance the growth rate (Traoré et al., 2009). Sheep biodiversity have been described using morphological measurements (Gizaw et al., 2007; Carneiro et al., 2010). The phenotypic variation in a population arises due to genotypic and environmental effects, and the magnitude of phenotypic variability differs under different environmental conditions.

According to Gizaw et al. (2007), morphological description is an essential component of breed characterization that can be used to physically identify, describe, and recognize a breed, and also to classify livestock breeds into broad categories. Dossa et al. (2007) reported that morphological measurements such as heart girth, height at withers and body length can be used for rapid selection of large size individuals in the field to enable the establishment of elite flocks. Weight determination is a major concern for almost all sheep buyers.

Sensory test showed that sheep from Menz were more preferable due to good result in taste, odor, texture and color of the meat. Also, Menz sheep had relatively white coat color. For horn type, the highest result was scored in Kewet that is 90 in number with hornless and the least was in Menz Keya.

On other hand, for white coat color of the sheep the highest result was scored in Menz Keya with 57 in number. In addition, hair hardness of the sheep was observed and the highest result was scored in Menz Gera, Efrata ena Gidm and Tarmaber with smooth, medium and hard hair type respectively.

Season is the main reason for market fluctuation, and from 120 respondents about 56 did not participate in animal fattening course and the rest 64 farmers participated. All local breeds got the first disease resistance for the selected 8 districts. The second and third types were cross and exotic, respectively. Half of the respondents said the first productive breed is exotic and cross type of breed is the second productive groups. The rest breed type is the third. The first, second and third factor to meat taste were feeding habit, sheep status and environment, respectively.

Conclusion

Menz District sheep has better meat quality in sensory (taste, odor and texture) and analytical tests (crude protein, fat, mineral and ash) contents. The environment where Menz sheep grow plays a major role in the quality of meat. Menz sheep feed on a plant species named *T. schimperi,* and the study believes that this plant contribute to meat quality of Menz sheep. Further researches are needed to give clarification on genetics and molecular aspects of the species studied.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Table 4. Number of cases, mean, standard deviation and variance of different parameters.

District	Parameter	Age at first lambing	Age at maturity	Weight (kg)	Height (cm)	Length (cm)	Hair length (cm)	Tail length (cm)
Kewet	Mean	5.58	4.58	41.97	64.61	90.31	2.45	23.22
	Std. deviation	0.37	0.43	12.79	16.30	20.37	1.29	6.83
	Variance	0.14	0.18	163.54	265.72	415.03	1.67	46.62
Efrata ena Gidm	Mean	5.46	4.63	34.19	58.20	60.32	3.48	22.60
	Std. deviation	0.43	0.40	16.35	5.42	4.63	0.33	1.38
	Variance	0.19	0.16	267.21	29.35	21.41	0.11	1.91
Tarmaber	Mean	5.38	4.46	30.87	48.87	73.67	1.75	17.63
	Std. deviation	0.48	0.48	12.47	9.64	11.23	0.63	5.08
	Variance	0.23	0.23	155.44	92.95	126.16	0.40	25.79
Menz Mama	Mean	5.61	4.51	41.08	57.47	94.24	5.25	16.93
	Std. deviation	0.46	0.45	4.34	5.89	8.51	2.18	3.38
	Variance	0.21	0.20	18.81	34.68	72.41	4.77	11.43
Menz Lalo	N	90.00	90.00	90.00	90.00	90.00	90.00	90.00
	Mean	5.63	4.60	40.47	53.84	92.13	5.27	16.06
	Std. deviation	0.47	0.44	4.90	4.30	6.75	2.01	4.54
	Variance	0.22	0.19	24.00	18.49	45.58	4.04	20.57
Menz Keya	Mean	5.67	4.53	33.63	72.27	82.40	7.40	13.77
	Std. deviation	0.44	0.45	3.56	11.63	5.13	1.88	1.51
	Variance	0.19	0.20	12.71	135.30	26.33	3.55	2.27
Menz Gera	Mean	5.68	4.58	33.46	67.80	78.24	5.31	15.12
	Std. deviation	0.45	0.42	8.36	9.21	9.76	1.99	5.81
	Variance	0.20	0.17	69.87	84.79	95.18	3.94	33.70
Enwari	Mean	5.62	4.51	37.26	60.46	88.60	4.49	14.99
	Std. deviation	0.46	0.46	4.79	3.86	6.38	1.98	1.87
	Variance	0.21	0.21	22.92	14.90	40.65	3.92	3.49
Total	Mean	5.58	4.55	36.62	60.44	82.49	4.42	17.54
	Std. deviation	0.45	0.44	10.30	11.58	14.80	2.38	5.38
	Variance	0.21	0.19	106.14	134.11	219.10	5.65	28.94

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REFERENCES

Anon C (2005). Agricultural Sample Survey 2004/2005.Volume II Report on Livestock and Livestock characteristics, Statistic Bulletin 331 Central Statistical Authority. Addis Ababa, Ethiopia. P 42.

AOAC International (2007). Official methods of analysis, 18th edn., 2005; Current through revision 2, 2007 (On-line). AOAC International, Gaithersburg, MD.

Beyne K, Beruk Y (1992). Animal genetic resources and breed characterization work in Ethiopia. In: African genetic resource; the characterization, conservation and utilization, (Rege, J. E. O and Lipner, M. E., eds). Proceeding of the research planning Workshop held at ILCA (international livestock center for Africa), Addis Ababa, Ethiopia. pp. 77-82.

Carneiro H, Louvandini H, Paiva SR, Macedo F, Mernies B, McManus C (2010). Morphological characterization of sheep breeds in Brazil. Uruguay and Colombia. Small Rumin. Anim. Res. 94:58-65.

Central Statistics Authority (CSA) (2004). The 2001/02 Ethiopian Agricultural Sample Enumeration (EASE), Executive Summary, Addis Ababa, Ethiopia.

Central Statistics Authority (CSA) (2008).Ethiopia agricultural sample enumeration. Central Statistical Authority of the Federal Democratic Republic of Ethiopia, Addis Ababa 2:48-50.

Domestic Animal Genetic Resources Information System (DAGRIS) (2006). Domestic Animal Genetic Resources Information System (DAGRIS). (Rege, W., Ayalew, E., Getahun, O., Hanotte and DessieT.eds). International Livestock Research Institute, Addis Ababa, Ethiopia.

Dossa LH, Wollny C, Gauly M (2007). Spatial variation in goat populations from Benin as revealed by multivariate analysis of morphological traits. Small Rumin. Anim. Res. 73:150-159.

Ermias E, Yami A, Rege JEO (2002). Fat deposition in tropical sheep as adaptive attribute to periodic feed fluctuation. J. Anim. Breed. Genet. 119:235-246.

Gizaw S, Van Arendonk JAM, Komen H, Windig, JJ, Hanotte O (2007). Population structure, genetic variation and morphological diversity in indigenous sheep of Ethiopia. Anim. Genet. 38:621-628.
Gizaw S (2009). Sheep Breeds of Ethiopia: a guide for identification and utilization. In: Yami, A, Awgichew K, Gipson TA, Merkel RC (Eds), Technical Bulletin No. 28.
Hozza AW, Mtenga AL, Kifaro CG, Shija NS, Mushi ED, Safari GF, Shirima MJ (2014). Meat Quality Characteristics of Small East African Goats and Norwegian Crosses Finished under Small Scale Farming Conditions. Asian-Austr. J. Anim. Sci. 27:1773-1782.
Markos T, Ayalew W, Awugichew K, Ermias E, Rege JEO (2004). On-station characterization of indigenous Menz and Horro Sheep breeds in the central highlands of Ethiopia. FAO Anim. Genet. Resour. 35:61-74.
Markos T (2006). Productivity and health of indigenous sheep breeds and crossbreds in the Central Ethiopian highlands. Doctoral dissertation, Uppsala University, Sweden.
Quasem JM, Mazahreh AS, Al-Shawabkeh AF (2009). Nutritive Value of Seven Varieties of Meat Products (Sausage) Produced in Jordan. Pak. J. Nutr. 8:332-334.
Soetan KO, Olaiya CO, Oyewole OE (2010). The importance of mineral elements for humans, domestic animals and plants. Afr. J. Food Sci. 4:200-222.
Solomon A (2002). Genetic evaluation of production, reproduction and survival in a flock of Ethiopian Horro sheep. Ph.D Thesis. University of the Free State.
Sidel JL, Herbert S (1993). The role of sensory evaluation in the food industry. Food Qual. Prefer. 4(1-2):65-73.
Traoré A, Álvarez I, Tamboura H, Fernández I, Kaboré A, Royo LJ, Gutiérrez JP, Sangaré M, Ouédraogo-Sanou G, Toguyeni A, Sawadogo L, Goyache F (2009). Genetic characterisation of Burkina Faso goats using microsatellite polymorphism. Livest. Sci. 123:322-328.
Vargas S, Larbi A, Sanchez M (2007). Analysis of size and conformation of native Creole goat breeds and crossbreds used in smallholder agrosilvopastoral systems in Puebla, Mexico. Trop. Anim. Health Prod. 39(4):279.