COMESA
Leather and Leather Products Institute
Journal of Africa Leather and Leather Products Advances
ISSN: 2410-0838
2014, Vol. 1, No. 1

The Effect of Breed on Skin/Leather Quality of Sudan Desert Sheep

M.A. Ebrahiem[1], I.Y. Turki[2], H.E. Haroun[3],

[1]Department of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan, P.O. Box 716.

Emai mahaali5656@gmail.com.

[2]Faculty of Animal Production and Technology, University of Sudan, Khartoum, Sudan.

[3]Faculty of Leather Engineering, University of Sudan, Khartoum, Sudan.

DOI: http://dx.doi.org/10.15677/jallpa.2014.v1i1.5

Abstract:

This study was carried out to estimate the effect of Sudan Desert sheep breed variations on skin\leather quality. One hundred and fifty (150) pieces of fresh skins from five non-castrated male of Sudan desert breeds (an average age of 1-1.2 years) were collected from west Sudan (Kordofan state) and east Sudan (Gezira and Butana). The results showed that, Fresh skin weight, elongation, tensile strength, flexibility, cracking, tear load, Moisture, fat and chrome oxide contents results were significantly affected (P ≥ 0.05) by breed variations. Thickness, Ash content findings were not significantly affected (P ≥ 0.05) by breed.

Introduction:

Sudan produce about 22 million pieces of raw material hides and skins, which were obtained from about 140 million of cattle, sheep, goats, reptiles and snakes (MAR, 2008). The world sheep leather production was estimated at 571.4 million pieces, which represent about 15% of total world leather production. Sudan produces about 9.3 million pieces of sheep skin which represents about 42% of total Sudan leather production (FAO, 2008 and ATO, 2009). Sudan sheep flock was estimated at 50.9 million head with total growth rate of 149%. Sudan desert sheep and their crosses makeup about 80 % of the sheep found in Sudan and mainly predominant north of 12º N, they are raised mainly under harsh dry land farming conditions for meat production (Idris1 *et al*, 2010a$_1$; Alraed, 2011 and FAO, 2009). Idris *et al*

(2001a$_2$) reported that, the nutritional limitation, low nutritive value of the range, high ambient temperature, scarcity of feed and water are have great effect on the reproduction and production performance of the sheep in semi-arid area of Kordofan state as compared to that in temperate regions. Generally, animals reared on natural pastures produce skins that vary in physical characteristics and chemical constituents when compared to animals raised in closed and semi closed systems or feed lots. These differences may be due chiefly to breeds and seasons variations especially in feedstuff matter quality (Ali, 2004). Thus this study was aimed to estimate the effect of breed variations; in area of Kordofan state and in Gezira and Butana region; on Sudan desert sheep skins production and hence leather quality, when compared with ISO standard specifications for leather quality.

Material and Methods:

Study area:

This work was conducted at the National Centre for Leather Technology Khartoum, Sudan. Sheep skins were collected from Kordofan region in the western part of the Sudan (latitudes 9˚:30˙ and 16˚: 30˙ North and longitudes 24˚ and 32˚: 25˙ East). Gazira state in the east-central region of the Sudan (latitudes 14˚:30˙ and 33˚: 30˙ North and longitudes 14˚:50˙and 33˚: 50˙ East). Butana plain in Eastern Sudan (Latitude 13˚:40˙and 17˚:50˙ North and Longitude 32˚:40˙ and 36˚ East). The rainfall ranges between 600 mm/year in the south-east to less than 100 mm/year in the northwest. The annual mean temperature ranges from 32˚ C during the day to 16˚ C at night in January (winter) and from 46˚ C during the day to 27˚ C at night in May-June (summer). Two vegetation zones are existing in the area, namely semi-desert Acacia shrub and short grasslands of the North Central Sudan and secondly, the low woodland savannah of central Sudan. The natural vegetation consisted mainly of the grass species *Panicum tugidum, Arisdia spp, Cympopogons spp., Ctenium elegan, Dactyloctenium aegyptium* and *Eragrostis tremula* (Farah, 2006; Darosa and Agab, 2013; Saint-Martin *et al*, 1992).

Selection of experiment animal skins:

For the study purpose, one hundred and fifty (150) pieces of fresh skins from Five (5) non-castrated male of Sudan desert sheep breeds (30 from each breed) were obtained from west and central-east of the Sudan. Hamari and Kabashi represent west Sudan sheep; Shugor, Watish and Dubasi represent the semi-arid area of central-east Sudan sheep.

Tanning procedures and sampling:

Leather was prepared from sheep skin according to the following main steps: Soaking, liming, degreasing, deliming, bating, pickling, tanning, neutralization and re-tanning.

Sampling and assessment of chemical and physical characteristics were done according to ISO2418 (2002). Physo-mechanical properties that assessed were Tensile strength and elongation percentage according to ISO3376 (2002), Flexibility test according to ISO5402-(2002) and Measurement of tearing load and resistance to grain cracking according to ISO3377-1 (2002) and ISO3378 (2002). Moisture, total Ash, fats and oils contents were determined according to AOAC (1984) and chromium content according to ISO5398-1 (2007) procedures.

Statistical Analysis:

The data were statistically analyzed according to complete randomized design using SPSS v.14.0 software package (SPSS, 1996). Duncan's Multiple Range Tests (DMRT) was used for means separation, beside comparing skin and leather measurements results with Sudanese Standard Thresholds for leather quality according to SSMO standards.

Result and Discussion:

skin\leather physical quality of Sudan desert sheep:

Green or fresh skin weight (kg) showed significant difference ($p \geq 0.05$.) between Sudan desert sheep breeds. Kabashi and Shugor Sudan desert sheep breeds recorded the highest weight, while, Dubasi Sudan desert sheep breed was recorded the lowest weight of fresh skin. These results were different from Sudha *et al*. (2009); Salehi *et al*. (2014) and Passman and Sumner (1983) whom stated that, no type effects on leather weight on crust tanned sheep leather from different types. These findings might considered according to T.R.C. -Triple Line Consulting- (2002) which determined the size (weight) of a hide or skin is closely related to the weight of the animal from which it came, and is typically between 7 and 11% of the live weight.

Elongation percents were significantly ($p \geq 0.05$) affected by breed. Hamari Sudan desert sheep breed was reported the highest elongation percent. These results were exceeded the estimated value of elongation percentage (60.6±0.9) which reported by Sudha *et al*. (2009); Salehi *et al*. (2014) and Passman and Sumner (1983). Otherwise, these findings were similar to Teklebrhan *et al.* (2012) Craig *et al*. (1987) and Jacinto *et al*. (2005) reports on native Ethiopian sheep leathers, which had numerically higher tensile strength and percentage elongation at break.

Tensile strength kg\cm^2 parameter was reported no statistically significant difference ($p \geq 0.05$) between Dubasi, Shugor, Watish and Kabashi but, they were different from Hamri finding which was the lowest finding in comparison to which were reported by the above group of desert sheep breeds. Similar results of insignificant differences in strength properties was reported by Teklebrhan *et al.* (2012) and Oliveira *et al* (2007) whom mentioned that, significant

difference in strength properties among sheep breeds was not detected when they studied Ethiopian sheep. However, it is below the estimated value for the parameter (203.6±5.1 kg /cm^2) which was reported by Sudha *et al*. (2009); Salehi *et al.* (2014) and Passman and Sumner (1983). However, these results were in line with Teklebrhan *et al.* (2012) Craig *et al*. (1987) and Jacinto *et al*. (2005) whom reported that, the native Ethiopian sheep leathers had numerically higher tensile strength and percentage elongation at break. This is evidence that leather produced from these breeds is stronger and could be extend more before the grain cracks.

Resistance to grain cracking N\cm^2 was affected ($p \geq 0.05$.) by breed. Kabashi and Watish were scored the highest load. These findings were in line with Sudha *et al*. (2009); Salehi *et al* (2014) and Passman and Sumner (2983) whom stated that, leather from adult sheep had significantly higher values for cracking force (7.6±0.7 N\cm^2). Craig *et al*. (1987) and Oliveira *et al*. (2007) reported that the strength and distension at grain crack and break of a leather act as a guide as to how the material will perform when a multi-directional stress is applied. Grain crack is primarily considered as a measure of the strength of the grain layer within the tested material. Generally, these variables are more important in shoe upper leather, although optionally used in garment leather as physical quality parameter.

The leather thickness was resulted in no a statistically difference ($p \geq 0.05$) observation between Sudan desert sheep breeds. This result was in line with Oliveira *et al.,* (2007) Sudha *et al*. (2009); Salehi *et al* (2014) and Passman and Sumner (1983) whom observed that, thickness of skin was not affected by sheep lamb breed and high degrees of homogeneity in thickness among different genotypes was obtained.

Shugor Sudan desert sheep breed was reported the high tear load and this was statistically different ($p \geq 0.05$) from which were recorded by Dubasi, Watish, Kabashi and Hamari. Watish and Hamri were reported the low tear load findings. These findings were similar to Sudha *et al*. (2009); Salehi *et al* (2014) and Passman and Sumner (1983) estimation for tear load at 37.9±0.5 kg/cm^2 on crust tanned sheep leather from different types.

Hamari and Dubasi scored the better degrees of flexibility test results. These values was significantly different ($p \geq 0.05$.) from those were reported by Shugor, Watish and Kabashi. These results were similar to Teklebrhan *et al.* (2012) and Oliveira *et al* (2007) results; significant difference in flexibility properties among sheep lamb breeds was not detected (Table, 1).

Journal of Africa Leather and Leather Products Advances
ISSN: 2410-0838
2014, Vol. 1, No. 1

Table (1): the effect of Sudan desert sheep breed on physical properties of skins chosen for the study during 2012-2013.

Parameters	Breeds					Total
	Dubasi	Shugor	Watish	Kabashi	Hamari	
Weight (kg)	1.23 ±0.10^{c}	1.48 ±0.23^{a}	1.33 ±0.17^{b}	1.56 ±0.24^{a}	1.38 ±0.20^{b}	**1.40 ±0.23**
Elongation%	58.15 ±5.89^{c}	62.68 ±6.17^{b}	64.47 ±5.79^{ab}	59.56 ±5.40^{c}	66.50 ±4.62^{a}	**62.27 ±6.33**
Tensile strength (kg\cm^2)	195.4 ±29.61^{a}	182.1 ±42.60^{b}	185.4 ±43.11^{a}	191.4 ±29.43^{a}	150.4 ±36.37^{b}	**180.92 ±39.60**
Cracking load (N\cm^2)	7.84 ±1.15^{c}	8.80 ±1.39^{b}	9.23 ±1.61^{ab}	9.49 ±1.92^{a}	7.95 ±1.22^{c}	**8.66 ±1.61**
Thickness (Kg\cm^2)	1.35 ±0.47^{a}	1.28 ±0.45^{a}	1.38 ±0.43a	1.39 ±0.32^{a}	1.21 ±0.35^{a}	**1.32 ±0.411**
Tear load (Kg\cm^2)	39.81 ±5.72^{c}	46.76 ±7.38^{a}	33.70 ±2.93^{d}	42.86 ±4.82^{b}	33.60 ±3.28^{d}	**39.34 ±7.26**
Flexibility (Degree)	2.87 ±0.90^{bc}	3.63 ±0.67^{a}	3.27 ±0.83^{ab}	3.43 ±0.82^{a}	2.57 ±0.73^{c}	**3.15 ±0.87**

Values in same row with different superscripts differ significantly (P≤0.05)

Leather chemical quality of Sudan desert sheep:

Shugor Sudan desert sheep breed leather moisture percent was significantly different (p≥ 0.05) from all other studied breeds. These results were in line with Sudha *et al*. (2009); Salehi *et al*. (2014) and Passman and Sumner (1983) and their estimation for moisture percent of 11.3±0.2 on crust tanned sheep leather.

Leather Ash content determined values ranged between 2.84-2.88% for all Sudan desert sheep breeds. These results were statistically similar and no significant differences (p≥0.05)

were detected . However, these results were below the estimated value for the parameter (6.2±0.4percentage) that reported by Sudha *et al*. (2009); Salehi *et al*. (2014) and Passman and Sumner (1983).

Estimated values of fat contents within Sudan desert sheep leather were reported significant difference (p≥0.05) between breeds. These values of fat contents were in range 4-10%, which were different from Sarkar (1991) who reported that, the natural fat content of sheep skin after degreasing (reducing the natural fat content) ranged from 0.13-0.38%. Chrome oxide percent was significantly affected (p≥0.05) by breed (Table 2).

Table (2): the effect of Sudan desert sheep breed on chemical constituents of skins chosen for the study during 2012-2013.

Parameters	Breeds					Total
	Dubasi	Shugor	Watish	Kabashi	Hamari	
Moisture %	8.95±1.58^{bc}	11.60±1.97^{a}	9.53±1.13^{d}	8.18 ±1.53^{b}	8.61±1.40^{cd}	**9.37±1.94**
Ash%	2.88±0.32^{a}	2.84±0.33^{a}	2.88±0.26^{a}	2.88 ±0.30^{a}	2.87±0.34^{a}	**2.87±0.31**
Fat%	6.40±1.31^{c}	7.65±1.87^{a}	6.84±1.22^{abc}	7.46±1.51^{ab}	6.58 ±1.51^{ab}	**6.99 ±1.56**
Cr_2O_3%	2.93 ±0.38^{ab}	2.87 ±0.32^{ab}	2.93 ±0.23^{ab}	3.04 ±0.53^{a}	2.81 ±0.32b	**2.92 ±0.37**

Values in same row with different superscripts differ significantly (P≤0.05)

Conclusion:

All studied Sudan desert sheep breeds produced leathers with chemical and physical characteristics compatible with the quality standards required by the leather industry according to ISO standards. The Gezira and Butana breeds tended to produce slightly higher quality leather than the Kordofan breeds. Sudan Desert sheep leather is stout and had enough strength and with optimum required thickness for making shoes upper, but for it is more elasticity (elongation); which is not desirable for this article; thus, it can use for diabetics patients shoe's making for it is ability to enfold and contained foot shape easily.

References:

Alraed electronic newspaper (2010). Forage gap: threatening livestock - Chairman Prof. Ibrahim Ghandour - Editor-in-chief Rashid Abdul Rahim http://www.alraed-sd.com/porta.

AOAC -Association of Official Analytical Chemists- (1984). Official Methods of Analysis, 14th ed. AOAC, Washington DC, USA.

Ali, Q. A. (2004). Strategy of leather industry in Sudan reality and ambition- (workshop paper). National Center for leather technology in collaboration with a value-added project for African Leather, Khartoum, Sudan.

ATO -Arabic Tourism Organization- (2009). Tourism investment in Sudan. www.arabictourism.org (26.7.2009).

Craig, A. S.; Eikenberry E. F. and Parry D. A. D. (1987). Ultra structural organization of skin: classification on the basis of mechanical role. Connective Tissue Research. Vol.116:(213–223).

Darosa A. E. M and Agab H. .2013. Studies on some camel (*Camelus dromedarius*) production traits, health and constraints in Butana area, Sudan. College of Veterinary Medicine and Animal Production, Sudan University of Science and Technology, P O Box 204, Khartoum North, Sudan. E. mail: hamidagab@hotmail.com. http://animal.sustech.edu/index.php/College_of_Animal_Producation_Science_and_Technology/publication/Studies-on-some-camel-Camelus-dromedarius/?lang=en&pubno=124

Farah, Sheikh Eldin .2006. Proposed research projects, a multidisciplinary approach in natural resources management for food security, poverty alleviation and sustainable development in Kordofan states in western Sudan. University of Kordofan, Elobied, Sudan.

FAO (2009). Quarterly Bulletin of Statistic, Food and Agricultural organization, Rome, Italy. www.fao.org/docrep/012/i0680e/i0680e.pdf.

FAO (2008). Production of sheep and lamb skins – main countries (million pieces) - ICT estimates 2007- Food and Agriculture Organization, Rome, Italy.

Jacinto M A C, Da Silva Sobrinho A. G., Costa R. G. (2005). Anatomic and structural characteristics of wool and non-wool sheep (*Ovis aries* L.) in regard to the physico-mechanical aspects of the leather. Brazilian Journal of Animal Science, 33 (4): (1001-1008).

Idris A. O; Elemam M. B.; Kijora C; El-Hag F. M. and Salih A. M. (2010a_1). Effect of dietary supplementation, sex and birth type on body weight of desert ewes and their lambs'

growth performance in semi-arid area of Kordofan State, Sudan. Livestock Research for Rural Development23:(2). http://www.lrrd.org/lrrd23/2/cont2302.htm.

Idris, A.O.; El-Hag, F.M. Kijora, C. and Salih, A.M.(2010a_2). Effect of dietary supplementation on reproductive performance of Sudanese Desert sheep. Livestock Research for Rural Development. 22:(8).http://www.lrrd.org/lrrd22/8/idri22140.htm

ISO 2418:2002 (IULTCS/IUP 2, IULTCS/IUC 2). Leather -- Chemical, physical and mechanical and fastness tests -- Sampling location- http://www.iso.org/iso/catalogue_detail.htm?csnumber=30426

ISO 4044:2008 (IULTCS/IUC 3). Leather -- Chemical tests -- Preparation of chemical test samples. http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=43409

ISO 3376:2002 (IULTCS/IUP 6). Leather -- Physical and mechanical tests -- Determination of tensile strength and percentage extension. http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=24031

ISO 3378:2002 (IULTCS/IUP 12). Leather -- Physical and mechanical tests -- Determination of resistance to grain cracking and grain crack index. http://www.iso.org/iso/catalogue_detail.htm?csnumber=31149

ISO 5398-1:2007 (IULTCS/IUC 8-1). Leather -- Chemical determination of chromic oxide content - Part 1: Quantification by titration. http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=39873

ISO 5402:2002 (IULTCS/IUP 20). Leather -- Physical and mechanical tests -- Determination of flex resistance by flexometer method. http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=31306

ISO 3377-1:2002 (IULTCS/IUP 40). Leather -- Physical and mechanical tests -- Determination of tear load -- Part 1: Single edge tear. http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=24033

M.A.R.-Ministry of Animal Resources- (2008). Web site of the ministry. Khartoum, Sudan. http://www.marf.gov.sd/page.php%3Fid%3D32

Oliveira, R. J. F; Costa, R. G; Sousa, W. H and Medeiros, A. N. (2007). Influence of genotype on physico-mechanical characteristics of goat and sheep leather. Small Ruminant Research 73(1-3): (181-185).

http://www.smallruminantresearch.com/article/S0921-4488(07)00035-1/fulltext

Passman, A. and Sumner, R. M. W. (1983). Effects of breed and level of feeding on leather production from 18month-oldwethers. New Zealand. Journal of Experimental Agriculture, Vol. 11: (47-52) http://dx.doi.org/10.1080/03015521.1983.10427726.

Salehi, M.; Kadim, I.; Mahgoub, O.; Negahdari, Sh. and Eshraghi Naeeni, R. S. (2014). Effects of type, sex and age on goat skin and leather characteristics. Animal Production Science, 54: (638–644) http://dx.doi.org/10.1071/AN13032

Sarkar, K. T. (1991). Hide and skins processing technique. In: how to processing raw hide and skins in the tannery. Published by Indian Leather Producer Association, Second Avenue, Mahatima Gandhi Road, Madrus, India.

Sudha, T.B.; Thanikaivelan, Palanisamy;A., Kavati P.; Krishnaraj, K. and Chandrasekaran, B. (2009). Comfort, Chemical, Mechanical, and Structural Properties of Natural and Synthetic Leathers Used for Apparel. Journal of Applied Polymer Science, Vol. 114 :(1761–1767) - Published online 24 June 2009 in Wiley Inter Science (www.interscience.wiley.com).

SPSS (1996). Statistical Packages for the Social Sciences. Cary, North Carolina.

Teklebrhan, T.; Urge, M. and Mekasha, Y. (2012). Skin/leather quality of indigenous and crossbred (Dorper x Indigenous) F1 sheep. Haramaya University, School of Animal and Range Sciences, P.O Box 138, Dire Dawa, Ethiopia.

T.L.C. -Triple Line Consulting- (2002). Market Requirements for importers of African Hides and Skins - The Hides, Skins and Leather Sector in Africa- Essential Actions to Meet Quality Requirements of Importers- Revised draft report- submission to a Workshop in Tunis in October 2002- Triple Line Consulting Ltd- London, U.K.