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Leather Quality of Kabashi Desert Sheep

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Abstract

This trail was designed to study two subtypes of Kabashi desert sheep leather properties in relation to breed, age and sex. Five (5) pieces of fresh skins of each of rums, lambs and ewes from two subtypes (Kabashi and Hamari) of Sudan desert sheep were collected randomly from Elobaied leather Market at north Kordofan state, Sudan. Tanning and laboratory work was done in the National Leather Technology Centre, Khartoum, Sudan. The study data were analysed using the Complete Randomized Design (CRD). The results revealed that, lamb's skin produced significantly ($p \geq 0.05$) better quality leather than rum's and ewe's skins in elongation %, tensile strength (kg/cm^2), cracking load (kg), thickness (mm), tear load (kg/cm), flexibility and moisture%. While it yielded leather with the same characteristics to rum's and ewe's leather in Ash%, fat % and chrome%. Leather properties; elongation %, tensile strength (kg/cm^2), cracking load (kg), tear load (kg/cm), flexibility and Ash%; were significantly ($p \geq 0.05$) affected by breed variation. On the other hand thickness (mm), moisture%, fat% and chrome% were not significantly ($p \geq 0.05$) affected by breed of the animal.

Keywords: *Leather Quality; Kabashi; Desert sheep; Age; Sex; Breed*

Abbreviations: kg: kilogram; cm: centimeter; mm: millimeter.

Introduction

The sheep population of Sudan is about 49 million, over 36% of the livestock in the country. Most are the Desert sheep, which are distributed across the low rainfall savannah, semi-desert and desert zones [1]. The desert sheep are distributed north of latitude 10°N, extending eastward into Eritria and westward into Chad [2]. Desert sheep of the Sudan comprises seven sub-types, namely Kabashi, Hamari, Meidob, Beja, Butana, Gezira and Watish [3]. The desert sheep is raised mainly under extensive nomadic conditions depending on natural grazing. Kababish (the model of the ecotype) is further classified into tribal subtypes, Hamari, Kabashi, and Shanbali in West and North Kordofan and Darfur states [4,5]. The tribal subtype Kabashi is raised in the northern and eastern parts of North Kordofan and Darfur States while Hamari subtype is found in the western part of Kordofan and Darfur regions with different grades of crosses between these two tribal subtypes in the middle of the region. The main colours of Kabashi are brown, light brown and spotted black or red and white. The dominant colour of Hamari is red [6]. This trail is aimed to study two subtypes of kabashi desert sheep leather properties in relation to age and sex.

Materials and Methods

Study area

Skins samples were collected from Elobaied leather market, North Kordofan state in latitudes 11° 5′ - 13° 75′ N and longitudes 27° - 29° 5′ E in Sudan [7]. The area is located within the poor Savannah belt. The climate is warm in wet season, hot dry in summer and cool dry in winter. The rainy season is about four months (mostly from July to October), peaking at August and the annual average rainfall is between 300- 400 mm [8]. The soil is generally of smooth undulating sandy plain dissected by batches of loamy sand in the southern part. The dominant vegetation is a mixture of thorny trees, shrubs, herbs, where *Acacia senegal* is the most important type from economic

point of view, for it produces Gum Arabic which is considered as the best cash crop, *Acacia nilotica, Acacia nubica, Boscia senegalensis, Sclerocarya birrea, Guira sengegalensis, Albezzia amara, Terminalia browni and Combretum cordofanum are also available. Grasses include Dactyloctinium aegyptiun, Cenchrus biflorus, Echnochloa colonum, Eragrostis tremula, Andropogon gayanus, Zornia glockidata*, and *Ipomea cordiosepala* [9]. During the dry season there are two grazing periods a day. The first grazing period in the early morning and the second in the evening and the latter may extend to midnight. Animals rest during the hot hours of the day. Lambs may be herded alone or sometimes left to run with their dams until evening [8].

Skin samples collection and tanning procedures

Five (5) pieces of fresh skins of each of rums, lambs and ewes from two subtypes (Kabashi and Hamari) of Sudan desert sheep were collected randomly from Elobaied leather Market at north Kordofan state, Sudan. These skins were cured by salt-drying technique where the salt (common salt $Nacl_2$) was added as 1/3 of skin weight. The cured skins were transported to Khartoum national leather Centre for tanning and laboratory analysis. Leather was prepared from sheep skin according to the following main steps: Soaking, liming, de-liming, bating, degreasing, pickling, tanning, neutralization and re-tanning.

Sampling and assessment of chemical and physical characteristics were done according International Standards Organization (ISO) [10,11]. Physical properties like tensile strength and elongation percentage according to [12], Flexibility test [13] and tearing load and resistance to grain cracking [14,15] were assessed. Moisture, total Ash, fats and oils contents were determined according to described by society of leather trades chemists [16] and chromium content according to method ISO [17] procedures.

Statistical Analysis

The data were statistically analysed using Complete Randomized Design (CRD) [18]. Duncan's Multiple Range Tests (DMRT) was used for means separation.

Results and Discussion

Effect of age on leather quality of Kabashi desert sheep

As shown in table 1, elongation % was significantly affected ($p \geq 0.05$) by the age of the animal. The proper elongation percent was recorded at lamb and rum leather of 58.7 ± 2.8 and 58.3 ± 3.6 respectively. While for ewes, elongation percent was 65.8 ± 2.9 which exceeded the accepted limit for upper, garment and lining leather that estimated at 60% by SSMO [19-21]. Tensile strength (kg/cm^2) results were significantly affected ($p \geq 0.05$) by animal age, and in the suitable standard of [19-21] for upper, lining and garment leather. Cracking load (kg) was significantly affected ($p \geq 0.05$) by animal age, and the high records were obtained at lamb's leather followed by rum's leather and last ewe's leather. Thickness (mm) results were significantly affected ($p \geq 0.05$) by animal age, and the higher value was seen in lamb's leather of 1.57 ± 0.1 mm. Thickness results were according to Sudanese standard and metrology organization (SSMO) standards for upper, lining and garment leather [19-21]. The high records of Tear load (56.4 ± 1.5 kg/cm) were assessed in lamb's leather and it significantly different ($p \geq 0.05$) from those of rums and ewes leather. Lamb's leather scored better level of flexibility of 1.4 ± 0.7 followed by ewe's leather of 2.3 ± 0.9 and the least one was observed in rum's leather of 3.6 ± 0.8.

Chemical contents of Ash%, fat %and chrome% of sheep leather were not affected ($p \geq 0.05$) by the animal age. While moisture% results were significantly affected ($p \geq 0.05$) by the animal age. The high content of moisture of 12.8 ± 1.7 was reported at ewe's leather of Kabashi sheep. All chemical constituents were in agreement with SSMO standards for leather chemical thresholds [19-21].

Quality parameters	Ages		
	Rum	Ewe	Lamb
Elongation %	58.3 ± 3.6^{B}	65.8 ± 2.9^{A}	58.7 ± 2.8^{B}
Tensile strength (kg/cm^2)	186.80 ± 12.9^{B}	159.10 ± 13.1^{C}	206.40 ± 12.3^{A}
Cracking load (kg)	19.2 ± 1.1^{B}	16.1 ± 1.4C	22.5 ± 1.3^{A}
Thickness (mm)	1.34 ± 0.1^{B}	1.22 ± 0.1^{C}	1.57 ± 0.1^{A}

Tear load (kg/cm)	43.5 ± 1.4^{B}	33.6 ± 1.2^{C}	56.4 ± 1.5^{A}
Flexibility degree	3.6 ± 0.8^{A}	2.3 ± 0.9^{B}	1.4 ± 0.7^{C}
Moisture%	9.6 ± 2.1^{B}	12.8 ± 1.7^{A}	9.7 ± 1.9^{B}
Ash%	2.74 ± 0.2^{A}	2.75 ± 0.1^{A}	2.64 ± 0.3^{A}
Fat %	4.07 ± 0.4^{A}	3.78 ± 0.7^{A}	4.30 ± 0.5^{A}
Chrome%	3.08 ± 0.5^{A}	3.02 ± 0.7^{A}	3.01 ± 0.6^{A}

Table 1: *Effect of age on leather quality of Sudan Kabashi desert sheep during January 2015. Means in the same row with the same letter are not significantly different (p ≥ 0.05).*

Effect of breed type on leather quality of Kabashi desert sheep

As shown in table 2, elongation percents were significantly (p ≥ 0.05) affected by breed. Hamari Sudan desert sheep breed was exhibited the highest elongation percent of 64.93 ± 3.1. These results were higher than those reported by Sudha [22], Salehi., *et al*. [23], Passman and Sumner [24]. Otherwise, these findings were similar to Teklebrhan., *et al*. [25], Craig., *et al*. [26] and Jacinto., et al. [27] while native Ethiopian sheep lamb leathers, had higher tensile strength and percentage elongation at break. Tensile strength kg\cm^2 was statistically different (p ≥ 0.05.) between Hamari and Kabashi subtypes. Teklebrhan., *et al*. [25], Ebrahiem., *et al*. [28] and Oliveira ., *et al*. [29] a statistically reported similar tensile strength in lambs of Ethiopian sheep breeds. However, it is below the estimated value for the parameter (203.6 ± 5.1 kg /cm^2) that studied by Sudha [22], Salehi., *et al*. [23], Passman and Sumner [24]. In addition, these results were in line with Teklebrhan., *et al*. [25], Craig., *et al*. [26] and Jacinto., *et al.* [27] who reported that, the native Ethiopian sheep lamb leathers had numerically higher tensile strength and percentage elongation at break. This is indicative 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 by breed. Kabashi subtype was scored high load of 23.33 ± 3.6. Similar results of significant difference were reported by Sudha [22], Salehi., *et al*. [23], Passman and Sumner [24] and Ebrahiem., *et al*. [28] when they studied different breed's leather proprieties. Craig., *et al*. [26] and Oliveira., *et al*. [29] 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 statistically comparable between Hamari and Kabashi subtypes. This result was in line with Sudha [22], Salehi., *et al*. [23], Passman and Sumner [24], Ebrahiem., *et al*. [28] and Oliveira., *et al*. [29] who observed that, thickness of skin was not affected by sheep lamb breed and high degrees of homogeneity in thickness among different genotypes was obtained. Kabashi Sudan desert sheep subtype scored the tear load of 54.47 ± 10.5 kg/cm and which was statistically higher (p ≥ 0.05) than that of Hamari subtype (44.53 ± 8.9 kg/cm). These findings were similar to observations of Sudha [22], Salehi., *et al*. [23], Passman and Sumner [24] and Ebrahiem., *et al*. [28] On crust tanned sheep leather from different types.

Hamari subtype scored the better degree of flexibility (2.13 ± 1.1). This value was significantly different (p ≥ 0.05.) than that was scored by Kabashi (3.73 ± 1.3). Similar result of significant difference in flexibility properties among desert sheep breeds was detected by Ebrahiem., *et al*. [28], Teklebrhan., *et al*. [25] and Oliveira., *et al.* [29] reported no significant difference when they studied different sheep leather of different breeds. No significant difference was detected (p ≥ 0.05) on moisture% between the two studied subtype of Kabashi desert sheep. This result is different from which was reported by Ebrahiem., *et al*. [28] who detected significant difference among Sudan desert sheep subtype leather moisture percent. Otherwise, this result is in line with Sudha [22], Salehi., *et al*. [23], Passman and Sumner [24] on crust tanned sheep leather.

Significant different (p ≥ 0.05) was detected on leather Ash of Hamri and Kabashi subtypes of desert sheep. Ebrahiem., *et al*. [28] reported insignificant difference in desert sheep. However, these values of Ash% of 2.88 and 2.54 for Hamri and Kabashi subtypes leather were lower than that reported by Sudha [22], Salehi., *et al*. [23] and Passman A and Sumner [24].

No significant difference ($p \geq 0.05$) was detected in leather fat% between Hamri and Kabashi subtypes. Different result was reported by Ebrahiem., *et al*. [28] who observed that, fat contents within Sudan desert sheep leather were significantly different ($p \geq 0.05$) between breeds. These values of fat contents were in estimated range of natural fat content of sheep leather after degreasing (reducing the natural fat content) that ranged from 3-5% Sarkar [30].

No significant difference was detected at chrome% between desert sheep subtypes. However according to Ebrahiem., *et al*. [28] Chrome oxide percent was significantly affected ($p \geq 0.05$) by breed.

Quality parameters	Breeds	
	Hamari	Kabashi
Elongation %	64.93 ± 3.1^{A}	59.27 ± 3.7^{B}
Tensile strength (kg/cm^2)	168.80 ± 29.3^{B}	189.40 ± 32.1^{A}
Cracking load (kg)	19.13 ± 3.7^{B}	23.33 ± 3.6^{A}
Thickness (mm)	1.37 ± 0.2^{A}	1.39 ± 0.2^{A}
Tear load (kg/cm)	44.53 ± 8.9^{B}	54.47 ± 10.5^{A}
Flexibility degree	2.13 ± 1.1^{B}	3.73 ± 1.3^{A}
Moisture%	10.47 ± 2.2^{A}	10.93 ± 2.7^{A}
Ash%	2.88 ± 0.2^{A}	2.54 ± 0.2^{B}
Fat %	3.79 ± 0.7^{A}	4.31 ± 1.1^{A}
Chrome%	3.09 ± 0.6^{A}	2.98 ± 0.5^{A}

Table 2: *Breed effect on leather quality of Sudan Kabashi desert sheep during January 2015. Means in the same row with the same letter are not significantly different ($p \geq 0.05$).*

Conclusion

Lamb's skin was exhibited better quality leather than rum's and ewe's skins in most of leather quality parameters. . Breed variation affected on leather physical properties. On the other hand leather chemical parameters were not affected by breed. From this study it can be concluded that leather quality of Kabashi subtype was superior to Hamari subtype.

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