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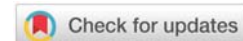
***Corresponding author:** Mohammed Alhadi Ebrahiem, Department of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan, Email: mahaali5656@gmail.com

ORCID: <https://orcid.org/0000-0003-545-1242>

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Research Article

Western Sudan Arabi camel hides attributes and leather quality characteristics

Mohammed Alhadi Ebrahiem* and Idris Adam Idris

Department of Animal Production, Faculty of Natural Resources and Environmental Studies, University of Kordofan, Sudan

Abstract

This study was aimed to evaluate camel hide attributes and leather quality characteristics of Western Sudan Arabi camel. Thirty pieces of fresh camel hides from three subtypes of Western Sudan Arabi camel ecotype (10 pieces from each of Kababish, Meidob, and Hawawir subtypes) were collected, cured, and tanned. Physical and chemical quality parameters were assessed. The data were analyzed using the Complete Randomized Block design. The results revealed that Significant differences ($P \leq 0.05$) were detected among Western Sudan Arabi camel subtypes fresh hides thickness and weight. Kababish hide thickness and weight were recorded the highest value of 0.155 ± 0.4 cm and 11.7 ± 1.3 Kg respectively in comparison to Meidob (0.145 ± 0.3 cm and 8.6 ± 1.2 Kg) and Hawawir (0.143 ± 0.4 cm and 7.7 ± 2.2 Kg). Kababish hides thickness value was above the minimum Sudanese standard threshold specification for cattle leather quality. While Meidob and Hawawir hide thickness values were below the minimum Sudanese standard threshold specification for cattle leather quality. Physical quality parameters; elongation, tensile strength, resistance to grain cracking, breaking load, and tear strength; were in the Sudanese standard threshold specification for cattle leather physical quality of 100%, 200 Kg/cm², 7N/cm, 8 N/cm, and 100 Kg/cm² respectively. Whilst flexibility parameter was below the Sudanese standard threshold specification for cattle leather quality. Chemical quality parameters were in the Sudanese standards threshold specification for cattle leather chemical quality of 18%, 4.5%, 2.5%, and 11% for moisture, Ash, chrome oxide, and fat contents respectively.

Introduction

Camels constitute 22% of the animal census in Sudan and 26.3% of the camel population in the Arab world. The estimation of the camel's population in Sudan was about 3,908 thousand heads [1]. These camels are spread in a belt that extends between latitudes 12–16N [2]. Since their domestication, camels have played a vital role in the daily life of many societies, where other livestock farming operations cannot be easily practiced [3]. Camels provide humans with a range of products and services, from fine wool to meat, milk, and draught power. Camels have the ability to go for long periods without water and live on thorny and high fiber diets, stand high altitudes, and extreme temperatures, making them one of the few families well adapted for food and agricultural production under harsh semi-desert environments [2,4].

Camels in Sudan and elsewhere are classified as a pack (heavy) and riding (light) types according to their function. Recent studies had been made to classify the camels according to their performance like dairy camels, meat camels, dual-purpose camels, and racing camels [1,5]. The Arabi Type is a heavy type that makes up the majority of the camel maintained by nomads about 80% [6]. They are sub-grouped into Arabi types and Rashaidi (Sawahli) types.

The Arabi type found in Kordofan, Darfur, and the Blue Nile constitute about 96%, and in eastern Sudan, it is about 55% of the total in that area. Most of the Sudanese camels are large heavy massive types with slow mobility [6]. Mainly the Arabi type is described as a large heavily built animal with a well-developed hump, and it has short hair except in the shoulder and hump. The mature camel weighs about 400– 500 kg as a

life weight, and can carry about 275 Kg over 25–30km per day, and is sandy gray. In western Sudan, the Meidob and Hawawir have herds of comparatively lightweight camels; some of which can be ridden [7].

Materials and methods

The study area

Kordofan region is located between latitudes $9^{\circ}:30' - 16^{\circ}:30'$ North and longitudes $24^{\circ} - 32^{\circ}:25'$ East. The region consists of North, West, and South states forming a total area of 380,000 Km² (90 million feddan). Each of the three states existed independently of one another while subscribing to the authority and jurisdiction of the federal government [8].

Selection of experiment camel hides

Thirty (30) pieces of fresh camel hide from three (3) Arabi camels' subtypes (10 pieces from each of Kababish, Meidob, and Hawawir subtypes) which bring from different geographical areas from West Sudan (Kordofan Rejoin).

Tanning procedures

Leather was prepared from camel hides according to the following main steps: Soaking, Liming, Deliming, Bating, Pickling, Tanning, Neutralization, and Re-tanning (Table 1). Sampling and assessment of chemical and physical characteristics were done according to SSMO (Sudanese Standard and Meteorology Organization) methodology. Physical properties that were assessed are: Tensile strength and elongation% according to [9], Flexibility test according to [10] and Measurement of tearing load and resistance to grain cracking according to [11]. Whilst, chemical characteristics were: moisture% according to [12], total Ash% According to SSMO2 (2006), fats and oils% according to [13], and chromium% according to [14] procedures.

Statistical analysis

The data were statistically analyzed according to Complete Randomized Block Design using SPSSv.14.0 software package [15]. LSD test was used for means separation, besides comparing skin and leather measurements results with Sudanese Standard thresholds for leather quality according to SSMO standards.

Results and discussion

Western Sudan Arabi camel fresh hides attributes

Significant differences ($P \leq 0.05$) were detected among Western Sudan Arabi camel subtypes fresh hides thickness. Kababish subtype of Western Sudan Arabi camel was scored the highest value of 0.155 ± 0.4 cm in comparison to 0.145 ± 0.3 cm and 0.143 ± 0.4 cm for Meidob and Hawawir subtypes respectively (Table 2). Kababish subtype hide thickness value was above the minimum Sudanese standard threshold specification for cattle leather quality. While Meidob and Hawawir Arabi camel subtypes their hide thickness values were blown the minimum Sudanese standard threshold for cattle leather

Table 1: Experiment tanning procedures.

Process	Water %	Chemical material	Chemical %	Time
Soaking	300	Common water		14-16 hrs
Unhairing	100	Sodium Sulfide	2	90 min
		Sodium Sulfide	2	90 min
Liming	80	Calcium hydroxide	3.5	12 hrs
Deliming	100	Ammonium sulfide	1	1h
		Ammonium sulfide	1	1h
Bating		Orbon (Zymex-R)	0.5	30min
Pickling	80	Sulfuric acid	1.5	15min
Tanning		Chrome	3	2hrs
		Chrome	3	2hrs
		Chrome	1	2hrs
Neutralization	100	Sodium by carbonate	1.5	30min
Retanning		Chrome sulfate	1	1h
		Sodium by carbonate	1	30min
		Fat	6	1h
		Mimosa	6	1h

Table 2: Western Sudan Arabi camel fresh hides attributes.

Attribute	Kababish	Meidob	Hawawir	Standard
Thickness/cm	0.155 ± 0.4^a	0.145 ± 0.3^b	0.143 ± 0.4^b	Minimum 0.150 cm
Weight/Kg	11.7 ± 1.3^a	8.6 ± 1.2^b	7.7 ± 2.2^b	

Values in the same row with the same superscripts do not significantly differ at 0.05

quality. Generally the thicker the hide is plump and stout. The properties of leather and its uses depend on the characteristic of the fiber bundles such as fullness, disorderliness, compactness, straightness, delineation, boldness, splitting, and separation. Poor nutrition causes an animal to be smaller and the skin or hide to be thinner and to be a poorer substance [8].

Also, Significant differences ($P \leq 0.05$) were detected among Western Sudan Arabi camel subtype's fresh hide's weights. Kababish subtype of Western Sudan Arabi camel has scored the highest value of 11.7 ± 1.3 Kg in comparison to 0.145 ± 0.3 Kg and 7.7 ± 2.2 Kg for Meidob and Hawawir subtypes respectively (Table 2). [16,17] stated that the most prominent features of fresh hides and skins (from cattle, and sheep/goats respectively) are their size, pelage, and color. All these are more or less closely related to the breed of the animal. 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. Accordingly, the hide of a 1,000 kg bull may be as much as 110 kg while the skin of small (25 Kg) sheep or goat may be as little as 1.8 kg (less in the case of a lamb or kidskin). This variation in size has innumerable implications during the course of tanning and will be referred to later.

Western Sudan Arabi camel leather physical quality parameters

Significant differences ($P \leq 0.05$) were detected within the parameters' values of elongation, tensile strength, breaking



load, and flexibility respectively. The highest elongation% and tensile strength Kg/cm², breaking load N/cm and flexibility% values of 44.73±2.2%, 225±6.5 Kg/cm², 9.84±0.55 N/cm and 87.20±3.9% respectively, were reported for Kababish subtype leather. On the other hand, no significant differences (P≥0.05) were detected among the values of resistance to grain cracking and tear strength parameters respectively. The highest resistance to grain value and tear strength of 6.74±1.8 N/cm and 95.56±5.3 Kg/cm² were reported for Hawawir subtype leather. Elongation, tensile strength, resistance to grain cracking, breaking load, and tear strength parameters were in the Sudanese standard threshold specification for cattle leather quality. These results confirm with [18] who mentioned that camel leather physical quality elongation percentage, tensile strength, resistance to grain cracking and breaking load of 33.85±10.42%, 207.97±11.32 Kg/cm², 6.35±0.69 Kg/cm², 7.57±0.68 Kg/cm² respectively were in the Sudanese, Indian and Europe standards for leather quality of 45%, 200 Kg/cm², 7.0 Kg/cm² and 8.0 Kg/cm² for the mentioned characteristics respectively. Whilst flexibility parameter was below the Sudanese standard threshold specification for cattle leather quality [18] found that, flexibility parameter for Arabi camel was 59.3±3.77% and blew the Sudanese, Indian, and European standards for leather quality of 100% for the mentioned characteristic (Table 3).

Western Sudan Arabi camel leather chemical quality parameters

Significant differences (P≤0.05) were detected among moisture and chrome oxide content values respectively. But no significant differences (P≤0.05) were observed among Ash and fat contents values respectively. Chemical quality parameters were in the Sudanese standards threshold specification for cattle leather quality of 18%, 4.5%, 2.5%, and 11% for moisture, Ash, chrome oxide, and fat contents respectively. These results confirm [18-22] who mentioned that camel leather chemical quality parameters; moisture, Ash, chrome oxide, and fat of 4.61±0.26%, 6.21±0.30%, 3.28±0.29%, and 9.46±0.38% respectively were in the Sudanese, Indian and Europe standards for leather quality of 18%, 4.5%, 2.5% and 11% for the mentioned characteristics respectively (Table 4).

Table 3: Western Sudan Arabi camel leather physical quality.

Parameter	Kababish	Meidob	Hawawir	Standard
Elongation%	44.73±2.2 ^a	33.22±6.5 ^b	31.60±7.8 ^b	Maximum 45%
Tensile strength Kg/cm ²	225±6.5 ^a	208±5.3 ^b	209±3.6 ^b	Minimum 200 kg/cm ²
Resistance to grain cracking N/cm ²	6.46±0.6 ^a	6.84±0.8 ^a	6.74±0.8 ^a	Minimum 7.0 N/cm
Breaking load N/cm ²	9.84±0.55 ^a	7.84±0.42 ^b	8.03±0.5 ^b	Minimum 8.0 N/cm
Tear strength Kg/cm ²	95.54±7.1 ^a	90.92±6.5 ^a	93.56±5.3 ^a	Minimum 100 kg/cm ²
Flexibility%	87.20±3.93 ^a	65.30±2.7 ^b	63.40±2.6 ^b	Minimum 100%

Values in the same row with the same superscripts do not significantly differ at 0.05

Standards: Sudanese standards (SSMO 8,9, 18, 19,20).

Table 4: Western Sudan Arabi camel leather chemical quality.

Parameter	Kababish	Meidob	Hawawir	Standard
Moisture%	8.40±0.3 ^b	9.75±0.6 ^b	11.66±0.4 ^a	Maximum 18%
Ash%	6.20±0.3 ^a	6.27±0.8 ^a	6.34±0.2 ^a	Minimum 4.5%
Fat%	9.40±0.5 ^a	9.38±0.3 ^a	9.58±0.7 ^a	Maximum 11%
chrome oxide%	3.88±0.5 ^a	3.53±0.5 ^b	3.23±0.4 ^b	Minimum 2.5%

Values in the same row with the same superscripts do not significantly differ at 0.05

Standard: Sudanese standards (SSMO 11,1 2, 13, 21).

Conclusion

Camel leather is similar in its quality to cattle leather. Therefore camel leather is suitable for manufacturing all types of leather articles those cattle leathers are used for. But with less quality in flexibility which will reflect in the less expected lifetime of camel leather articles in comparison to cattle leather articles.

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