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Defects and Grading of Hides and Skins in Kordofan Region, Sudan

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ABSTRACT

This study was carried out at Elobeid, Elnohud and Babanosa locations of Kordofan region, Sudan. The main objective was to study hides and skins production defects which may, contribute to down grading the value of raw material. 75 pieces from each of cattle hides and goat skins and 100 pieces of sheep skins were randomly selected for grading in each location. Also 10 pieces of defected and damaged hides and skins were chosen for tanning and leather quality assessments. The data were analyzed using frequencies and percentages. Grading results indicated that the most common defects to Kordofan hides and skins was flaying defects, followed by branding on cattle hides, putrefactive taints, mechanical damages, inadequate salting defects, and lastly skin diseases defects. Chemical and physical tests results reflected the poor quality tanning, limited flexible, less durable and a low aesthetic of the produced leather from defected hides and skins.

Keywords: Defects, Skins, Hides, Grading.

INTRODUCTION

The contribution of hides and skins in national economy of the Sudan is significant (18.7 million Dinars) from exporting of about 9 million pieces of sheep skins, 7 million of goats skins, 3 million pieces of cow hides, million pieces of snakes skins and 22640 pieces of desert lizard (*warals*) skins. In proportion to the livestock which is estimated at 103 million of cattle, sheep, goats and camels, it could be seen that, hides and skins form a huge natural resources, for various reasons the full potential of such material is not realized (MAWF, 2004) .

Hides and skins obtained from slaughter houses are estimated at 21.5 % of cattle hides, 17.1% of sheep skins and 8% of goat skins. These rates are estimated by Said *et al.*, (1999) according to the proportion of animal numbers slaughtered in the acceptable slaughter houses with an annual rate of meat consumption. It could be seen that large numbers of hides and skins are never recovered and may be allowed to be wasted chiefly as a result of many

defects. Wastage percentage of hides and skins are estimated at 5% from cow hides, 10% of sheep and goat skins and 8% of camel hides. In addition to a huge number of hides and skins wasted as a result of inadequate storing, transporting and handling. So this trail was designed to study hides and skins production defects which may, to greater or lesser degree, contribute to down grading the value of raw material.

MATERIALS AND METHODS

Hides and 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. The rainfall ranges between 600 mm/year in the southeast 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, Dactylocteniun aegyptium and Eragrostis tremula (Ebrahiem *et al*., 2015a and b).

Tannery Grading

75 pieces from each of cattle hides and goat skins and 100 pieces of sheep skins were randomly selected for grading in each location (Elobeid, Elnohud and Babanosa). Some of hides and skins defects cannot be observed in raw material, that is why a requisition of Kordofan hides and skins were followed and graded from raw material up to tanning stage. Losses were reported during the different stages of tanning process.

Laboratory Work

Sampling

Skins and hides with following conditions were sampled for tanning and analysis:

A- Skin diseases and infections

- One piece of sheep and goats skin and one piece of cattle hide, infected with mange, were selected randomly.
- One piece of sheep and goats skin and one piece of cattle hide, infected with ringworm were also selected randomly.
- One cow hide was intended for *cutaneous streptothericosis* disease.

B- Parasites

- One piece of sheep and goats skin and one piece of cattle hide, damaged by external parasites, were selected randomly .
- One piece from each of sheep, goats and cattle, with store damage, were also selected randomly .

C-Mechanical Damage

- One piece from each of sheep, goats and cattle, with brand and flaying damage, was selected randomly .

D- Putrefaction Damage

- One piece of sheep, goats and cattle, with foul and bacterial attack, was chosen randomly .

E- Nutritional deficiency

- Two pieces of skins representing sheep and goats were selected randomly for nutritional deficiency.

F-Drying Defects

- One piece from each of sheep, goats and cattle red heated damaged, was selected and also the same samples were taken from sun dried ones .
- Three pieces were taken one from each of the three animal species as upgrade samples (free from defects as control).

Tanning Procedure and Lap-Quality Tests

Leather was prepared from goat skin according to the following main steps: Soaking, liming, deliming, bating, degreasing, pickling, tanning, neutralization and re-tanning.
Sampling and assessment of chemical and physical characteristics were done according International Standards Organization (ISO2418, 2002 and ISO 4044, 2008). Physomechanical 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 SLTC Society of Leather Trades Chemists- (1965) and chromium content according to ISO5398-1(2007) procedures.

Analysis Method

The data were statistically analysed using frequencies and percentages according to SPSS v.14.0 software package (SPSS, 1996).

RESULTS AND DISCUSSION

Tannery Grading

Raw material hides and skins regarding both before and after tanning reflected that the most common defects to Kordofan cattle hides were poor flaying which is resulted in 28% of damages and 12% of wasting, followed by branding, putrefaction, mechanical damages and lastly diseases 2% and 3% of damages both before and after tanning and 2% of wasting. Also in sheep skins flaying defects were the most common which cause 8% and 10% of damages both before and after tanning and 10% of wasting, followed by putrefaction, diseases and lastly red heat taints which resulted in 3% and 4% of damages both before and after tanning and 4% of wasting. As in cattle and sheep skins, the most common damages to goat skins were flaying defects which resulted in 4% of damages and 4% of wasting, followed by diseases and lastly putrefaction which resulted in 2% of damages and 2% of wasting (Table1).

Table 1: Grading results of Kordofan transported hides and skins for tanneries

	Grading	Flaying		Brand		Mecha		diseases		Putref		Red heat	
		No	%	No	%	No	%	No	%	No	%	No	%
Cattle Hides (322)	Before Tanning	90	28	54	17	32	10	4	2	29	9	-	-
	After Tanning	90	28	54	17	36	11	7	3	35	11	-	-
	Wastage	40	12	34	11	8	3	4	2	25	8	-	-
Sheep skins (598)	Before Tanning	45	8	-	-	-	-	25	4	29	5	21	3
	After Tanning	57	10	-	-	-	-	29	5	37	6	27	4
	Wastage	57	10	-	-	-	-	29	5	37	6	27	4
Goat shins (1050)	Before Tanning	35	3.5	-	-	-	-	34	3.4	17	2	35	3.5
	After Tanning	35	3.5	-	-	-	-	40	4	20	2	39	3.9
	Wastage	35	3.5	-	-	-	-	40	4	20	2	15	1.5

Laboratory Work

Chemical Analysis

Chemical analysis of cattle leather samples revealed that ticks infection, flaying defects, branding damages and upgrade were higher than Sudanese standard level for chrome oxide contents. While mange, ringworm, *streptothricosis*, store, putrefactive and red heated damaged samples were lower than upgrade and Sudanese standard level. All samples were above Sudanese standard level in their ash contents. Flaying defects, branding damage and upgrade samples in their fat contents were in Sudanese standard range. Concerning moisture contents, all samples were within the range of Sudanese standard range (Table 2). Whereas the chemical analysis of sheep leather samples showed that, mange infected, ticks damaged, storing defected, flaying damaged and upgrade in their chrome oxide exceeding Sudanese standard level for shoe upper mineral tanned (Table3).

Table 2: Chemical analysis of upgrade and defected cattle leather samples from Kordofan region

Sample	Chrome oxide %	Ash%	Fat%	Moisture%
Mange	3.16	2.51	2.61	9.23
Ringworm	3.06	2.22	1.89	8.25
Streptothricosis	2.78	2.32	2.52	11.62
Ticks	3.51	2.96	2.95	10.82
Store damaged	2.99	2.87	1.76	7.06
Flaying defected	3.53	2.57	3.87	10.05
Branding	3.49	2.91	3.56	9.12
Putrefaction	2.66	2.01	2.44	16.71
Salting defected	3.11	2.06	1.66	14.01
Sun dried	-	-	-	-
Upgrade	3.53	2.92	4.01	9.66
Standard	3.5	2	3-7	not exceed 18

Table 3: Chemical analysis of upgrade and defected sheep leather samples from Kordofan region

Sample	Chrome oxide %	Ash%	Fat%	Moisture%
Mange	3.51	2.88	2.21	11.33
Ringworm	2.41	2.01	2.01	9.33
Ticks	3.52	2.71	2.22	12.02
Store damaged	3.56	2.81	1.95	6.66
Flaying defected	4.51	2.82	3.05	7.72
Putrefaction	3.01	2.92	2.26	7.92
Red heated	2.96	2.05	1.99	9.69
Sun dried	-	-	-	-
Nutrition deficiency	-	-	-	-
Upgrade	3.68	2.98	3.96	6.62
Standard	3.5	3	not less than3	not exceed 15

The leather samples which were taken for chemical analysis from the defected hides and skins showed less contents of chrome oxide and fat contents. This reflected the less acceptability to chrome tanning and hence alkali retaining. On the other hand, flaying, branding and bad storing defected samples were successfully tanned. Similar samples were poor in their physical properties according to tensile strength, breaking load, elongation percentages and flexibility tests. This may be in one line with Devassy and Argaw (1989) and Elliott (1981) opinion that best quality properties of leather are plump or stout and its uses depend on the characteristic of the fiber bundles such as fullness, disorderliness, compactness etc... Taking in account tensile strength gives an idea about the fiber strength of the leather and it also depends on moisture and fat contents of the leather. When moisture and fat contents go down, the leather shows lower tensile strength. Similar results were obtained when the fat content of the leather goes down.

Leathers Ash contents in all samples except upgrade were lesser than in Sudanese standard level. Fat contents only in flaying defected and upgrade samples were above Sudanese standard threshold. All samples in their moisture contents were in Sudanese standard range for shoe upper mineral tanned leathers (Tables 2, 3 and 4).

Chemical analysis of goat leather samples in their showed lesser contents of chrome oxide in most of it except flaying defected which was above Sudanese standard level for chrome oxide contents. All samples except flaying defected and upgrade showed low values of fat contents when compared with Sudanese standard range for fat determination threshold in shoe upper mineral tanned leathers. All samples moisture contents were in Sudanese standard range of determined moisture (Table 4).

Table 4: Chemical analysis of upgrade and defected goat leather samples from Kordofan region

Sample	Chrome oxide%	Ash%	Fat%	Moisture%
Mange	2.11	2.51	2.77	9.33
Ringworm	2.05	2.89	2.01	8.32
Ticks	2.76	2.78	2.87	7.01
Store damaged	2.96	2.61	2.88	9.53
Flaying defected	3.51	2.96	3.02	6.64
Putrefaction	2.87	2.01	2.76	9.33
Red heated	2.98	2.70	2.85	10.22
Sun dried	-	-	-	-
Nutrition deficiency	-	-	-	-
Upgrade	3.59	2.87	3.51	9.21
Standard	3.5	3	not less than3	not exceed 15

Physical Analysis

Physical tests always give an idea about future live of tanned leathers when used in article purposes. Flexibility and tensile strength is the most common tests needed to determine leathers viability especially in manufacturing leather goods. In all cattle's studied samples breaking load (Kg/cm^2) showed less values both in perpendicular and parallel taken specimens, while upgrade recorded less variation under Sudanese threshold for shoe upper mineral tanned leathers. Tensile strength was determined depending on breaking loads, which resulted in low values for all samples except branding damaged perpendicular only and upgrade specimens than Sudanese standard threshold. Elongation percentages in all samples were under Sudanese standard threshold for shoe upper mineral tanned leathers. Mange infected, store damaged and red heated specimens the lesser degree than Sudanese standard threshold for flexibility test, followed by branding damaged and putrefactive tainted, then poor flayed and streptothricosis infected and lastly ringworm infected and ticks damaged (table 5).

Table 5: Physical analysis of upgrade and defected cattle leather samples from Kordofan region

Samples	Tested specimen	Breaking load kg/cm^2	Tensile strength kg/cm^2	Elongation %	Thicknes s mm.	Flexibility test
Mange	Perpendicular	63.4	247.7	26.3	1.28	6
	Parallel	78.6	197.0	33.6	1.99	
Ringworm	Perpendicular	53.1	157.1	29.5	1.69	2
	Parallel	39.1	118.5	30.8	1.56	
Streptohtricosis	Perpendicular	29.9	95.2	27.7	1.57	3
	Parallel	21.9	64.8	19.5	1.69	
Ticks damaged	Perpendicular	54.0	143.6	30.7	1.88	2
	Parallel	52.6	137.0	29.1	1.92	
Store damaged	Perpendicular	55.6	162.6	33.2	1.71	6
	Parallel	54.6	153.4	14.9	1.78	
Flaying	Perpendicular	64.4	196.3	60.1	1.64	3
	Parallel	68.0	172.6	55.4	1.97	
Branding	Perpendicular	93.9	255.2	23.1	1.84	5
	Parallel	69.6	186.1	28.9	1.87	
Putrefied	Perpendicular	50.1	130.4	14.4	1.92	5
	Parallel	47.8	125.1	16.8	1.91	
Red heated	Perpendicular	36.5	97.6	22.1	1.87	6
	Parallel	32.6	94.8	25.1	1.72	
Sun dried		-	-	-		
Upgrade	Perpendicular	98.7	288.6	64.0	1.71	1
	Parallel	94.8	280.5	61.1	1.69	
Sudanese Standard		100	250	65	1.4-2.2	-

Physical analysis for sheep leathers samples indicated that all specimens except upgrade were under the Sudanese standard threshold for breaking load in shoe upper mineral tanned leathers. Also all samples, except upgrade specimens and flaying damaged backbone parallel specimen records lesser tensile strength values in comparing to Sudanese standard. Only upgrade backbone perpendicular specimen was in Sudanese standard threshold for elongation percentage. Store damaged and bacterial putrefied specimens showed the lesser values to Sudanese standard threshold for flexibility, followed by mange infected and red heated, then flaying damaged and lastly ticks damaged and ringworm infected specimens (Table 6).

Most of goat samples which were taken for physical tests showed less values in breaking load compared to Sudanese standard for shoe upper mineral tanned leathers, where ticks damaged parallel taken specimen to the backbone, red heated perpendicular taken specimen to the backbone and upgrade in both parallel and perpendicular to the backbone specimens were in and above the minimum threshold of Sudanese standard. Flaying defected and the upgrade in their perpendicular and parallel specimens were only above the Sudanese standard minimum threshold in determining tensile strength for shoe upper mineral tanned leathers. Elongation percentages for all samples were under the minimum Sudanese standard threshold. Ringworm infected, store damaged and red heated specimens recorded the lowest degree of flexibility; followed by putrefied damage, mange infected, ticks damage and flaying defected specimens respectively in comparison to Sudanese standard threshold (Table 7).

Under sun dried hide and skins and nutritional deficiency skins were totally lost in the beam house operations during fleshing process (Tables 2, 3,4,5,6 and 7). Exposing to sun rays during preservation and nutrition deficiency tainted hides and skins samples were giving rise to loss of the grain, even with loss of portions. This is in line with Devassy and Argaw (1989); Aten *ea al*., (1985) and Elliott (1981) who mentioned that the hide or skin being submitted to sun rays will become hotter and therefore will stew instead of drying.

Table 6: Physical analysis of upgrade and defected sheep leather samples from Kordofan region

Samples	Tested specimen	Breaking load kg/cm^2	Tensile strength kg/cm^2	Elongation %	Thicknes s mm.	Flexibility test
Mange	Perpendicular	10.8	42.9	25.7	1.26	5
	Parallel	0.9	4.7	51.6	0.95	
Ringworm	Perpendicular	37.8	142	14.6	1.33	3
	Parallel	29.6	107.2	10.1	1.38	
Ticks damaged	Perpendicular	50.8	181.4	61.6	1.40	3
	Parallel	45.5	172.3	29.5	1.32	
Store damaged	Perpendicular	29.1	125.4	38.4	1.16	6
	Parallel	35.6	93.7	38.4	1.90	
Flaying	Perpendicular	45.5	186.5	24.4	1.22	4
	Parallel	42.8	209.8	22.6	1.02	
Putrefied	Perpendicular	37.5	173.6	27.0	1.08	6
	Parallel	33.7	170.2	11.4	1.99	
Red heated	Perpendicular	40.0	14108	29.0	1.41	5
	Parallel	37.7	190.4	31.1	0.99	
Sun dried		-	-	-	-	-
Nutrition deficiency		-	-	-	-	-
Upgrade	Perpendicular	79.9	302.7	79.8	1.32	1
	Parallel	75.6	295.3	77.9	1.28	
Sudanese Standard		60	200	80	0.7-1.4	

Table 7: Physical analysis of upgrade and defected goat leather samples from Kordofan region

Samples	Tested specimen	Breaking load kg/cm^2	Tensile strength kg/cm^2	Elongation %	Thickness mm.	Flexibility test
Mange	Perpendicular	30.9	147.1	8.9	1.05	4
	Parallel	28.6	130.0	18.7	1.10	
Ringworm	Perpendicular	53.9	143.4	21.3	1.88	6
	Parallel	44.5	143.5	31.2	1.55	
Ticks damaged	Perpendicular	67.5	185.5	65.3	1.82	3
	Parallel	59.8	174.9	67.5	1.62	
Store damaged	Perpendicular	39.6	126.9	29.9	1.56	6
	Parallel	30.8	108.5	27.5	1.42	
Flaying	Perpendicular	70.1	224.7	65.3	1.56	2
	Parallel	57.6	211.4	67.5	1.62	
Putrefied	Perpendicular	63.1	179.3	20.3	1.76	5
	Parallel	27.0	76.7	18.7	1.76	
Red heated	Perpendicular	60.1	186.6	55.1	1.69	6
	Parallel	57.6	170.4	55.1	1.69	
Sun dried		-	-	-	-	-
Nutrition deficiency		-	-	-	-	-
Upgrade	Perpendicular	71.0	251.8	75.8	1.41	1
	Parallel	68.9	341.1	72.9	1.01	
Sudanese Standard		60	200	80	0.7-1.4	

CONCLUSION

Hides and skins represent renewable sources with a great economic value to the Sudan. In spite of this facts, still the production of raw material, hides and skins, is faced by many constraints. Defects always detract from the ability of producing valuable and price-able hides and skins. Flaying defects could be avoided, if the recommended slaughtering equipments were used and flaying procedures were kept under control in the acceptable slaughterhouses. Branding of native cattle could be avoided, if smaller marks were used on less valuable parts of hide.

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