

## Study on the Major Defects That Causes Sheep and Goat Skins Rejection in Bahir Dar Tanning Industry, Ethiopia

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**Abstract:** A cross sectional study was conducted from November 2014 to April 2015 with the objective of assessing and determining the prevalence of major defects that caused skin rejection at Bahir Dar tannery which is located at about five kilo meters south of Bahir Dar to the Blue Nile Falls. From the examined 400 (200 sheep and 200 goat) pickled skins 114 (28.5%) of skins were rejected. Most skins were grouped under grade five (27.8%) and six (34.5%) in both species. 30(25.2%) “ekek” (itching) and 17(25.0%) flying defect was the major causes of down grading and /or rejection of shoat skins at pickled level followed by scar 59(14.8%), scratch 57(14.2%), poor substance 40(10.0%), pox 29(7.2%) and putrefaction 20(5.0%). The overall prevalence of sheep and goat skin defects was 100%. There was no any pure skin that is why grade one and two were excluded from grading of pickled skins. High rejection were recorded from extra large-sized skins (30.0%), followed by large-sized (29.0%), small-sized (22.0%) and medium-sized (17.0%). The result showed that 26.5% of goat skins and 22.5% sheep skins were rejected. There were statistically significant variations in the occurrence of the defects between the shoat skins. “Ekek” (27.5%) and flying defect (17.0%) were highly prevalent in sheep skins where as scratch (14.2%) was prevalent on goat skins. The occurrence of “ekek” was statistically different between species, 110(27.5%) higher in sheep than 16.5% (33/200) in goats. There was also statistically significant difference in the prevalence of scratch between shoats’ skins. Since most Ethiopian skins are brought from homesteads, defects occur due to careless flaying and storage, diseases and mal management of practice shoat. Therefore, these defects should be controlled by drug treatment, creating awareness about the importance of skins at regional and national level.

**Key words:** Bahir Dar • Sheep • Goat • Tannery • Skin rejection • Ethiopia

### INTRODUCTION

An estimate indicates that Ethiopia is a home for about 54 million cattle, 25.5 million sheep and 24.06 million goats. 1.91 million Horses, 6.75 million donkeys, 0.35 million mules, 0.92 million camels, 50.38 million poultry and 5.21 million bee hives [1]. Ethiopian small ruminant skins especially sheep skins traditionally have good reputation for quality in the world leather market due to their fine grain and compact structure [2]. The leather industry sector is one of the fast growing economic sectors in Ethiopia. There are, at present, 21 tanneries in the country. These tanneries have an average tanning capacity of approximately 4,000 pieces of hides and 30,000 pieces of

skins per day [3]. The export of processed and semi processed skins constitutes Ethiopian’s second largest commodity. However, over the last 10 years, there are indications that the quality of raw material has deteriorated with an increasing number of reject grades and the appearance of skin disease called “ekek” that is mainly due to lice, keds and mange infestations [4].

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It is becoming a grown concern that skin and hide quality is deteriorated from time to time due to many factors. One of the major problems affecting the leather and especially tanning industries is related to the decreasing quality of skins. Skin diseases, scratches, scabs, flay cuts and hole, putrefactions and heat and poor substances are the main problems related to skin and hide quality that the tanners are facing [6].

The annual off-take rate from the Country's cattle is estimated at 7% while from sheep and goats it is estimated to be 33% and 35% respectively. The annual potential supply of hides and skins is estimated at 3.8 Million pieces of hides and 16 million pieces of skins [7]. In terms of livestock population, Ethiopia stands first in Africa and 10<sup>th</sup> in the world in livestock population [8]. Hides and skins are the basic raw materials for the leather industry and Ethiopia is capable of supplying 16 to 18 million hides and skins per annum. The leather industry processes raw hides and skins and produces semi-processed and finished leather for both export and local consumption. The industries are also sources of employment. This is why the sector needs great attention by the government and all concerned stakeholders [4].

Skins are downgraded as a result of various ante-mortem and post-mortem factors, including poor animal husbandry, disease and parasites, bad slaughtering and flaying techniques and bad practices in curing, collection, transportation, storage and general handling. Estimates from tanneries have put the percentage of reject skins at certain times of the year as high as 50 to 60% [9]. Up to 65% of the defect that lead to decline of the quality occur in the pre-slaughter stage of production while the animal still alive and a considerable portion of these pre-slaughter defects are directly associated to skin disease initiated by external parasites [10]. Therefore, the major objectives of this study were:

- To assess the major factors affecting quality of small ruminant skins
- To determine the prevalence of major skin defects that causes rejection in Bahir Dar tannery

## **MATERIALS AND METHODS**

**Study Area:** it was conducted from 2014 to 2015 at Bahir Dar tanning industry which is located at about five kilo meters south of Bahir Dar to the Blue Nile Falls. Bahir Dar city is found in north western part of Ethiopia near Lake

Tana located between 11°29' – 11°41' N latitude and 37°16' – 37°27'E longitude. The landscape is flat with some small hills to the East and West. The average elevation in the town is about 1795 meters above sea level (m.a.s.l). The town covers an area of about 16,000 hectares. The mean annual precipitation depth recorded at Bahir Dar Station in 37 years period from 1962 to 1999 is about 1437 mm. The study area experiences average annual rainfall that ranges from 1200-1600 mm and it has mean annual temperature of 26°C [11].

**Study Design:** A cross-sectional study was carried out from 2014 to 2015 at Bahir Dar tanning industry. In this study a simple random sampling techniques was employed at pickled sheep and goat skins. Then active data was generated from randomly selected skins with regard to size, grade, species, considering as risk factors to test for the occurrence of skin defects that caused down grading and rejection.

**Study Population and Study Units:** The study populations were all skins that were brought from different areas to Bahir Dar tannery and the study units were randomly selected from all skins of sheep and goat after pickled stage. The randomly selected skin samples were thoroughly examined visually for different defects.

**Study Methodology and Sample Size Determination:** A Simple random sampling technique was employed to assess the major defects that cause skin rejection at pickled stage in the tannery. Sampling was conducted after the skin has reached pickled stage and after it was categorized by size as extra large, large, medium and small [12]. After sampling, it was examined for defects by the skillful skin selector man and women and was graded accordingly as grade1, grade 2, grade 3, grade 4, grade 5, grade 6 and rejected based on skin grading on defects set by Ethiopian Standard Authority in 2008. Skin examination was conducted by natural light to inspect any defect on the pickled skins and each skin defect identified was carefully recorded and was analyzed.

The desired sample size will be determined by assuming 99.9% expected prevalence which was reported by Zenaw and Mekonnen [13] 2012 of defects at 95% confidence interval and 5% precision or accuracy level the sample size was calculated to be 384 using the formula given by Thursfield [14]. (2005).

$$n = \frac{1.96^2 P_{exp} (1 - P_{exp})}{d^2}$$

Where: n = sample size;  
 P<sub>exp</sub> = expected prevalence = 99.9%  
 1.96 = the value of z at 95% confidence interval  
 d = desired accuracy level at 95% interval. Then using the above formula, the sample size was calculated as:

$$n = \frac{(1.96)^2 0.999(1 - 0.99)}{(0.05)^2} =$$

$$n = \frac{3.8416 * 0.999 * 0.001}{0.0025}$$

N=154

Thus, the sample size will be estimated to be 154, but to increase accuracy, 400 (200 sheep and 200goat) pickled skins were taken.

**Data Collection:** A total of 400 pickled skins were collected randomly from skins collected from different areas of the country to the tannery and then analysed using SPSS version 16.

## RESULTS

Of the total 400 pickled skins examined during the study period, all were not free from defects. There was no statistically significant difference observed between the skin of the two species in the occurrence of the defects ( $\chi^2=32.553, p>0.05$ ). Moreover, (26.5%) of goat skins were rejected followed by (22.5%) of sheep skins. However, there was statistically insignificant difference ( $\chi^2=8.723, P>0.05$ ) between shoats and grade of skins as shown in Table 1. Most of the skins in the two species were grouped under grade 5 and 6.

Mean while, there was no any pure skin seen that is why grade one and two were excluded from grading of pickled skins in the tannery. There were statistically significant ( $\chi^2=27.969, p<0.05$ ) differences observed between different qualities (grades) of skins and their sizes. Out of the total 400 (200 sheep and 200 goat) pickled skins observed, the highest rejection were from extra large-sized skins (30.0%), followed by large-sized (29.6%), small-sized (22.4%) and medium-sized (17.3%) as shown in Table 2.

**Equal Number of Skins Was Sampled from Each Size:** “Ekek” (itching) (29.8%), flying defect (17.0%), scar (14.8%), scratch (14.2%) poor substance (10%) are highly responsible for rejection of the skins in the tannery though putrefaction (4.8%) and shoat pox (7.2%) have effects on the quality of the skins as shown in the table. There were statistically significant ( $\chi^2=31.553, p=0.000$ ) differences of the occurrence of the defects between the sheep and goat skins.

The total prevalence of “ekek” was 110/400(27.5%) higher scored in sheep 38.5% (77/200) and 16.5% (33/200) in goats as shown in the above table 3. There were statistically significant ( $\chi^2=24.276, P<0.05$ ) difference on the prevalence of “ekek” between sheep and goat skins. The total prevalence of scratch was 65/400(16.2%). It was higher 24.5% (49/200) in goats than sheep 8.0% (16/200). Analysis of the data showed that there was statistically significant difference ( $\chi^2=20.05, p<0.05$ ) in the prevalence of scratch between sheep and goats. The total prevalence of flying defect was 68/400(17.0%). This was higher in sheep than goats and there was statistically significant variation ( $\chi^2=8.991, p<0.05$ ) on prevalence of flaying defect between the species.

Of the total examined skins, 30(25.2%) “ekek”, 17(25.0%) flaying defect, 11(19.3%) scratch, 9(15.3%) scar, 17(42.5%) poor substance, 8(40.0%) putrefaction and 5(17.2%) pox (total of 114(28.5%) skins were rejected. Analysis of the data revealed that there was a statistically significant difference ( $\chi^2=46.443, p <0.05$ ) between types of defects and qualities (grades) of skins. Poor substance, putrefaction and pox were also proved to cause defects and lead to reject out the skins in the tannery and had occurred in both species without statistically significant variations ( $\chi^2=0.497, p>0.05$ ) as described in table 3.

As shown in Table 4 that flying defect was statistically significant ( $\chi^2=23.576, p < 0.05$ ) difference between sheep (35.0%) and goats (21.5%) this might be because of sheep skins are extremely soft, comfortable and pliable and is water absorbable so it is vulnerable to pierce and damage during slaughter with knife with low force but goat skins are better strong and durable and water resistant as explained by Desta [9].

As it has been indicated on table 6, out of the four sites (origins) the total prevalence of skin defects at Bahir Dar (40.8%) was higher where as Debre Tabore (15%) is the least one. Analysis of the data showed that there were not statistically significant ( $\chi^2=17.361, p>0.05$ ) difference on the occurrence of defects in different places.

Table 1: The proportion of grades on sheep and goat skins

Species	Grade 1 %	Grade 2 %	Grade 3 %	Grade 4 %	Grade 5 %	Grade 6 %	Reject %	Total
Goat	-	-	6(3.0%)	12(6.0%)	61(30.5%)	68(34.0%)	53(26.5%)	200
Sheep	-	-	2(1.0%)	20(10.0%)	62(31.0%)	71(35.5%)	45(22.5%)	200
Total	-	-	8(2.0%)	32(8.0%)	123(61.5%)	139(34.75%)	98(24.5%)	400

Table 2: Proportion of size of sheep and goat skins to different grades

Size	Grade 1%	Grade 2%	Grade 3%	Grade 4 %	Grade 5 %	Grade 6 %	Reject %	Total (%)
Small	-	-	2(25.0%)	9(28.1.0%)	31(25.2%)	36(25.9%)	22(22.4%)	100(25%)
Medium	-	-	3(37.0%)	4(12.5.0%)	43(35.0%)	33(23.7%)	17(17.3%)	100(25%)
Large	-	-	2(25.0%)	16(50.0%)	20(16.3%)	33(23.7%)	29(29.6%)	100(25%)
Ex large	-	-	1(12.5%)	3(9.4%)	29(23.6%)	37(26.6%)	30(30%)	100(25%)
Total	-	-	8(2.0%)	32(8.0%)	123(30.8%)	139(34.8%)	98(24.5%)	400(100%)

Table 3: Prevalence of different defect on sheep and goat pickled skins

Defects	No. Skin Affected (%)		Total prevalence	P value	$\chi^2$
	Sheep	Goats			
Ekek*	77(38.5%)	33(16.5%)	110(27.5%)	0.000	24.276
Scratch	16(8.0%)	49(24.5%)	65(16.2%)	0.000	20.005
Scar	34(17.5%)	25(11.5%)	59(14.8%)	0.088	2.904
Flying defect	35(17%)	33(16.5%)	68(17.0%)	0.003	8.991
Poor substance	20(10.0%)	19(9.5%)	39(9.5%)	0.866	0.028
Putrefaction	7(4.0%)	13(5.5%)	20(4.8%)	0.481	0.497
Pox	19(8.5%)	17(9.5%)	36(9.0%)	0.727	0.122

\*Amharic word meaning itching due to keds, lice

Table 4: Proportion of skin defects in different grades of skin

Defect	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Reject
“Ekek”	-	-	3(2.5%)	10(8.4%)	36(30.3%)	40(33.6%)	30(25.2%)
Scratch	-	-	3(5.3%)	6(10.5%)	22(38.6%)	15(26.3%)	11(19.3%)
Scar	-	-	2(3.4%)	8(13.6%)	12(20.3%)	28(47.5%)	9(15.3%)
Flyingdefect	-	-	0(0.0%)	2(2.9%)	24(35.3%)	25(36.8%)	17(25.0%)
Poorsubstance	-	-	0(0.0%)	1(2.5%)	9(22.5%)	13(32.5%)	17(42.5)
Putrefaction	-	-	0(0.0%)	3(15.0%)	5(25.0%)	4(20.0%)	8(40.0%)
Pox	-	-	0(0.0%)	1(3.4%)	12(41.4%)	11(37.9%)	5(17.2%)
Total	-	-	6(3.2%)	24(6.0%)	111(27.8%)	138(34.5%)	114(28.5%)

Table 5: Proportion of (%) skin defects in different size

Defect	Small	Medium	Large	Extra	Total	$\chi^2$	P value
ekek	26(%)26.0	29(29.0%)	17(27.0%)	28(28.0%)	110(27.5%)	0.251	0.969
Scratch	15(15.0%)	14(14.0%)	16(16.0%)	20(20.0%)	65(16.2%)	1.525	0.677
Scar	6(6.0%)	13(13.0%)	18(18.0%)	21(21.0%)	58(14.5%)	10.405	0.015
Flying defect	29(29.0%)	26(26.0%)	28(28.0%)	30(30.0%)	113(28.2%)	0.432	0.934
Poorsubstance	6(6.0%)	9(9.0%)	17(17.0%)	7(7.0%)	39(9.8%)	8.495	0.037
Putrefaction	11(11.0%)	0(0.0%)	6(6.0%)	2(2.0%)	19(4.8%)	15.638	0.001
Pox	7(7.0%)	11(11.0%)	6(6.0%)	12(12.0%)	36(9.0%)	3.175	0.365
processingdefect	0(0.0%)	4(4.0%)	2(2.0%)	1(1.0%)	7(1.8%)	5.088	0.165

Table 6: Proportion (%) of defects in deferent origin of the raw skins

Defects	origin			
	North Gondar %	Debre tabore %	Bahir Dar %	Debre Markose%
*ekek	24(30.0%)	20(33.3%)	46(28.2%)	16(16.5%)
scratch	20(12.5%)	11(18.3%)	20(12.3%)	29(29.9%)
scar	16(20.0%)	4(6.7%)	21(12.9%)	18(18.6%)
Flying defect	10(12.5%)	10(16.7%)	33(20.2%)	15(15.5%)
Poor substance	6(7.5%)	8(13.3%)	19(11.7%)	7(7.2%)
putrefaction	5(6.2%)	0(0.0%)	10(6.1%)	5(5.2%)
pox	7(8.8%)	6(10.0%)	11(6.7%)	5(5.2%)
Processing defect	2(2.5%)	1(1.7%)	3(1.8%)	2(2.1%)
total	80(20.0%)	60(15.0%)	163(40.8%)	97(24.2%)

\*ekek/cockle=itching due to ked and lice

Table 7: proportion (%) of skin quality in different origin

Origin	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Reject	Total
N/Gondar	-	-	3(23.1%)	6(25.0%)	17(15.3%)	32(23.2%)	23(20.2%)	81(20.2%)
D/Tabore	-	-	3(23.1%)	5(20.8%)	17(15.3%)	21(15.2%)	13(11.4%)	59(14.2%)
B/Dar	-	-	5(38.5%)	4(16.7%)	45(40.5%)	61(44.2%)	48(42.1%)	163(40.8%)
D/Markos	-	-	2(15.4%)	8(33.3%)	33(29.7%)	30(21.7%)	33(28.9%)	106(26.5%)

As indicated in the table, highest percentage of skins was rejected from Bahir Dar 48(42.1%) and small amount of skin was rejected from Debre Tabore 13(11.4%). However statistical analysis of this data showed that there was no statistically significant variation between origin and causes or defects of skins to be rejected in those areas (Table 7).

## DISCUSSION

A total of 114(28.5%) skins were rejected out of 400 sampled shroat skins during the study period. From the total 400 examined skins, 30(25.2%) “ekek” and 17(25.0%) flying defect, respectively as major causes for downgrading and /or rejection of skins at pickling level followed by scar 59(14.8%), scratch 57(14.2%), poor substance 40(10.0%), pox 29(7.2%) and putrefaction 20(5.0%) in the study area. The high prevalence of ‘ekek’ is said to have increased from year to year and attained the maximum prevalence in 1999 [15]. A study conducted by Zenaw and Meonnen[13] at Bahir Dar Tannery reported that the overall prevalence of flying defects was 27.8% (278/1000) which was similar to this work.

With respect to the species “ekek” 77(38.7%) was the major cause of rejection in sheep skins where as scratch 44(22.0%) was the dominant cause of rejection in goat skins. This difference might be because of sheep have ticker and longer hair coat than goats which give to the

external parasites that damages the skin directly using their piercing mouth parts mechanically or indirectly by causing irritation and rub their body against objects finally leaves unnoticeable scars FAO [16], a better living environment than goats where as the reason why scratch was responsible for the higher percentage of downgrading and rejection of skins kept under extensive and semi extensive management systems might be due to their feeding behaviour that is they prefer to graze on leaves on thorny bush areas which exposes them to much damage and causes different level scratches. This result was in agreement with a study done by Worku *et al.* [5] that was stated as the dominant cause of skin rejection are cockle/ekek (30.11%) and (scratch 26.26%) at Modjo Tannery. Similarly, Assefa *et al.* [17] at Bahir Dar Tannery described that “ekek” (58.3%) and scratch (22.5%) of sheep pickled skins were rejected. According to Tefera and Abebe [18] who conducted similar study in their recent research in Dessie and Kombolcha tanneries indicated that 42 % of downgrading and rejection on wet blue goat pelts were due to cockle/ekeke.

The overall prevalence of the flying defect was 17.0 % which was in parallel with the result reported by Bisrat[19] (18.7 %) in Addis Ababa and Modjo Tanneries. In the current study it was significantly higher in sheep (35%) than goat (21.5%). This is because of sheep skin is extensively soft, comfortable and pliable while goat skins are strong and durable with a smooth fine grain [9].

The present study in Bahir dar tannery for rejected skins revealed that 114(28.5%) skins were rejected this finding was much higher than a report described by Worku *et al.* [5] 90 (4.8%) this difference may be brought by geographical differences where the prevalence of ecto parasites are lower.

The result also showed that high rejection of pickled skins was from extra large-sized skins (30.0%) and large-sized (29.0%) skins. This is because ectoparasitic diseases run chronically in adults and old aged shoats than young animals and this is also because of scars and scratches have the tendency to occur in older animals than young aged because as size or age increase, animals are prone to acquire more defects on their life span [20]. This result was in parallel with the report described by Assefa [17] indicated that most rejected skins were from extra large sized (58.3%) while the least were from medium sized skins.

The prevalence of skins rejected in Bahir Dar 48(42.1%) and Debre Markose 33(28.9%) were higher than skins rejected in North Gondar 23(20.25) and Debre Tabore 13(11.4%). This may be due to Poor nutrition [21] or due to the existence of skin diseases that causes irritation as a result scar and scratch formation which is verified by Kassa[22]. It might be variations in climate and feeding of animals that cause the major factors in determining quality of skins.

The skins rejected due to poor substance was 17 (42.5%) from the total of 114(28.5%) rejected skins in the tannery. Animals with poor nutrition yield skin of poor substance and lesser area than well feed healthy animals [22].

## CONCLUSION AND RECOMMENDATIONS

As indicated by the result different skin defects are responsible for the rejection and downgrading of sheep and goat skins which leads to loss the benefit from the live stock sector. These defects were natural (scratches), manmade (flying defect, putrefaction), diseases (shoat fox, ekek/cockle) managemental defect (poor substance). 'Ekek' and flying defects on sheep skins and scratch on goat skins were the major skin defects that caused a significant amount of shoat skins rejection in Bahir Dar tanning industry. 'Ekek', flying defect, scar, scratch, poor substance, pox and putrefaction were the defects that encountered defects that caused down grading and /or rejection of shoat skins at pickling level in Bahir Dar Tanning Industry. Since most Ethiopian skins are brought from Goats and sheep slaughtered mainly in homesteads,

damages occur by careless use of an axe and knife during flaying/skinning due to lack of knowledge by penetrating through the skin. Due to ignorance of the health of animals, different skin diseases and internal diseases are the causes of skin leads the skin to be poor substance and small in size.

Therefore, based on the above result and conclusion the following points are recommended;

- Awareness creation among the societies about the harmful effect of these defects and the methods of managing animals like feeding and disease prevention methods, on the benefit from the skins should be the best solution to protect these defects and to gate foreign currency by exporting pure semi processed and processed skins and leather.
- Integrated effort towards managemental practice, animal health care, using the right drug to prevent animal diseases should be applied to protect these defects from damaging the skin of animals.
- Defects due to careless use of an axe and knife during flaying/skinning due to lack of knowledge by penetrating through the skin should be avoid by teaching the society about the right way of flying/skinning.
- Detailed studies on the distribution, seasonal occurrence and the direct and in direct economic impact of ectoparasites should be carried out.
- Reducing the prevalence of ectoparasites mainly relies on treatment of affected animals with appropriate acaricides and improving the management system. Therefore all stakeholders: farmers, tanners and the government should participate and implement effective ectoparasites control programs.

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