

Pre- and Post-Slaughter Factors Influencing Hide and Skin Quality in West Shewa Zone, Ethiopia

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Abstract

Ethiopia has high livestock population and hence has high potential for hide and skin production. Likewise, in west Shewa Zone of the country there is high hide and skin production. But hides and skins are affected by different types of defects that hampered effective and efficient utilization of these resources. Therefore, a study was conducted in Bako Tibe and Ilu Gelan districts of west Showa zone with the objectives to assess pre- and post-slaughter defects that influence hide and skin qualities. Primary data were collected from sample household heads, middlemen, butcheries, hotel/restaurants and tanneries using semi-structured interview and direct observations. All middlemen, butchery and hotel/restaurants in the study areas were employed for data collection while households were selected using simple random sampling techniques. Results of the study revealed that all household respondents reported absence of extension services on hide and skin management. The maximum pre-slaughter defect observed by households (87.2%), hotel/restaurants (91.3%), butcheries (93.3%) and middle men (90%) were due to ectoparasites. Out of the respondents 64.6%, 40% and 82.6% of respondents from household, butcheries and hotels/restaurants, respectively were slaughtered animals on the ground without stunning. The maximum post-slaughter defects observed during slaughtering by households (95.4%), hotel/restaurants (87.0%), and butcheries (86.7%) were dirt and flay cut. According to the respondents, 38.5 of the households kept hide and skin on the ground before marketing. It was found that the major post-slaughter defects of hide were flesh remnant (94.3%), dirty (74.3%), corduroying (71.4%), and flay cut (65.7%). Moreover, traditional animal husbandry and slaughtering practices, poor storage and preservation methods of raw hides and skins, the absence of slaughtering facility and extension service exacerbated the prob-

lem. Therefore, there is an urgent need for good animal management practices, animal transportation and slaughtering, and post slaughter hide and skins management.

Keywords

Animal Transportation, Cattle, Defects, Goat, Quality, Sheep

1. Introduction

Ethiopia is the first African country in livestock populations having 55.03 million cattle, 27.35 million sheep, and 28.16 million goats [1]. The potential of hide and skin was estimated as 3.78 million cattle hides, 8.41 million sheep skins and 8.42 million goat skins [2]. Ethiopian skins and hides, especially sheep skins from highland breeds, are well known in the world for production of high-quality leather due to its fine grain and compact structure [3]. However, in Africa it was ranked fifth and third on raw hides and skins production, and leather products and footwear exports, respectively. Even if livestock population is high, there is critical shortage of raw hides and skins in Ethiopia due to insufficient supply to meet even the most minimal market demand, and their poor-quality (scarred, diseased, improperly flayed) which directly limited the market potential of the finished leather products [4].

The leather and leather product exports increased in Ethiopia from 67 million to 104 million USD between 2004/05 and 2010/11 [5]. Hence, trends of the different leather product categories of crust, finished leather and shoe exports were increased while wet blue and pickle declined. In fact, pickle and wet blue exports cease in 2010 due to Ethiopian government policy that puts heavy taxes on exports of wet blue, pickle and crust in order to encourage production and export of finished leather products [6]. On average, the country has the capacity to supply 16 to 18 million pieces of hides and skins to local tanneries. But the country did not utilize the huge potential in the sector.

The main challenges associated with downgrading of skin and hide quality can generally be categorized as natural defects (scratches, disease, ectoparasite induced defects) and manmade defects (brand marks, ripping and flaying, preservation, transportation, storage and poor handling). Overall, there is much to be done from live animal management up to transportation of raw products to improve the quality of hides and skins [7].

There is a paucity of research output in identifying hide and skin downgrading problems, causes of rejections, and the measures to be taken under different agro-ecologies. Most of the studies were on impact of sheep and goats ectoparasites on leather products and tanning industry [8] [9] [10] [11] [12]. However, there is no report on the prevalence of defects on the hides and skins in the current study areas. Therefore, the objectives of this study were to assess pre- and post-slaughter factors that influence hide and skin quality in West Shoa

Zone, Oromia Regional State, Western Ethiopia.

2. Materials and Methods

2.1. Description of the Study Area

The study was conducted in Bako Tibe and Ilu Gelan districts of West Shewa Zone, Oromia Regional State. Bako Tibe district is located about 251km from Addis Ababa to the western direction. The district lies between 8°56' to 9°06'N latitude and 37°01' to 37°12'E longitudes. The major agro-ecological zones of the study area are semi-arid, sub-humid, and humid with bimodal rain fall characteristics. The area receives an average of 1242 mm/annum rainfall and the temperature ranges from 13.3°C to 27.9°C. The major livestock species raised are cattle (137,343), sheep (12,502), and goats (24,212).

Ilu Gelan district is located at about 200 km from Addis Ababa to the west. The district is located on geographical coordinates of 08°59'51"N latitude and 37°19'49"E longitude. The average temperature of the district is 27.3°C with average altitude of 1665 - 1790 m.a.s.l. Total livestock population of the district was 108,732 (cattle), 7780 (sheep) and 8980 (goats).

2.2. Study Design

A cross-sectional study was employed to collect data on pre- and post-slaughter factors that influence hide and skin quality. The factors include animal management practice in relation to hide and skin (pre-slaughtering factors), animal slaughtering technique used, hide and skin management during slaughtering and post-slaughtering, identification of defects on raw hide and skins at collection centers, means of transportation of hide and skin to collection center and tanneries and down grading problem in tanneries.

2.3. Study Population and Sampling Method

This research work was involved in survey and observational studies to assess factors that influence hide and skin quality in the study areas. Purposive sampling method was employed to select Bako Tibe and Ilu Gelan districts based on accessibility, livestock population and potential for hide and skin production. From the two districts, six rural kebeles (the smallest administration unit) were purposively selected, three rural kebeles from each district. Then from the total household population of 39,097 of Bako Tibe and Ilu Gelan, 195 respondent households were selected using the formula for finite population [13].

$$n = \frac{z^2 \cdot p \cdot q \cdot N}{e^2 (N - 1) + z^2 \cdot q \cdot p}$$

where,

N = size of households from both district (39,097).

n = sample size.

e = acceptable error (the precision error 0.0526).

p = standard deviation of population (0.83).

z = standard variant at a given confidence level (1.96).

$q = 1 - p$; $n = 195$.

Then these 195 sample respondents were proportionally allocated for the six rural kebeles (**Table 1**).

On the other hand, all butcheries (15), middle men (20), and hotel/restaurants (23), found in both districts were included in the study by availability sampling. From 27 tanneries found in the country three top tanneries were selected purposively depending on hides and skins socking capacity per day. Moreover, one hide and skin grader, production manager and supervisor were purposively selected as key informant from each tannery.

Sample size determination for hide and skin defect prevalence at collection centers were determined, after taking one-month preliminary survey on the supply of hides and skins at collection centers of both districts. Depending on preliminary survey observations, during the month of holidays (Christmas and Epiphany) large number of animals were slaughtered, and hence observations were made from December to January to ensure maximum sample size of hides and skins for data collection. The study took one month at each district and collection centers were visited every day. Therefore, by taking all available hide and skin per day in the collection center quality examinations were undertaken. During the two months, a total of 1610 hides and skins were observed and examined. Therefore, about 735 sheep skins, 455 goat skins and 420 cattle hides were observed and examined for quality related defects (**Table 2**).

Table 1. Sample size of household employed from each rural kebeles.

Districts	Rural kebeles	Number of House hold	Sample size
	Walkituma Bakerere	1120	37
Bako Tibe district	Karu Wera Reba	1098	37
	Becera Odagibe	1200	40
Sub-total		3418	114
	Rafiso Kemera	996	25
Ilu Gelan district	Sibabichi	1179	30
	Alle Wera Ilu	1043	26
Sub-total		3218	81
Total		6636	195

Table 2. Sample size of hide and skin at both districts collection centers.

Collection center	Hides	Sheep skins	Goat skins	Total
Bako Tibe district	206	572	231	1009
Ilu Gelan district	214	163	224	601
Total	420	735	455	1610

2.4. Data Collection

To collect data from household, middle men, butcheries and hotel/restaurant respondents, structured questionnaires were used. Nine key informants from tanneries were selected purposively for gathering data on parameters employed during buying hide and skin, and major defects observed at tannery. The observation was conducted to understand about the quality level of hides and skins at collection centers. Various forms of defects appearing on raw or grain sheep and goat skins and cattle hides from the edges towards the center of the skin like holes and flay cut, poor pattern, dirt, flesh remnant, gouge-marks (thinning of the skin caused by knife), corduroying (a series of shallow and parallel streaks appearing on the skin due to poor flaying), and putrefaction of skin revealed by a premature loss of hair were registered from grain and flesh surfaces of raw hide and skin.

2.5. Data Management and Analysis

Data were collected, coded, entered and managed and analyzed using Statistical Package for Social Sciences (SPSS, version 16) software. The study used both qualitative and quantitative method of data analyses. Descriptive statistics such as means, frequency distribution, and percentage were used to analyze quantitative data. The Chi-square (X^2) test was used to analyze the association between species, and hide and skin defects.

3. Results

3.1. House Hold Characteristics in the Study Areas

The results of this study indicated that majority of the respondents were in the age group of 31 - 62 years old that accounts 76.4% of the sampled respondents (**Table 3**). About 49.7% of the respondents were illiterate while only 8.2% attended grade 12 and above. Therefore, this finding revealed high illiteracy rate in the study areas. A chi-square test analysis revealed that there was no statistically different between the two districts in terms of education level at $X^2 = 0.129$ ($P > 0.05$).

According to house hold (HH) respondents, ruminant animals were kept to fulfill multipurpose functions. Majority of the HHs rear cattle for draught power and milk whereas only few of them kept cattle for fattening as a source of cash income (**Table 4**). Moreover, sheep and goat were reared in the study areas primarily for income generation followed by home consumption particularly during holidays.

About 95% of middle men, 43.5% of hotel and restaurants and 33.3% of butcheries were reported that their common source of slaughtered animals was from local market that is found within the district (**Table 5**). These animals were transported to and from market on foot during which animals can be exposed to many mechanical factors such as horn rake, rope mark and scratch and tearing due to different thorny plant along transportation routes.

Table 3. Demographic profile of households in the study areas.

Variable		Districts				Over all N = 195	
		Bako Tibe N = 114		Ilu Gelan N = 81		F	%
		F	%	F	%		
Age of the respondents	Under 15 years old	4	3.5	4	4.9	8	4.1
	16 - 30 years	21	18.4	17	21.0	38	19.5
	31 - 46 years	62	54.4	43	53.1	105	53.8
	47 - 62 years	27	23.7	17	21.0	44	22.6
Sex of the respondents	Female	27	23.7	18	22.2	45	23.1
	Male	87	76.3	63	77.8	150	76.9
Educational level of the respondents	Illiterate	56	49.1	41	50.6	97	49.7
	Primary	48	42.1	34	42.0	82	42.1
	Secondary & above	10	8.8	6	7.4	16	8.2

F = Frequency, N = Number of respondents.

Table 4. Number and purpose of keeping livestock in the study areas.

Variables	Description	Districts				Overall (N = 195)	
		Bako Tibe (N = 114)		Ilu Gelan (N = 81)		F	%
		F	%	F	%		
Indigenous cattle (number)	<10	54	47.4	36	44.4	90	46.2
	11 - 12	60	52.6	45	55.6	105	53.8
Indigenous sheep (number)	<5	55	48.2	35	43.2	90	46.2
	6 - 10	51	44.7	40	49.4	91	46.7
	>11	8	7.0	6	7.4	14	7.2
Indigenous goats (number)	<5	76	66.7	57	70.4	133	68.2
	6 - 10	38	33.3	24	29.6	62	31.8
Crossbred cattle (number)	0	108	94.7	79	97.5	187	95.9
	1 - 5	6	5.3	2	2.5	8	4.1
Purpose of keeping Cattle	Income generation	6	5.3	2	2.5	8	4.1
	Draught power & milk	108	94.7	79	97.5	187	95.9
Purpose of keeping sheep and goat	Income generation	97	85.1	70	86.4	167	85.6
	Home consumption	17	14.9	11	13.6	28	14.4

F = Frequency, N = Number of respondents.

3.2. Hide and Skin Quality Management Practices

Pre-slaughter factors affecting hide and skin quality

One-fourth of middle men sold animals within a day and the rest used to keep the animals for more than one day (**Table 6**). Similarly, 40% and 60% of butcheries

Table 5. Sources of slaughter animal for middle men, butcheries, hotel/restaurants.

Respondent category	Common source	Districts				Overall	
		Bako Tibe		Ilu Gelan		F	%
		F	%	F	%		
Butcheries	local market	2	22.2	3	50.0	5	33.3
	HH + local market	7	77.8	3	50.0	10	66.7
Middle men	HH	0	0	1	12.5	1	5.0
	Local market	12	100.0	7	87.5	19	95.0
Hotel/restaurants	HH	2	15.4	1	10.0	3	13.0
	Local market	5	38.5	5	50.0	10	43.5
	HH + local market	6	46.1	4	40.0	10	43.5

F = Frequency, HH = household.

Table 6. Holding period of livestock until sold or slaughtered.

Respondent category	Holding period	Districts				Over all	
		Bako Tibe		Ilu Gelan		F	%
		F	%	F	%		
Middle men	Immediately sold	3	25.0	2	25.0	5	25.0
	Hold for 1 - 2 days	9	75.0	6	75.0	15	75.0
Butcheries	Hold for 1 - 2 days	2	22.2	4	26.7	6	40.0
	Hold for 3 & above days	7	77.8	2	13.3	9	60.0
Hotel/restaurants	Immediately slaughtered	2	15.4	1	10.0	3	13.0
	Hold for 1 - 2 days	11	84.6	9	90.0	20	87.0

F = Frequency.

kept slaughter animals for 1 - 2 days and for more than 3 days, respectively until slaughtering.

All of butcheries, 84.6% of households, 75% of middle men and 87% of hotel/restaurants reported that slaughter animals were housed in rough earthen floor during night until being sold and/or slaughtered (Table 7). This indicates that some of the defects of hide and skin may occur due to housing system.

The effect of pre-slaughter related factors on hide and skin quality in the study area was expressed in three basic indicators such as level of animal care at HH, access to extension services and knowledge of animal owner (Table 8). Hence, majority of household respondents reported that they were not cared for their animal to reduce hide and skin damage and they were not aware of factors that affect hide and skin before slaughtering. All respondents in the study areas were ascertained the absence of extension services on hide and skin production and management. Only few of the respondents were given due attention for their animal to reduce hide and skin damage through proper housing, dehorning and treating animal for external parasite.

Table 7. Housing system of livestock in the study areas.

Housing system	Respondents category							
	Middle men		Butcheries		Hotel/restaurants		Households	
	BT	IG	BT	IG	BT	IG	BT	IG
	N = 12	N = 8	N = 9	N = 6	N = 13	N = 10	N = 114	N = 81
	%	%	%	%	%	%	%	%
In house with smooth earth floor	0	0	0	0	0	0	5.3	2.5
In house with rough earth floor	41.7	50.0	22.2	66.7	77.0	70.0	29.8	22.2
In fenced pen with rough earth floor	33.3	25.0	77.8	33.3	7.7	20.0	51.8	66.7
In fenced pen with smooth earth floor	0	0	0	0	0	0	13.2	8.6
Others	25.0	25.0	0	0	15.3	10.0	0	0

BT = Bako Tibe district, IG = Ilu Gelan district, N = number of respondents.

Table 8. Pre-slaughtering management of live animals.

Variable		Districts				Overall	
		Bako Tibe (N = 114)		Ilu Gelan (N = 84)		(N = 195)	
		F	%	F	%	F	%
Care for animals	Yes	20	17.5	7	8.6	27	13.8
	No	94	82.5	74	91.4	168	86.2
	Housing	2	10.0	0	0	2	7.4
	Dehorning	1	5.0	1	14.3	2	7.4
Animal Management	Treating animal for external parasite	6	30.0	2	28.6	8	29.6
	Housing and treating animal for external parasite	11	55.0	4	57.1	15	55.6

N = Number of respondents, F = Frequency.

Of the total respondents 85%, 60% and 56.5% of middle men, butcheries and hotel/restaurants, respectively considered the quality of hide and skin while they were buying the animals (**Table 9**). All of middle men, 80% of butcheries and 87% of hotel/restaurants assumed the animal were beaten during transportation. Moreover, One-third of butcheries, three-fourth of middle men and 45% of hotel/restaurants do not consider the position they beat the animal. Majority of respondents reported that they transported the animals on foot that might exposed the animal to many mechanical factors.

The average pre-slaughter defects observed by four different respondents confirmed wound (87.2%), ecto-parasites (87.2%) and horn rake (76.9%) as the major causes of defects observed on the live animals (**Table 10**). Moreover, household respondents reported that the majority of livestock in both districts roamed

Table 9. Livestock body beating practice and part of body frequently beaten.

Respondent category	Meat animal	District				Overall	
		Bako Tibe		Ilu Gelan			
		F	%	F	%	F	%
Middle men	Yes	12	100.0	8	100.0	20	100.0
Butcheries	Yes	6	66.7	6	100.0	12	80.0
	No	3	33.3	0	0	3	20.0
Hotel/restaurants	Yes	12	92.3	8	80.0	20	87.0
	No	1	7.7	2	20.0	3	13.0
Body parts frequently beaten							
Middle men	On leg	2	16.7	2	25.0	4	20.0
	On shoulder	0	0	1	12.5	1	5.0
	Does not consider the position	10	83.3	5	62.5	15	75.0
Butcheries	On leg	2	33.3	0	0	2	16.7
	On shoulder	3	50.0	3	50.0	6	50.0
	Does not consider the position	1	16.7	3	50.0	4	33.3
Hotel/restaurants	On leg	4	33.3	3	37.5	7	35.0
	On shoulder	2	16.7	2	25.0	4	20.0
	Does not consider the position	6	50.0	3	37.5	9	45.0

F = Frequency.

Table 10. Pre-slaughter hides and skins defect in the study areas.

Defects (%)	Respondents category							
	Middle men		Butcheries		Hotel/restaurants		Households	
	BT N = 12	IG N = 8	BT N = 9	IG N = 6	BT N = 13	IG N = 10	BT N = 25	IG N = 14
Horn rake	33.3	25.0	55.6	50.0	7.7	20.0	80.0	71.4
Rope mark	8.3	12.5	11.1	-	-	10.0	4.0	14.3
Branding	8.3	12.5	22.2	-	-	10.0	8.0	21.4
Ectoparasites	91.7	87.5	88.9	100	92.3	90.0	96.0	71.4
Wounds	83.3	75.0	77.8	100	61.5	80.0	92.0	78.6
Wire damage	-	-	-	-	7.7	-	-	14.3

BT = Bako Tib District, IG = Ilu Gelan District, and N = number of respondents.

freely in the wilderness and were subjected to thorny and shrubby vegetation resulting in wound, ectoparasites that can contribute for the downgrading of hide and skin. Likewise, interviewed butcheries reported that ectoparasites, wound and horn rake with 93.3%, 86.7% and 53.3%, respectively were the do-

minant pre-slaughter defect observed on livestock at the time of marketing. Moreover, hotel/restaurant respondents observed different pre-slaughter hide and skin defects on purchased livestock. Therefore, ectoparasites, wound and horn rake were the major pre-slaughter defects observed on live animals in the study areas that reduce hide and skin quality.

Post-slaughter factors affecting hide and skin quality

On average about 64.6%, 40% and 82.6% of respondents from household, butcheries and hotels/restaurants slaughtered livestock on the ground without stunning and hanging on the pole (Table 11). These practices attributed to defects such as poor bleeding, flesh remnant, flay cut, poor pattern, gauge mark, corduroying and dirt on hides and skins that ultimately downgrade hide and skin value. The Pearson chi-square results indicate that households from Bako Tibe district and Ilugelan districts were not statistically different on slaughtering practice ($\chi^2 = 1.738$, $df = 1$, $N = 195$, $P > 0.05$).

About 61%, 70% and 56.5% of households, butcheries and hotel/restaurants used locally available knives and axe during slaughtering for ripping and flaying hide and skin (Table 12). Therefore, majority of the respondents used improper materials such as knives and axe for ripping and flaying that increased the probability of flay cuts, corduroying and gauge mark as defects during slaughtering.

Lack of awareness and knowledge about hide and skin quality of household respondents commit one or more defects on hide and skin during the slaughtering periods that reduce hide and skin quality. Therefore, the major post-slaughter defects reported by households were dirt, flay-cut, flesh remnant and poor pattern (Table 13). In general, the maximum post-slaughter defects observed by

Table 11. Method of livestock slaughtering practices.

Respondent	Slaughtering types	Districts				Over all		P
		Bako Tibe		Ilu Gelan		F	%	
		F	%	F	%			
Households	On the ground without stunning and hanging on the pole	78	68.4	48	59.3	126	64.6	0.187
	On the ground without stunning	36	31.6	33	40.7	69	35.4	
Butcheries								
	On the ground without stunning	1	11.1	3	50.0	4	26.7	
	On the ground without stunning and hanging on the pole	3	33.3	3	50.0	6	40.0	
	Slaughter at abattoirs	5	55.6	-	-	5	33.3	
Hotel/restaurants								
	On the ground without stunning	2	15.4	2	20.0	4	17.4	
	On the ground without stunning and hanging on the pole	11	84.6	8	80.0	19	82.6	

F = Frequency.

Table 12. Material used during slaughtering of livestock.

Respondent	Materials	Districts				Overall	
		Bako Tibe		Ilu Gelan		F	%
		F	%	F	%		
Household	Locally available knives	45	39.5	31	38.3	76	39.0
	Locally available knives and axe	69	60.5	50	61.7	119	61.0
Butcheries	Both ripping and flaying knife	1	25.0	2	33.3	3	30.0
	Locally available knives and axe	3	75.0	4	66.7	7	70.0
Hotel/restaurants	Both ripping and flaying knife	6	46.2	4	40.0	10	43.5
	Locally available knives and axe	7	53.8	6	60.0	13	56.5

F = Frequency.

Table 13. Post-slaughter defects.

Defects	Respondents category					
	Households		Butcheries		Hotel/restaurants	
	BT	IG	BT	IG	BT	IG
	N = 114	N = 84	N = 9	N = 6	N = 13	N = 10
	%	%	%	%	%	%
Poor pattern	82.5	71.6	44.4	66.7	61.5	50.0
Flesh remnant	83.3	90.1	55.6	50.0	69.2	60.0
Dirt	96.5	93.8	77.8	100.0	84.6	90.0
Flay cut	96.5	93.8	77.8	100.0	84.6	90.0
Gauge mark	13.2	3.7	22.2	50.0	15.4	30.0
Corduroying	14.0	22.2	33.3	33.3	23.1	40.0
Poor bleeding	3.5	6.2	22.2	-	15.4	10.0

BT = Bako Tib District, IG = Ilu Gelan District, and N = number of respondents.

households (95.4%), hotel/restaurants (87.0%), and butcheries (86.7%) were dirty and/or flay cut.

Hide and skin management practice by respondents after flaying is indicated in **Table 14**. According to the respondents, 38.5% and 33.8% of the households put hide and skin on the ground, and fold and put on the ground, respectively.

Around one-third of hotel/restaurants and more than two-thirds of household respondents kept hides and skins at home without preservation before selling for 6 hours and from 12 hours to 1 day, respectively. Besides, one-fifth of butcheries respondents were not selling hides due to low price (**Table 15**).

The average prices of hide, sheep skin and goat skin in 2017 were 5.6, 10.6 and 3.4 Ethiopian Birr (ETB) per piece, respectively (**Table 16**). According to the respondents report the cost of hide and skin were generally declined in the study area as compared to the price between 2010 to 2015. Hence, the decline in price made the producer to be less interested to sell, and to give poor attention during slaughtering of livestock and transportation of hides and skins.

Table 14. Hide and skin management practices.

Storage place immediately after slaughter	Districts			P
	BT N = 114	IG N = 81	OA N = 195	
	%	%	%	
Store on the ground	39.5	37.0	38.5	0.193
Used for storing of fresh meat	2.6	4.9	3.6	
Fold and put on the ground	34.2	33.3	33.8	
Used for fresh meat storage + fold and put on the ground	19.3	12.3	16.4	
Store on the ground + used for fresh meat storage	4.4	12.3	7.7	
Fresh Hide and skin storage method				
On the ground	80.7	80.2	80.5	
In plastic bag	19.3	19.8	19.5	

BT = Bako Tibe district, IG = Ilu Gelan district, OA = Over All.

Table 15. Duration of storage of hide and skin without preservation before selling.

Respondent category	Duration of storage	Districts				Overall		P
		Bako Tibe		Ilu Gelan		F	%	
		F	%	F	%			
Household	6 hours	11	9.6	11	13.6	22	11.3	0.045
	12 hours	42	36.8	33	40.7	75	38.5	
	1 day	52	45.6	23	28.4	75	38.5	
	2 days	9	7.9	14	17.3	23	11.8	
Hotel/restaurants								
Butcheries	Sale immediately	8	61.5	7	70.0	15	65.2	
	For six hours	5	38.5	3	30.0	8	34.8	
	Sale immediately	8	88.9	4	66.7	12	80.0	
	Ignore selling	1	11.1	2	33.3	3	20.0	
Reason for delay	Poor market access	96	84.2	62	76.5	185	81.0	
	Low price	18	15.8	19	23.5	37	19.0	

F = Frequency.

Table 16. Price of hide and skin in 2017 in the study area.

Source of hide and skin	Respondents	Price of hide and skins/piece in ETB			
		N	Mean	Minimum	Maximum
Cattle	House hold	195	5.4	5.0	9.0
	Butcheries	15	6.9	5.0	9.0
	Hotel/restaurants	23	6.5	5.0	9.0
	Total/average	233	5.6	5.0	9.0

Continued

Sheep	House hold	195	10.5	10.0	15.0
	Butcherries	15	11.5	10.0	15.0
	Hotel/restaurants	23	11.4	10.0	15.0
	Total/average	233	10.6	10.0	15.0
Goat	House hold	195	3.2	3.0	5.0
	Butcherries	15	4.1	3.0	5.0
	Hotel/restaurants	23	3.8	3.0	5.0
	Total/average	233	3.4	3.0	5.0

N = Number of respondents, ETB = Ethiopian Birrs.

3.3. Hide and Skin Defects at Collection Centers

The highest prevalent defects observed at collection centers were flesh remnant, contamination with dirt, corduroying and flay cut/hole (**Table 17**). These defects were directly related to the absence of slaughtering facilities in the study areas especially in Ilu Gelan district. In addition, during group discussions the discussants explained that hide came from animals slaughtered for festivity purposes were with higher defects due to faulty slaughtering techniques and handling of hide and skin.

One-third, one-fifth, two-third and half of the hides observed in the store had defects on the belly, shoulder and butt by corduroying, flay cut, flesh remnant and dirt, respectively (**Table 18**). According to the criteria set by Ethiopian quality standard (EQS) for the assessment of defects on hide and skin indicated that the place where the defects occurred had a significant effect on hide and skin quality.

In sheep skins, there was a higher prevalence of flesh remnant followed by dirt, poor pattern and flay cut/hole (**Table 19**).

All fresh skins sampled from 455 goat skins were found with at least one defect. A higher prevalence of dirt was observed in goat skins followed by flesh remnant, flay cut/hole, corduroying, poor pattern and other defects (**Table 20**).

Poor pattern, flay cut hole and flesh remnant were significantly higher ($P < 0.05$) in sheep than in goat skins (**Table 21**). This difference may be the natural/genetic variation in which sheep skin is highly vulnerable to mechanical damages and easily affected by dirt, and sheep skin is also extensively soft, comfortable and pliable while goat skins are strong and durable with a smooth fine grain.

3.4. Pre- and Post-Slaughter Defects of Hides and Skins

Regarding sources of materials, the key informant confirmed that the major sources of hides and skins for their respective tanneries were wholesalers. The tanneries used quality parameters such as size, poor pattern, skin lesions, knife cuts and purification while purchasing hides and skins from wholesalers. The

Table 17. Post-slaughter defect on cattle hide in both districts.

Defects	Districts						P
	Bako Tibe (N = 206)		Ilu Gelan (N = 214)		Overall (N = 420)		
	F	%	F	%	F	%	
Poor pattern	60	29.1	84	39.3	114	34.3	0.029
Gauge marks	74	35.9	106	49.5	180	42.9	0.005
Corduroying	148	71.8	152	71.0	300	71.4	0.853
Flay cut	108	52.4	168	78.5	276	65.7	0.000
Flesh remnant	192	93.2	204	95.3	396	94.3	0.349
Putrefaction	12	5.8	12	5.6	24	5.7	0.923
Dirty	179	86.9	133	62.1	312	74.3	0.000

F = Frequency.

Table 18. Prevalence of green hide defects at different parts of the skin (N = 420).

Defects	Position of defects							Overall
	B	S	Bu	B + S	B + Bu	S + Bu	B + S + Bu	
	%	%	%	%	%	%	%	
Poor pattern	5.7	14.3	0	14.3	0	0	0	34.3
Gauge mark	2.9	-	17.1	2.9	2.9	2.9	14.3	42.9
Corduroying	8.6	2.9	8.6	8.6	8.6	0	34.3	71.4
Flay cut	11.4	8.6	0	8.6	8.6	5.7	22.9	65.7
Flesh remnant	0	14.3	0	11.4	2.9	0	65.7	94.3
Purification	0	0	0	0	0	0	5.7	5.7
Dirt	5.7	0	0	11.4	0	5.7	51.4	74.3

N = Number of observed cattle hide; B = Bellies, S = Shoulder, Bu = Butt, B + S = Bellies + Shoulder, B + Bu = Bellies + Butt, S + Bu = Shoulder + Butt, B + S + Bu = Bellies + Shoulder + Butt.

Table 19. Post-slaughter defect observed on sheep skin in the study districts.

Defects	Districts						P
	Bako Tibe (N = 572)		Ilu Gelan (N = 163)		Overall (N = 735)		
	F	%	F	%	F	%	
Poor pattern	176	30.8	34	20.9	210	28.6	0.013
Gauge marks	32	5.6	10	6.1	42	5.7	0.793
Corduroying	59	10.3	25	15.3	84	11.4	0.075
Flay cut	161	28.1	49	30.1	210	28.6	0.633
Flesh remnant	395	69.1	109	66.9	504	68.6	0.596
Putrefaction	31	5.4	11	6.7	42	5.7	0.519
Dirty	206	36.0	67	41.1	273	37.1	0.235

F = Frequency.

Table 20. Post slaughter defect observed on fresh goat skins in the study districts.

Defects	Bako Tibe (N = 231)		Ilu Gelan (N = 224)		Overall (N = 455)		P
	F	%	F	%	F	%	
Poor pattern	36	15.6	16	7.1	52	11.4	0.005
Gauge marks	15	6.5	11	4.9	26	5.7	0.467
Corduroying	38	16.5	27	12.1	65	14.3	0.180
Flay cut	31	13.4	60	26.8	91	20.0	0.000
Flesh remnant	62	26.8	68	30.4	130	28.6	0.406
Putrefaction	8	3.5	5	2.2	13	2.9	0.431
Dirty	106	45.9	102	45.5	208	45.7	0.940

F = Frequency.

Table 21. Comparison between green sheep and goat skin defects.

Defects	Source of green skin						P
	Sheep (N = 735)		Goat (N = 455)		Total (N = 1190)		
	F	%	F	%	F	%	
Poor pattern	210	28.6	52	11.4	262	22	0.00
Gauge mark	42	5.7	26	5.7	68	5.7	0.150
corduroying	84	11.4	65	14.3	149	12.5	0.148
Flay cut	210	28.6	91	20	301	23.5	0.001
Flesh remnant	504	68.6	130	28.6	634	53.3	0.000
Putrefaction	42	5.7	13	2.9	55	4.6	0.023

major defects observed on hide and skin bought from whole sellers were horn rake, ectoparasites, wounds and branding. These problems were attributed to poor live animal husbandry, poor veterinary services, traditional methods of slaughtering and poor collection and handling of hides and skins at different levels.

Moreover, according to the tanneries the major defects that downgrade and increase the chance of rejection of skin after pickling and wet blue stage were; “*ekek*” (itching) and flaying defect followed by scar, scratch, poor substance, pox and putrefaction. In cattle hide, “*ekek*”, flaying cuts, putrefaction, scratch, branding, scar and wounds were the major defects.

4. Discussion

Households in the study areas sold or slaughtered livestock at an advanced age and as the age of an animal advance it accrues more defect on hide and skin such as bruise, horn rake, diseases, parasites, scratches and other defects. As animals grow older, the grain surface becomes tougher and coarser and aged animals accumulate more scars from brands, diseases, parasites, scratches and other injuries [14]. Livestock transported to market places on foot could also be exposed

to many mechanical factors such as horn rake, rope mark and scratch and tearing due to different thorny plant along transportation routes.

4.1. Pre-Slaughter Factors Affecting Hide and Skin Quality

Slaughtering without sufficient rest is the causes of incomplete bleeding and reduces effective removal of hides/skin from animal. ESGPIP reported that fatigued animals, especially after a long trek on foot or rail, should be allowed to recover prior to slaughter, and if not, incomplete bleeding may occur [15]. Removing the skin from fatigued slaughtered animals is also difficult and leads to more chances for the skin to be cut. Therefore, animals should get rest with free access to drinking water, and either held off-feed or given very little feed for at least 24 hours before slaughter.

In the study areas slaughter animals were housed in rough earthen floor during night until being sold and/or slaughtered. This indicates that some of the defects of hide and skin may occur due to housing system. In this regard, housing and fencing are the main factors that predispose to damages such as pricking, scratches, drag marks and dunging to hide and skins [16].

The major pre-slaughter defects observed on live animal were caused by wounds and horn rake in the study areas. At Bahir Dar Tannery the major reason for the production of low-quality pelts was attributed to high prevalence of ectoparasitic diseases [17]. Other study reported that most bruises and wounds are inflicted on animals due to severe beating especially for draught animals, and during transportation [18].

The current study found that there was no extension service about husbandry practices that can reduce hide and skin defect on live animals and hence majority of respondents did not have the required knowledge and skill on hide and skin production and management. Similarly, in Arsi Zone of Ethiopia the major constraints on hides and skin management were absence of extension services regarding pre-and post-slaughter management of hide and skins [19]. In Kenya most bruises and wounds are inflicted on animals due to severe mechanical factors like horn rake, rope mark and wounds during transportation [18]. Other study around Assela and Sagure town, East Arsi most transporters beat the animals during transportation to slaughter house or from market to market [20].

4.2. Post-Slaughter Factors Affecting Hide and Skin Quality

Hide and skin defects such as poor bleeding, flesh remnant, flay cut, poor pattern, gauge mark, corduroying and dirty that downgrade hide and skin value were attributed to slaughtering of animals on the ground without stunning. Stunning animal prior to slaughter makes the animal unconscious, and reduce stress and injuries that in turn reduce defect of hide and skins. In some part of Kenya rudimentary tools were used for slaughtering that caused manmade defects on skins and hides and thus reduce prices [21]. Inappropriate slaughtering

methods like hole/flay cuts, score, gouges, siding were the commonly observed and visible defects at tanneries in Addis Ababa and Modjo [22]. Similarly, USAID reported that the major producers of hides and skins are individual householders residing in the different kebeles across Ethiopia and hence majority of sheep and goats (90%) and most of the cattle (70%) are slaughtered informally in homesteads for consumption by the owner or in a small group on which formal slaughtering facilities do not exist [4]. These findings are in agreement with the report that filthiness, gauge marks, flay cut and poor pattern to be the most important defects of hide and skin in East Gojam Zone of the Amhara Regional State [23].

This result indicates that most respondents were not given due attention for hide and skin after slaughtering which is in agreement with findings in Eastern Tigray poor handling system exposed hide and skin to different defect [24]. USAID also reported that in most cases hides and skins remain unpreserved until it reached the trader [4]. Moreover, delay to sell and inappropriate handling of hide and skin in the study districts were attributed to low hide and skin prices and poor market access. Similarly, poor quality of hides and skins led to low prices and on the other hand discouraged pastoralists from selling their products [25]. Moreover, in Eastern Tigray lack of competitive pricing (price setting), lack of transparent quality measurement and lack of access to the market (information and distance) had significant impact on marketing of hide and skin by the farmers [24].

4.3. Hide and Skin Defects at Collection Centers

In addition, during group discussions the discussants explained that hide came from animals slaughtered for festivity purposes were with higher defects due to faulty slaughtering techniques and handling of hide and skin. Similarly, USAID reported that many of municipal slaughtering house remove hides and skins from animal carcasses by hand [4]. Manual removal of hides and skins can cause extensive damage to the hide/skin via cuts and holes which substantially reduces their value. Moreover, flesh remnant, contamination with dirt, flay cut/hole and corduroying were the most frequently observed defects on hides and skins in Arsi Negele districts [26].

In the study areas there was a higher prevalence of flesh remnant on sheep skin followed by dirt, poor pattern and flay cut/hole. Similarly, on raw skin of sheep the most prevalent defects were flay cut hole, dirt, corduroying, gouge mark in East Arsi Zone [19]. It is also in line with the report from Bahir-Dar town that poor pattern, dirt and corduroying were the major defects of sheep skin [27].

Moreover, according to the tanneries the major defects that downgrade and increase the chance of rejection of skin after pickling and wet blue stage were; “*ekek*” (itching) and flaying defect followed by scar, scratch, poor substance, pox and putrefaction. In cattle hide, “*ekek*”, flaying cuts, putrefaction, scratch,

branding, scar and wounds were the major defects. This finding is similar with from tanneries in Addis Ababa and Mojo in which “*ekek*”, scratch, wound and scar, putrefaction and flay cuts were major causes of skin and hide rejection [22]. In agreement to this, earlier study indicated that the leather industries were constrained by the poor quality of raw materials, lack of an efficient market structure, a weak extension service, competition from local and rural tanning industries, and a lack of price incentive for production of good quality raw material [28]. Similarly, the current study also observed similar constraints on the leather industries.

5. Conclusion

The major pre slaughter defects observed on hide and skin of livestock were wound, ectoparasites and horn rake which affect the quality of hide and skin in the study districts. Whereas, from post-slaughter activities, the major defect observed was dirty, flay cut and flesh remnant. Animals were slaughtered on the ground without stunning which increased defects. Locally available knives and axe were used for ripping and flaying hide and skin. These equipments increase the probability of flay cuts, corduroying and gauge mark defects during slaughtering. This result also indicated that most respondents did not gave due attention for hide and skin after slaughtering which exposed hide and skin for contamination with blood and dirty that facilitate putrefaction. To address these constraints, awareness creation and training should be given to households, middle men (traders), butchers and hotel/restaurant on animal housing, feeding, transporting, slaughtering methods and post slaughtering hide and skins managements. Standardized municipality abattoir should be constructed particularly at Ilu Gelan town to avoid or to limit backyard animal slaughtering which was the major cause of hide and skin defects. Moreover, hide and skin storage of the collectors should be constructed according to the standard set by Ministry of Agriculture (MoA). The government and private institutions need to organize individual middlemen under micro-enterprise for proper management of hide and skin and for job creation. Last but not least better market information, access and criteria-based prices according to defined quality of hide and skin need to be introduced.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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