

Prevalence of pathological conditions causing skin damage and consequently reducing its market value in domestic ruminants of Punjab, Pakistan

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Abstract

Data regarding the prevalence of skin diseases reducing the market value of skins and hides and ultimately refined leather were not available in Pakistan. The current study was conducted in the hide/skin markets and abattoirs of Lahore and Faisalabad and tanneries of Sheikhpura, Kasur and Sialkot. The record of various skin diseases and conditions damaging the skin/hide of cattle, goat and sheep was made. Lesions, extent and type of damage were recorded. A total of 21,671 skins / hides were examined out of which 3918 of skins and 600 hides were examined at the abattoirs of Lahore and Faisalabad, 6784 Skins and 1399 hides at hide markets and 8091 skins and 879 hides at tanneries. Out of total 21,671 skins / hides, 66.12% were normal and 33.88% were having some sort of damage. The data were gathered on questionnaire sheets. The prevalence of skin diseases was assessed through Strata V.9 software program. The correlation of the disease and area was analyzed by the chi-square. The prevalence of various diseases and damages due to mal-management in sheep, goats and cattle has been discussed in detail. The damages in goat skins were significantly less as compared with cattle and sheep. However, the type of defects and severity varied amongst various ruminants studied. The most common damages observed, overall in all species studied were atrophy of skin (Thin skin) 6.38%, followed in descending order observed was lesions of wounds 4.94%, old lesions of pox 4.82%, flaying cuts 3.17%, tick infestation 3.08%, lesions caused by mites infestation 2.45%, scratches 2.33%, lesions caused by warble fly larvae 1.47%, decomposition 1.32%, charr (fibrosis) 1.28%, ringworm infection 1.10%, extensive soiling by dung 0.84%, chronic abscesses 0.46%, and Lice infestation 0.17%.

Introduction

Leather and leather products represent most important and dynamic industrial sectors in Pakistan after cotton and textile. Leather industry of Pakistan is comprised of a large number of small and large units and there are 800 tanneries in the country that employ more than 0.50 million people directly and indirectly. It contributes 6.15% of large scale manufacturing GDP and 6.56% of export earnings. The export earnings from finished leather and value added leather products were approximately \$1251 million for the year 2007-08.¹ Leather industry of Pakistan has shown a great growth over the last many years. The industry is unique in many respects and needs to be exploited.

The quality of the hide or skin is to a large extent related to the amount of damage to the grain (or outside) surface. The damage may be due to skin parasites that affect the live animal, related scratch, husbandry practices on the farm or in transport of the live animal (scratches, bruising, or dirt contamination); it may be due to damage during slaughter or removal of the hide; or it may be caused by inappropriate handling or inadequate preservation techniques.² Most types of damage can be reduced or avoided altogether by better management of the animals or the hides.³

The biggest problem faced by the tanning and leather industry is the poor quality of the raw material received from the slaughterhouses or the hide markets. It is estimated that an increase of 30% can be realized in leather industry by controlling skin diseases and avoiding flaying cuts.

A large number of parasitic, fungal, bacterial and viral infections damage the skins and their magnitude depends upon the duration of condition and severity of the disease. Several ectoparasites can be responsible for damage of cattle hides. Some of the damage is very specific.⁴⁻⁹ Slaughterhouses across the country are over-crowded, poorly designed with insufficient facilities to handle animals before and after slaughter. Animals are slaughtered and dressed on the ground and many contaminants like manure, dirt, etc. are transferred to hides/skins and also to meat. This ultimately influences the quality and value of the products.

The most important factor affecting the quality of hides and skins is damage due to knives. Holes, cuts and scratches produced by knives are very common due to hand flaying. These blemishes are due to carelessness of unskilled workers at the abattoirs and bad handling of carcasses.

The present project was undertaken to know the prevalence of skin diseases in domestic ruminants and other damages inflicting to the skins and hides in Pakistan.

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The aim was to generate data regarding geographical distribution of skin diseases so that the preventive measures could be adopted. The other monumental problems incurred on living animals before and at the time of slaughter and to hides and skins after slaughter were also identified.

Materials and Methods

Design and area of study

The basic data regarding the prevalence of pathological skin conditions in Pakistan were lacking. The present project was designed in collaboration with Pakistan Tanners Association to study the prevalence of various pathological conditions of skins and hides in domestic ruminants (sheep, goat and cattle), which reduce the economic value of skins/hides (would be leather) in various areas of Punjab. Abattoir proved to be best source with regards to pathological conditions of the skin. Visits were made twice a week to Lahore abattoir. The animals were examined ante- and post-mortem. As soon as the animals were flayed, skins/hides and visceral organs were carefully

examined for the presence of any lesions. The lesions were brought in an appropriate manner in the pathology department for histopathological investigations. The study was conducted in the hide/skin markets and abattoirs of Lahore and Faisalabad and tanneries of Sheikhpura, Kasur and Sialkot. The record of various skin diseases and conditions damaging the skin of cattle, goat and sheep was made. Lesions, extent and type of damage were recorded. The data were collected on monthly basis for two years (January 2007 to December 2008) to record seasonal prevalence of various conditions. At the hide/skin markets and tanneries grading of skins/hides was done as per prevailing system.

There are three main ecological zones of Punjab including arid districts, northern irrigated districts and southern irrigated districts. The study was conducted in all three zones to investigate the prevalence of pathological conditions of skin in these regions.

Data management and statistical analysis

The data were gathered on questionnaire sheets and then pooled. The prevalence of skin diseases was assessed through Strata V.9 software program. The correlation of the disease and area was analyzed by the chi-square. The prevalence of disease was declared significant (S) if $P \leq 0.05$ and declared non-significant (NS) if $P \geq 0.05$.

Results and Discussion

In large cities, the animals are slaughtered in the slaughterhouses where ante- and post-mortem examination of the animals is performed to assure the hygienic meat supply to the population while in the rural areas and towns people slaughter the animals on their own. Skin and hides of the animals are then transported to the cities having hide markets. In the recent project was aimed to study the damages to the skins and hides caused by bad husbandry practices, diseases, mishandling of animals during transportation and at the abattoirs. The hides and skins can also be damaged if they are not properly cured and handled during transportation. Rodríguez *et al.* described the marketing system of goat and sheep skins in highland Baluchistan.¹⁰ They also stated that because of poor management, the quality of skins and hides was very low. Flaying cuts and other pathological conditions are common in that area. Different pathological conditions resulting in low grade skins and hides were recorded on the Proformas.

In the current study, a total of 21,671 skins and hides (Table 1) were studied from the

slaughterhouses, hide markets and tanneries over a period of two years. Out of total 21,671 skins/hides, 66.12% were found normal and 33.88% showed various kinds of damage. The detail of the data collected from different localities and types of lesions studied are given in Table 2.

The most common damages observed, overall in all species studied were atrophy of skin (thin skin) 6.38%, followed in descending order observed was lesions of wounds 4.94%, old lesions of pox 4.82%, flaying cuts 3.17%, tick infestation 3.08%, lesions caused by mites infestation 2.45%, scratches 2.33%, lesions caused by warble fly larvae 1.47%, decomposition 1.32%, charr (fibrosis) 1.28%, ringworm infection 1.10%, extensive soiling by dung 0.84%, chronic abscesses 0.46%, and Lice infestation 0.17% (Table 2).

The most common pathological condition observed was atrophy of skin, which seems to be associated with malnutrition, parasitic infestation, and other chronic diseases (tuberculosis, Johne's disease, etc.). The atrophied skins fetch fewer prices as compared with normal skins; leather as well is not of good quality. Thin skin was mostly observed in the female goats because they have more nutritional deficiencies during gestation and lactation periods and they are kept for long time to get offspring.

The second most common pathological condition was represented by wounds. Animals can get wounded at the farm, during transportation, or at the abattoir by getting strike against some hard object, kicked by another

animal or by goads. Even the skins and hides can be torn while being transported to hide markets and tanneries by nails and other sharp objects in the vehicle being used for transportation. The wounded skins/hides are graded low and the extent of injury is directly proportional to economic loss and poor quality of leather produced. Wounds of various sizes and shapes were seen in all the ruminants.

The third most important disease of skin recorded in the present study was goat pox. At postmortem examination pox lesions are of light brown to dark brown in color. The goat pox and sheep pox are often fatal and are characterized by wide spread skin eruption, often on muzzle, ears, and areas free of wool and long hair. Lesions start as erythematous areas on the skin and raise rapidly to circular plaques with congested borders caused by local inflammation, edema, and epithelial hyperplasia. As lesions start to regress necrosis of the dermis occurs, and dark, hard scabs form, which are sharply separated from the surrounding skin. Regeneration of the epithelium beneath the scab takes several weeks. When scabs are removed, a star shaped scar, free of

Table 1. Total data of goat, sheep and cattle collected from hide/skin markets, abattoirs and tanneries of Lahore and Faisalabad.

Hide markets	Slaughterhouses	Tanneries	
		Skins	Hides
6784	1399	3918	600
		8091	879

Table 2. Total disease wise data of goat, sheep and cattle collected from hide/skin markets, abattoirs and tanneries.

Study area/ Disease	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
		GOAT														
Tanneries	5518	310	171	139	160	-	138	361	95	638	126	75	-	-	-	7731
Abattoirs	2368	251	74	77	113	19	55	173	36	160	0	112	-	-	-	3438
H. Markets	4368	305	204	105	120	-	119	232	82	555	108	92	-	-	-	6290
Total	12,254	866	449	321	393	19	312	766	213	1353	234	279	-	-	-	17,459
	SHEEP															
Tanneries	164	35	27	21	18	-	17	35	0	0	5	-	43	-	-	360
Abattoirs	191	41	63	22	21	11	28	24	0	26	0	-	48	-	-	480
H. Market	398	5	39	4	9	-	4	6	2	5	13	-	9	-	-	494
Total	753	81	129	47	48	11	49	65	2	31	18	-	100	-	-	1334
	CATTLE															
Tanneries	336	28	21	40	2	-	41	96	105	-	7	-	-	125	130	931
Abattoirs	322	35	16	45	34	8	24	38	18	-	0	-	-	28	32	600
H. Markets	664	35	73	52	54	-	243	107	34	-	28	-	-	31	78	1399
Total	1322	98	110	137	90	8	308	241	105	-	35	-	-	184	240	2878
Grand total	14,329	1045	688	505	531	38	669	1072	320	1384	287	279	100	184	240	21,671
Percentage	66.12	4.82	3.17	2.33	2.45	0.17	3.08	4.94	1.47	6.38	1.32	1.28	0.46	0.84	1.10	

1, normal; 2, pox; 3, butcher cut; 4, scratches; 5, mite infestation; 6, lice; 7, ticks; 8, wound; 9, warble fly infestation; 10, thin skin (atrophy); 11, decomposition; 12, fibrosis; 13, abscesses; 14, dung; 15, ringworm.

hair or wool remains. The reason of high rate of infection could be due to the fact that goat population is not vaccinated in the country. After tanning process, the lesions become more prominent in form of white spots on the skin. The disease can be controlled by the use of vaccines, which are very effective and the immunity lasts forever in vaccinated animals.

Flaying cuts are the result of flaying by unskilled people and due to the use of unappropriate flaying tools. This results in cuts in the hides and skins thus reducing the economic value of skins and hides. These cuts mainly occur especially during Eid-ul-Azha, when there is huge slaughtering of animals for sacrifice purpose and trained flayers are not available to every individual. The overall prevalence of flaying cuts in all the animals was 3.17%. The percentage of occurrence of flaying cuts recorded was significantly higher during Eid-Ul-Azha. In technologically developed countries, the flaying is done with air pressure flaying machines and the personal are well trained, consequently the flaying cuts are negligible in those countries. Keeping this in view the modern flaying machines were obtained through this project and trainings were arranged at a local private abattoir for the persons engaged for this job. The first training was done of the employees of the above mentioned abattoir. The subsequent trainings will be done for other organizations and the students of the University of Veterinary and Animal Sciences, Lahore.

Tick infestation was the third common pathological condition that affects the skin of ruminants. Ticks are notorious threat animals causing irritation, allergy, and toxicosis.¹¹ They are known to transmit diseases, such as babesiosis, anaplasmosis, theileriosis, etc.¹² Ticks also harbor a number of pathogenic bacteria (Pasteurellae, Salmonellae, Brucellae, etc.), thus act as reservoir and transmit these bacteria to man and animals.¹³ The ticks feed by attaching to the skin of animals to suck their blood via needlelike mouth parts (hypostome). Most of the pathogenic ticks, affecting skins and hides, of domestic ruminants belong to the family Ixolidae (hard ticks).

Tick bites directly damage to the skin at the site of attachment, which predisposes to secondary bacterial infection leading to abscesses or myiasis. Adverse reactions to ticks depend in part on the content of salivary secretions. The severity of local cutaneous reactions varies not only with salivary secretions, but also with host resistance. Lesions include red papules that progress to circular erythematous areas up to 2 cm in diameter, which progress to focal necrosis, erosions, ulcers, crusts, and in some animals, nodules. Lesions heal with scarring and alopecia. Secondary bacterial infection of the wounds sometimes disfigure the skin, both epidermis and dermis. This affects

the quality of leather produced (its grain and suede).

Sajid *et al.* determined the diversity and intensity of tick population infesting domestic ruminants in districts of Layyah and Muzaffargarh, lower Punjab (Pakistan).¹⁴ A total of 1050 cattle, 700 buffaloes, 1400 each of sheep and goats and 250 camels were randomly selected and examined for the prevalence of tick infestation. The highest prevalence of tick infestation was found in cattle (n=789/1050; 75.1%) followed in order by goat (n=723/1400; 51.6%) and buffaloes (n=281/700; 40.08%). None of the examined camels and sheep was found infested with ticks. *Hyalomma anatolicum* was the most abundant followed by *Rhipicephalus sanguineus*.

The mites seen on the skins of animals at the abattoir were mainly demodex. These mites are common inhabitants of hair follicles and sebaceous glands leading to inflammation, loss of hair, and sometimes abscess formation. An important sign of infection by demodex mites is raised tuft of hair, underneath which are nodules formation, which can be seen more clearly on removing hair. In cattle, lesions were more frequent on the neck, shoulder, and back areas. In sheep, the disease was of lesser occurrence as compared to goats. It was more common on coronets, nose, tip of the ears, and around the eyes. This could be the reason of less prevalence, as the head and forelegs are removed and on the skins collected and sent to hide markets and tanneries the lesions are not carried over. In goats, it was more severe and the lesions were found more frequently on the lower side of neck, shoulders. In advanced stages of infestation, raised large (up to 10 mm in diameter) lesions on the goat skins were observed. In less advanced infestations, pitting of the skin surface was seen. In the latter situation, damage to the hide surface similar to the small holes and scars caused by ticks.

Scratches are linear wounds caused by nails, metallic wires, thorns and other hard pointed objects. They can occur at the farm, during transportation of animals, at the abattoir, or while the skins/hides are transported to the hide markets and tanneries. Usually the grain surface (epidermis is damaged), rarely the scratches are deeper and damage the dermis as well.

Brand marks are put on animals for identification. The branding is done through hot iron and freeze branding by copper or bronze super cooled in liquid nitrogen. The branding spoils leather like wounds.

The percentage of infestation of Warble fly larvae was comparatively more in cattle followed by goat and sheep. Perforations in the skins/hides were mostly seen in prime area. Ultimate diagnosis of the infestation was done by breathings holes caused by the larvae of the

flies. Bovine hypodermosis is a myiasis caused by larvae of *Hypoderma bovis* and *Hypoderma lineatum*. The larvae of the latter fly migrate to the submucosal connective tissue of the esophageal wall, where they accumulate for 2-4 months. *H. bovis* larvae migrate to the region of the spinal canal, where they are found in the epidural fat between the dura matter and the periosteum for a smaller period. The larvae arrive in the subdermal tissue of the back of the host where they make breathing holes through the skin. Finally the third stage larvae emerge through breathing holes, drop to the ground and pupate.¹⁵ The prevalence of *Hypoderma bovis* is reported to be much more in cattle in Turkey.⁷ The prevalence varies in different areas of the world.^{16,17} Ayaz and Khan examined 3000 buffaloes from DG Khan District of Southern Punjab and found 7 (0.23%) buffaloes affected with hypodermosis.¹⁸ The same workers expanded their study and in 2004 examined 30,000 buffaloes; Khan reported high prevalence of hypodermosis in cattle and goats from various areas of Pakistan.¹⁹

Decomposition (putrefaction) occurs if the hides/skins are not properly salted (preserved) and kept for long time, especially during hot and humid weather conditions, until they are processed. Decomposition results because of the growth of saprophytic, usually anaerobic bacteria, which degrade the proteins and other biological molecules. Before processing decomposed skins become discolored and smell very bad. After processing the putrefaction damage appears either as pitting of the surface of the leathers, or as a complete loss of the upper most surface of the leather, depending on the severity of the damage.

Fibrosis was another pathological condition, only found in goat's skins, in which linear fibrosed areas were seen extending from the chest regions of both side towards the dorsal mid line. These linear fibrosed areas could have been produced through healed migratory larvae of *Hypoderma crossi* or *Hypoderma silence*. The eggs of these larvae are laid on the long hair at the sides of the body and the larvae penetrate directly through the skin, remaining there to develop for about seven months. It has also been mentioned by Ayaz²⁰ that flies affecting goat are different from the cattle and the larvae emerge from the back of the goats after completing their life cycle.

Ringworm (Korrh) is a pathological condition of the hides observed only in cattle is characterized by roughly circular areas of discoloration of varying sizes (from 3 to 10 cm in diameter), on the outer side. After wet blue, these areas stand raised and rough against the uniformly smooth areas reflecting the normal skin. In finished leather these lesions appear as dull patches on the shiny normal skin. On microscopic examination it was revealed that

the lesions were due to ringworm infection, which is characterized by circular patches on the leather. The damage is permanent even if the infection is clinically cured on animal. If the infection is still active when the animal was slaughtered, then the damage was very pronounced with severe distortion of the grain surface and follicle mouths. Once the infection has cleared, the damage is less severe, but still very noticeable on the surface of the leather. Because of the alteration in the skin surface, the damage appears as shiny patches on dull leather or dull patches on shiny leather.²¹ Histopathological examination revealed parakeratosis, and acanthosis of the epidermis in most of the histological samples. Fungal hyphae and spores were also present from the samples collected from abattoirs with active infection.

The lesions caused by the lice usually cannot be seen by visual and tactile senses. However, experimental or known lice infestation at the abattoir revealed that biting by lice, results in skin inflammatory/immunological reaction, followed by necrosis and focal fibrosis. This skin damage in the leather would take the form of light spots and flecks. Heavy infestation of lice on sheep can also lead to cockle defects, which are small hard nodules on the leather (due to increased amount of tissue reaction). Nafstad et al. reported mild to moderate orthokeratotic hyperkeratosis while histopathological examination of biopsies of eleven steers infested with lice.² They also observed varying degrees of perivascular infiltration of mononuclear cells and eosinophilic granulocytes. In biopsies of 5 other steers they found only slight skin changes of the same type. In our study we also observed similar histological lesions as reported by the above mentioned workers.

Skin abscess was the most important condition affecting sheep skins. In a previous epidemiological study performed in an enzootic area (Segovia, central Spain), Tejedor *et al.*²² found that between 0.5 and 2.5% of 1-2 year old sheep were affected by abscess disease, and suggested that these animals might act as reservoirs and maintain the bacteria between outbreaks. Quiteria *et al.*²³ reliably reproduced the disease in lambs and kids rubbing superficial skin incisions with a swab soaked in an overnight culture of the bacteria. According to these authors, the first signs (a slight increase of rectal temperature and enlargement of one or more superficial lymph nodes), observed 5-7 days after infection, may go unnoticed under field conditions, and the disease is usually first identified when abscesses are clinically detectable about 3 weeks post-infection.

In another outbreak, the animals most probably became infected about shearing time and, probably, via shearing cut wounds. The location of abscesses in the natural cases of the

disease, as well as the results of experimental infections, suggest that the primary portal of entry for *S. aureus* subsp. *anaerobius* is skin abrasions or wounds.^{23,24} Caseous lymphadenitis (CLA) spreads mostly at shearing and can spread without external abscesses being cut during shearing.²⁵⁻²⁷ Paton *et al.*²⁸ found that post-shearing management, especially shower dipping and keeping sheep under cover, and affects the seroincidence of CLA. Conclusively, as is the case for CLA, shearing should also be considered an important risk factor for the spread of abscess disease.

The prevalence of chronic sheep abscess is 7.4%. Abscess is found in the hind part of the body. Its more prevalence in sheep is due to shearing practice that causes minor or micro injuries in the skin that facilitate the entry of pyogenic bacteria into skin. Initially, abscess is hard then progressively it becomes soft. Skins are placed in 4, 5 and rejected grade depending upon the number of abscesses present on the skin. This condition causes high economic losses in leather industry. Grossly, abscess is found as round mass and more clearly seen on the internal side of the skin. Histopathologically, it shows dark stained pus and neutrophilic infiltration.

In the current study, there was no significant difference found in prevalence of skin diseases in different geographical zones of Punjab.

Conclusions

Improved husbandry practices and good transportation and handling methods can prevent the damage to the hides and skins. Societies for prevention of cruelty to animals and non-government organizations dealing with animal welfare can help in public awareness that can be of use in preventing stress to animals and consequently prevent damage in form of wounds and scratches. Likewise, public awareness and provision of facilities of slaughter and flaying through modern techniques is recommended to prevent flaying cuts and subsequent huge economic losses.

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