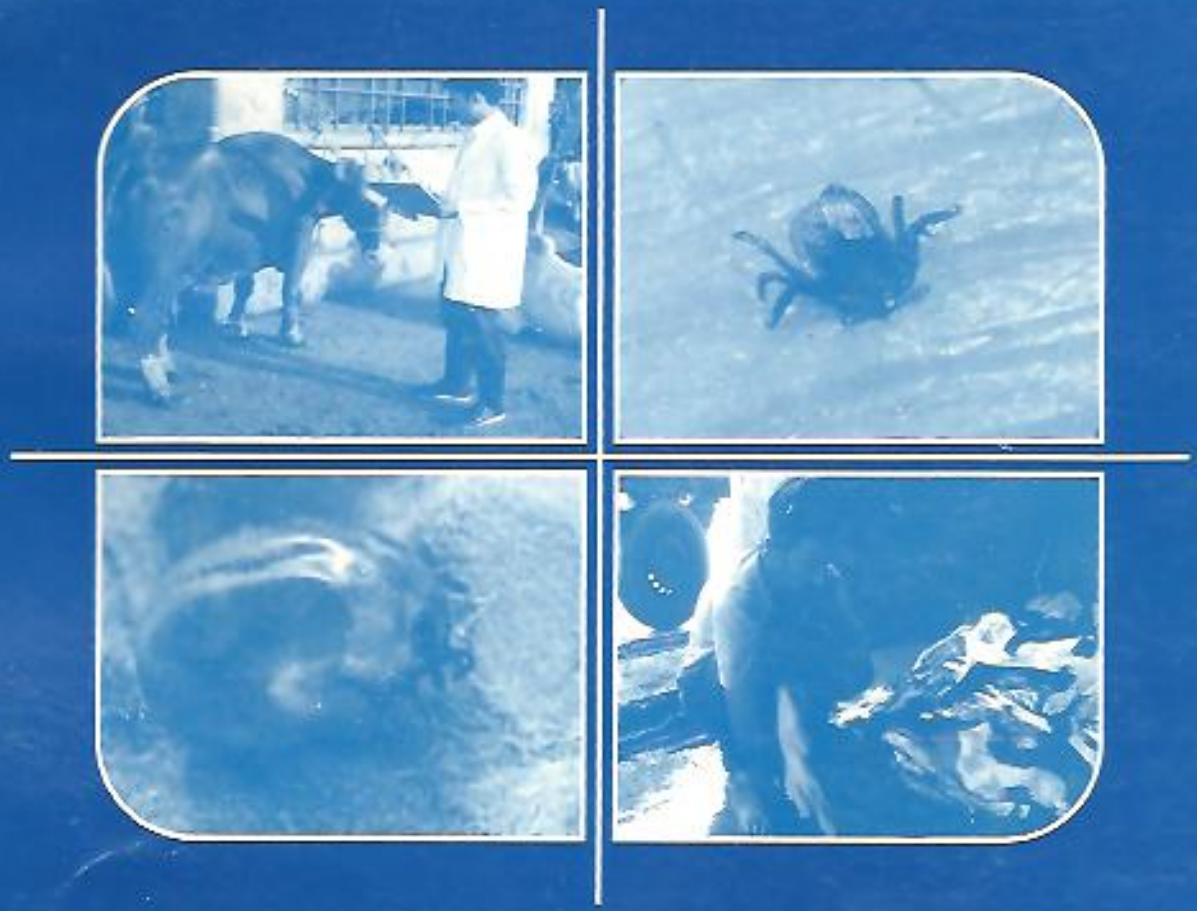
Research Report

On

Prevalence and Control of Pathological Conditions Causing Skin Damage and Consequently Reducing its Market Value in Domestic Ruminants of Punjab



Joint Project of
UVAS & PTA

Final Report

Project Title: Prevalence and Control of Pathological Conditions Causing Skin Damage and Consequently Reducing its Market Value in Domestic Ruminants of Punjab.

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Co-Principal Investigator: Mr. Agha Saiddain

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Project Duration: Two years extended upto three years

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بسم الله الرحمن الرحيم
O assembly of jinn and men! did there not come to you messengers from among you, relating to you My communications and warning you of the meeting of this day of yours? They shall say: We bear witness against ourselves: and the world's life deceived them, and they shall bear witness against their own souls that they were unbelievers.
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AL-QURAN

And Cattle He has created for you (men) from them ye drive Warmth, and numerous benefits and of their meat ye eat.

(16:5)

HOLY BIBLE

And Adam also and to his wife did the LORD GOD make Coats of skins and clothed them.

(CHAPTER 3:21)

And Abraham was very rich in Cattle in Silver and Gold.

(CHAPTER 13:2)

MOHENJO DARO

MEMORANDUM OF UNDERSTANDING
BETWEEN
PAKISTAN TANNERS ASSOCIATION
AND
UNIVERSITY OF VETERINARY AND ANIMAL SCIENCES (UVAS), LAHORE

1. The Pakistan Tanners Association and the University of Veterinary and Animal Sciences, Lahore, perceiving that mutual co-operation in the field of Leather Industry activities will strengthen the scientific research, training and technology in the relevant field will bring benefits to both sides, do hereby agree to cooperate in the following fields.

2. Both, the Pakistan Tanners Association and the University of Veterinary and Animal Sciences, Lahore undertake to pursue a programme of training, research and technical collaboration for the exchange of ideas, skills and techniques of mutual interest as agreed from time to time. Initially the cooperation may include the following:

   i.) Facilitate technical personnel to survey the skin/hides diseases and damage caused due to butcher's cuts at the time of flaying.

   ii.) Joint or collaborated scientific research to devise economic measures to control the skin/hides diseases prevalent in various areas of Punjab. To achieve this objective, the Association will support the University through provision of required equipment, award of internship training to all eligible undergraduate and postgraduate students. The scientist of the University producing outstanding research results shall also be recognized through meritorious awards.

   iii.) Human resource development by providing training to technical personnel at abbatoirs and to reduce the extent of damage inflicted to skins and hides.

   iv.) Leather Industry, training visits of staff and university students to Industrial Leather manufacturing Units.

   v.) Any other form of cooperation that both parties may agree.

3. The two organizations agree to co-operate as this would facilitate joint interactions and efforts between scientists and professionals and industrial of wide experience leading to resoling of the existing problems affecting skins/hides productivity.

4. Having agreed to the above contents of MOU, the parties concerned have fixed their signatures as under on December 31, 2004

manzoor ahmad

(PROF. DR. MANZOOR AHMAD)
VICE-CHANCELLOR,
UNIVERSITY OF VETERINARY AND
ANIMAL SCIENCES, LAHORE

(AGHA SAIDDAIN)
CONVENER
HIDE & SKIN IMPROVEMENT
(SUB-COMMITTEE)
PAKISTAN TANNERS ASSOCIATION

MOU is being signed by Prof. Dr. Manzoor Ahmad, Vice-Chancellor, University of Veterinary and Animal Sciences, Lahore (Right) and Mr. Agha Saiddain, Convener Hide and Skin Improvement (Sub-Committee), Pakistan Tanners Association (Left), on December 31, 2004.

Project Team

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Project Activities

Office of the Project

Motorcycles purchased for the field work

Bone Saw

Flaying Machine and Blade sharpener

Research Associate making Antemortem report

Research Associate making Postmortem report

A view of the Hide Market

Skin Specimens collected from abattoirs

A worker getting training of flaying machine at an Abattoir

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 500000 people directly and indirectly. It is third most dynamic sector after cotton, textile and rice. 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. (Federal Bureau of Statistics). Leather industry of Pakistan has shown a great growth over the last many years. Leather industry of Pakistan is unique in many respects and these areas need 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 (Nafstad *et al.,* 2001) 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. Most types of damage can be reduced or avoided altogether by better management of the animals or the hides (International Council of Tanners, 2004).

The biggest problem faced by the tanning and leather industry is the poor quality of the raw material it receives from the slaughterhouses or the hide markets. It is estimated that an increases of 30% can be realized in leather industry by controlling skin diseases and avoiding butcher's 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, such as grub damage caused by warble fly larvae, but most ectoparasite damage is more nonspecific. (Nafstad and Gronstol, 2001)

Mange is quite prevalent in our livestock and is responsible for chronic skin infections associated with debility, intense itching, rubbing and scratching. Parasites

tunnel in the skin and results in rough pitted leather with damaged grain (George *et al.*,1986). Warble flies are prevalent in many parts and fly larvae (Warbles / Meroo) damage the skin or cause perforations (Otranto *et al.*, 2005; Karatepe and Karatepe ,2008). In recent years, hide damage caused by lice has been increasingly recognized as a significant effect of lice infestation (Bugby et al.,1990; Weboter and Bugby 1990). The damage is described as areas of grain loss up to 3mm diameter that are seen on dyed crust leather (Bugby *et al.*, 1990).

Healed wound leave scars, which is a blemish, and become apparent after tanning. Tick infestation causes pinhole spots at the point of their attachment and it can be worsened by tick birds and secondary bacterial infections.

Many generalized diseases cause emaciation in animals and affect the size and strength of the skin produced from these animals. Nutritional status, body conditions, and age of the animal at slaughter affect the quality and size of the hides and skins. Ideally a tanner will like to have a skin from a healthy animal without a slaughtering blemish, removed properly, preserved and delivered to it without any damage. Our animals generally suffer from mal-nutrition and not many animals are specially raised or finished for meat industry. Healthy animals provide stronger hides / skins with greater thickness.

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 their quality and value.

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 under taken to know the prevalence of skin diseases in domestic ruminants and other damages inflicting to the skins and hides in Pakistan. The economic losses incurred due to skin diseases and management problems were also estimated. 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.

REVIEW OF LITERATURE

Monga and Mohapatra (1980) reviewed the available published reports on animal mycoses in India and the fungal agents isolated from animal material. Among dermatophytes, the occurrence of *Trichophyton verrucosum, T. mentagrophytes, T. rubrum, T. equimum, T. violaceum, T. simii, T. tonsurans, T. terrestre, T. ajelloi, Microsporum canis, M. gypseum and M. namum* has been reported. Cases of aspergillosis, candidiasis, phycomycosis, rhinosporidiosis, epizootic lymphangitis, mycotic abortions and mycotic mastitis have been recorded in animals in this country. However, there is no report of histoplasmosis, sporotrichosis, blastomycosis and coccidioidomycosis among animals from India.

Cundiff *et al.*, (1987) described Inheritance of vertical fiber hide defect (VFHD), a structural defect in collagen fiber orientation that causes weakness and reduced value of leather, using histological data on hide biopsies obtained from 465 Hereford cattle by 65 sires. The data set included 44 offspring-dam pairs, for which VFHD phenotypes had been diagnosed on both the offspring and dam. Examination of offspring and parental frequency distributions indicated that inheritance of the condition was likely to be an autosomal recessive. In a subsequent experiment, a Hereford bull with a known VFHD phenotype was mated to Hereford cows with known VFHD phenotypes and to Angus cows not showing the defect. Angus was chosen because the defect has never been observed in the breed. all offspring (5) resulting from VFHD × VFHD mating expressed the defect, while no offspring (12) out of VFHD × non-VFHD mating (angus cows) expressed the defect. It was concluded that VFHD is inherited as an autosomal recessive. The role that selection and alternative crossbreeding systems can play reducing phenotypic frequency of the defect.

Paton *et al.*, (1996) studied associations between the incidence of caseous lymphadenitis (CLA) in sheep and post-shearing management and environmental factors. CLA incidence was measured in 126 groups of 1 and 2-year-old sheep in 70 Western Australian flocks selected from the cull-for-age ewes with CLA lesions at abattoirs. CLA incidence was assessed using a CLA toxin ELISA. Dichotomous and polychotomous stepwise logistic regression methods were compared in examining the effects of management and environment on CLA incidence. Shower dipping sheep for ectoparasite control after shearing increased the odds of high CLA incidence by five to six times and keeping sheep under cover for 1 h or more after shearing increased the odds of being in high CLA incidence categories three-fold. The seroprevalence of existing CLA infection within each age group affected incidence more than did the overall slaughter-based flock estimate. This suggests that CLA spreads mostly within groups of sheep shorn together.

Castro *et al.*, (1997) tested three different tick control policies in groups of traditionally managed Sanga cattle in the Central Province of Zambia over a period of 3 years. One group was given strategic tick control treatment using 12 pyrethroid acaricide spray applications between the onset and the end of the wet season (October to March). The productivity of this herd was compared with that of a group with no tick control and a group under an intensive tick control regimen of spraying every week in the wet season and every 2 weeks in the dry season (36 applications per year). The highest output was associated with intensive tick control, followed by strategic control and then no tick control policies. However, when the costs of tick control were taken into account, the strategic tick control policy produced the best economic result, followed by the intensive and then the no tick control policies. Neither the strategic nor the intensive tick control policy was sufficient to prevent the transmission of East Coast fever (ECF) infection when this disease was introduced to the area.

Guglielmone *et al.*, (1999) studied the horny *Haematobia irritans* recently spread to Argentina and Uruguay which is believed to cause damage to cattle hides. Four groups of ten Holstein steers each were maintained for 58 weeks under different infestation levels with *H. irritans* to determine if it was the cause of this problem. Hides (chrome tanned) from steers maintained under minimum infestation level had 4.7±3.8% of the area damaged. Maintaining the steers under low *H. irritans* level for the last 44 days of the trial using insecticidal ear-tags, resulted in 29.5±15.8% of hide area being damaged. Steers that were treated with 5% cypermethrin pour-on, when the *H. irritans* population was close to 50 flies, showed that 31.3±16.6% of hide area was injured, and 46.6±12.8% of damaged hide area was found in hides from non-treated steers. Significant differences were found between mean hide damage from steers maintained continuously under low *H. irritans* infestation levels and all other groups. Hyperaemia was significantly lower in the skin of steers under low *H. irritans* infestation level than in the skins of non-treated steers and steers maintained under low-level infestations for the final 44 days. Eosinophil and mononuclear cell infiltration was significantly lower when the population of *H. irritans* was less than six per steer than when the population was more than 100 flies per steer. Low numbers of *Stomoxys calcitrans* were found in all groups, but most hide damage was presumed due to *H. irritans*.

Milnes *et al.*, (1999) used a postal questionnaire to collect information on the prevalence of lice on cattle on a random sample of dairy farms in England and the bordering counties of Wales. Replies were received from 1040 (52·8 per cent) of the 1970 farms which were mailed. Fifty per cent of farmers reported having ever seen or suspected lice in their herds and 29 per cent reported possible infestations in the winter of 1996/97. Visits were made to 24 farms in the south west of England during February 1998. Twelve of the farmers said that they had seen or suspected lice in their herd since October 1997, and that lice were more frequently observed on the adult cattle. However, examination revealed lice on 18 of the 24 farms, and adult cattle were the least likely group to be infested.

Kanagaraj *et al.*, (2001) studied the ill-effects of sodium chloride on the environment and eco-system and suggested that there is an urgent need for the development and adoption of a viable cleaner curing system. In their study, a short-term preservation technique using silica gel has been studied and standardized. The possibility of using silica gel in place of salt as a curing agent alone and in combination with a suitable biocide was studied at an ambient temperature of 31°C. The preservation efficacy of the methods was assessed by various parameters such as moisture content, total extractable nitrogen, and bacterial count. The layer wise moisture content was determined using a NMR micro-imaging technique. The effect of the new curing methods on the fibre structure of treated skins was assessed using scanning electron microscopic (SEM) studies. The pollution load generated in the processing of the skins treated using the new techniques was compared with that for salt cured stock. The results showed that the cleaner preservation techniques developed were as efficient as salt curing for the preservation of skins. The new curing methods did not pose any problem either in soaking or in the leather manufacturing processes. The methods developed were found to be effective and viable options for combating the pollution problems of chloride and total dissolved solids (TDS).

Campbell *et al.*, (2001) applied several insecticides to cattle at various rates, mixtures, application methods and number of treatments and evaluated for control of cattle lice.Five endectocides, Eprinex®, Ivomec®, Dectomax®, Cydectin® and Phoenectin® were all applied at the same rate. The cattle utilized in this research were all infested with a mixture of lice species. The species included: *Bovicola* (*Damalinia*) *bovis* (L.), *Haematopinus eurysternus* (Nitzsch), *Linognthus vituli* (L.) and *Solenoptes capillatus* (Enderlein). Most of the cattle were infested with at least two species and some had three or all four species present. All of the treatments except permethrin 1.0%+5% PBO, at a rate of 3 ml/45.4 kg wt. provided acceptable lice control with one application. Data indicated that applying the insecticides in early January should provide enough control to render the need for a second treatment unnecessary.

Nafstad *et al.*, (2001) studied the skin histology and the scanning electron microscope morphology of the hide defect light flecks and spots after tanning in 11 steers infested with biting lice *(Damalinia bovis)*. Nine steers from herds free of lice were used as controls. Skin biopsies from 6 of the animals in the lice infested group showed mild to moderate hyperkeratosis and moderate perivascular to diffuse dermatitis with infiltration of mainly mononuclear cells and some eosinophilic granulocytes. The steers were slaughtered at an age of 18 to 23 months. Light flecks and spots occurred on all examined hides from the infested group after tanning. No examined hides from the control group demonstrated similar damage. Both light microscopic examination of sections of tanned hide with light flecks and spots and scanning electron microscopy of the same defects showed superficial grain loss and craters with a irregular fiber base encircled by smooth and intact grain. The association between louse infestation at an early age and damage of hides following slaughter 6 to 15 months later, suggested that louse infestations lead to a prolonged or lifelong weakening in the dermis. This weakening may cause superficial grain loss during the tanning process.

Nafstad and Grønstøl (2001) developed and evaluated eradication as a strategy to control lice in cattle. Thirty-three herds of cattle were selected and observed during a period of two and a half years. Before eradication, biting lice (*Damalinia bovis*) were present in 94% of the herds and 27% of the animals. Sucking lice (*Linognathus vituli*) were present in 42% of the herds and 5% of the animals. These levels were very similar to those reported from other countries in Northern Europe. The eradication strategy was successful in 28 of 33 herds, but lice were still present in 5 herds 3 to 6 months after treatment. Biting lice were present in all these 5 herds; sucking lice were present in 3 herds. During the next 12 months, nine of the 28 herds were reinfected with lice. Six herds were reinfected with just biting lice, 2 herds with just sucking lice and one herd was reinfected with both. There was no significant difference between the 2 louse species regarding the risk of unsuccessful eradication or reinfection. The only significant risk factor for reinfection was either purchase of livestock or use of common pasture, combined with failure in pre-treatment of newly introduced animals.

Coles *et al.*, (2003) investigated the relationship between lice infestation and leather damage in a trial involving 61 cattle, half of which were treated with ectoparasiticides for lice control either in their first or second year. Hides from the lice-free and lousy calves were removed manually at an abattoir, tanned and inspected for lice-related damage, commercially referred to as light spot and/or fleck. In both the first- and second-year animals there was a significant difference between the hides of the lousy and lice-free animals, confirming that the chewing louse *Bovicola bovis* is a cause of winter light spot. There was also a difference between the two groups in the levels of scratch damage. After the infested animals had been treated with fenvalerate and eprinomectin to kill all the lice, the damage to the hides had not been fully reversed 13 weeks later.

Otrantoa *et al.*, (2005) estimated the presence and the seroprevalence of hypodermosis in Albania, 625 head of cattle were bled during two sampling seasons (i.e. from February to March 2003 and from November to December 2003). The cattle came from three collection sites in Northern (site A), Central (site B) and Southern (site C) Albania. Milk samples were collected monthly from four animals from October 2002 to May 2003 during the lactating period. The animals were also clinically examined for the presence of warbles by manual palpation from April to July 2003 and 2004 and third instar larvae were collected and morphologically identified. Serum and milk samples were processed by ELISA. One hundred and thirty-three (38.6%) out of 344 and 116 (41.3%) out of 281 animals were found to be seropositive for Hypoderma during the first and the second sampling season. In particular, the animals from site C presented the highest percentage of seropositive results (i.e. 72.8% and 97.8% in the first and in second year, respectively) followed by the animals from sites A (i.e. 35.8% and 23.8% in the first and in second year, respectively) and B (i.e. 17.8% and 3.4% in the first and in second year, respectively). The kinetics of anti-Hypoderma antibodies in milk samples showed the highest antibody titres from October to February 2003. All the seropositive animals in both the sampling periods showed the presence of one or more warbles under the skin during April and May 2003 and 2004 and the third-stage larvae collected were morphologically identified as Hypoderma bovis. The results of this survey indicate that hypodermosis is widespread in Albania and that early prophylactic treatments must be

carried out accordingly. The hope is not only to reduce the parasitic intensity with obvious benefits for livestock production, but also to avoid the risk of spreading this parasitic disease to neighboring countries.

Hadley *et al.*, (2005) studied the relationship between lice infestation in calves during their first winter and damage to the leather produced was investigated in a trial involving 500 calves, 100 of which were treated with a pour-on endectocide during the first winter. All the calves received routine lice treatment in the second winter and were reared to slaughter weight. The hides were removed at the abattoir, tanned, inspected for lice-related damage, and graded according to their suitability for the production of high quality leather. The untreated group developed natural infestations of the chewing louse *(Bovicola bovis)* during the first winter but none was observed in the second winter. Hides from cattle infested with lice in their first winter had higher levels of lice damage than hides from those treated with eprinomectin, at both the chrome-tanned and dried dyed-crust stages of leather production.

Yeh and Perng (2005) studied defects exist on natural leather surfaces that cannot be eliminated during processing. No international criterion specifies the compensatory counting for calf leather surface defects. So complicated negotiations, causes additional cost and argument between suppliers and purchasers. The objective of this article is to establish a compensatory standard of leather defects for finished leather transactions. We start by collecting 170 samples of defective leather and classify the leather defects into seven types. By using digital image processing techniques, we can identify the defects and group nearby defects into a larger scrap area. The area of leather falling into disuse can be calculated. The compensatory standard corresponding to each type of leather defect is then defined. The established compensatory standard for finished leather transactions is evaluated for simulated practical leather transaction. Simulation results showed that the proposed approach is useful and beneficial for practical leather transactions.

Bhanuprakash *et al.*, (2006) stated that sheep are the moving banks of shepherds and their economic contribution in terms of meat, wool and skin/hide is immense. Various infectious diseases jeopardize the optimum productivity; among which sheep pox is more important as the disease restricts the export of sheep and their products besides other economic losses. Although, clinical signs are indicative of the disease but a laboratory confirmation is necessary for unequivocal diagnosis and studying epidemiology. The causative agent, sheep pox virus (SPV), is antigenically and genetically closely related to goat pox virus (GPV) and lumpy skin disease virus (LSDV), the other members of the genus capripox virus. In some countries, SPV and GPV are cross infective to small ruminants posing problem in diagnosis and epidemiology. However, recent studies have showed that the viruses are phylogenetically distinct and can be differentiated by molecular tools. Prophylaxis using attenuated vaccines is the choice of control measure as the immunity is long lasting. Detailed information on isolation, identification, pathology, epidemiology, diagnosis and prophylaxis would not only help in updating the knowledge of scientific fraternity but will be useful to the policy makers in order to formulate appropriate measures for control and eradication of the disease. This synthesis is to present an up-to-date review of the disease and its control to provide the reader with an overview of the problem.

James *et al.*, (2007) stated that pruritic behaviour and deranged fleece are often used as indicators of sheep louse infestation but the exact relationship between infestation and the observation of signs of pruritis are unclear. Two studies were conducted to examine this association. In the first, 24 castrated Merino sheep were randomly assigned to six pens in groups of four and the sheep in three pens infested with 10 lice each on the right mid-side. Louse numbers were counted, fleece derangement scored and pruritic behaviour assessed periodically on each sheep until 38 weeks after infestation. In the second study a single moderately infested sheep was paddocked for 15 weeks with 32 uninfested sheep and louse numbers and fleece derangement monitored for 41 weeks.

In the pen studies, differences between infested and non-infested sheep in fleece derangement and pruritic behavior first became significant ($p < 0.05$) at 8 and 14 weeks, respectively and at louse densities of 0.06 and 0.27 per 10 cm wool part. Some sheep showed definite signs of deranged fleece as early as 5 weeks after initial infestation. In the paddock studies, it took 37 weeks until lice were detected on all sheep in the flock. The correlation between louse numbers and fleece derangement score first became significant ($r = 0.44$ and $p < 0.05$) at 9 weeks after introduction of the lousy sheep, reached a maximum of $r = 0.79$ ($p < 0.001$) at 22 weeks when 84% of sheep had lice detected and the mean louse density was 0.29 per part, and then declined to $r = 0.12$ (n.s.) at 41 weeks when all sheep were infested and the mean louse density was 3.04 per part.

Karatepe and Karatepe (2008) carried out a study to investigate the prevalence of hypodermosis in cattle between January and June 2005 in Nigde province, which is located in the middle of Turkey. A total of 1336 cattle, which were slaughtered in Nigde, were investigated for Hypoderma larvae. The 68 out of 1336 cattle (%5.08) were found positive for Hypoderma larvae. A total of 536 Hypoderma larvae were found in the skin and subcutaneous tissue of the back of infested cattle. The 489 out of 536 larvae (%91.23) were identified as *Hypoderma bovis* and 47 out of 536 (%8.77) as *H. lineatum*. Number of Hypoderma larvae counted on single infested cattle varied between 1–45 and the mean number of Hypoderma larvae per cattle was 7.88 (536/68). Hypodermosis was recorded for the first time in cattle from Nigde.

Shede *et al.*, (2008) reported microbiological inception in leather industry was with reference to tanning processes where major concern was finished product bacteriology. Present investigation aims to study the bacteriology of unprocessed raw material, buffalo hide in particular using culture based and culture independent approach. Denaturing gradient gel electrophoresis (DGGE) analysis of the stored hide at different time intervals was done to study temporal successional shifts in the bacterial community. Considering the protein and fat content of hide, proteolytic and lipolytic

bacteria were isolated and identified as major degradative flora. The degradative nature of individual isolate was confirmed through in vitro and in vivo investigations as collagenase production and ability to deteriorate raw hide to release amino acids and free fatty acids, respectively. Furthermore, the histological analysis of bacterially spiked raw hides was done as aid to the conclusions drawn. It was found that the temporal bacterial successional shifts occurring on ambient stored raw buffalo hide could be better understood using DGGE. Isolated and characterized degradative flora could be used as test organisms to discover new preservatives and to assess the process of preservation. Even though the process of degradation is very complex, the culture based and culture independent analysis of degradative microflora is comprehensive

Kuhn *et al.*, (2008) reported that sarcoptic mange (or scabies) is an important skin disease which can affect a variety of species including humans, cattle, goats, sheep, horses, pigs, rabbits, and dogs. Approximately 300 million people are affected worldwide and in livestock animals the infestation may lead to substantial economic losses caused by depression in growth and feed conversion rates. Diagnosis of Sarcoptes infestation is difficult and only a few serological tests have been developed using whole mite antigen for diagnosis of mange in animals. Here we describe the isolation and characterisation of cDNAs of several immunoreactive clones and their recombinant expression in Escherichia coli. Three of the proteins contain repetitive sequence which suggests that they might be involved in immune evasion. The application of these antigens in serodiagnosis and the suitability for diagnosis is discussed.

Sajid *et al.*, (2008) determined the diversity and intensity of tick population infesting domestic ruminants in Districts Layyah and Muzaffargarh of lower Punjab (Pakistan). 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 (P=0.00) 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*.

Appropriate control measures for ticks need to be employed in the study area for economical animal production.

Pawaiya *et al.*, (2008) reported fifteen goats affected in a goat pox outbreak that occurred in the Institute's goat farm. After full clinical course of the disease, all the adult animals recovered while young ones succumbed to infection. Papular lesions on sparse hairy skin including udder and scrotum were invariably developed in all animals. Microscopically, epidermal thickening, hyperplasia, acanthosis, hydropic degeneration of prickle cell layer, microvesiculation and necrotizing vasculitis were observed. Characteristic large intracytoplasmic eosinophilic inclusion bodies were conspicuously noticed in dermal cells

Rehbein *et al.*, (2003) conducted a study to evaluate the effects of mange on cattle. Twenty-four Simmentaler Fleckvieh bulls were formed into eight replicates of three bulls based on Day −56 body weight (288–414 kg). Within replicates bulls were randomly allocated to groups G1: uninfested control, G2: infested control or G3: infested, treated with 0.2 mg ivermectin/kg (1% ivermectin injection; IVOMEC®, Merial) on Day 0. The G2 and G3 bulls were infested with *Sarcoptes/Chorioptes* mites on Days −56 and −49. Feed consumption was recorded daily throughout the study (Days −56 to 56). Body weights were measured and serum samples collected. Mites were counted at bi-weekly intervals from Day −14 on. The carcasses of the bulls and the leather produced from their hides were evaluated. Differences between variables were declared significant if $P \leq 0.05$.

All G2 and G3 bulls became infested. No *Sarcoptes* or *Chorioptes* mites were detected on the G3 bulls after Day 14 or Day 28, respectively, whereas G2 bulls maintained infestation throughout the study. From Days −42 to 0, anti-*Sarcoptes* antibody levels in the two infested groups increased linearly, while levels in the uninfested G1 remained near zero. From Day 14 to Day 56, antibody levels in G2 continued to increase and those in G3 decreased ($P \leq 0.05$). From Days −56 to 0, G1 had significantly greater mean weight gain (94.0 kg) than the infested G2 and G3 (76.1 and 75.9 kg). During Days 0–56, G3 gained significantly more weight (90.4 kg) than G2

(58.8 kg), while G1 gained 76.0 kg, not significantly different from either G2 or G3. During Days −56 to 0, the feed conversion efficiency (kg gain/kg feed) of the infested G2 and G3 was significantly lower than that of the uninfested G1; during the 56 days following treatment, feed conversion efficiency of G3 was significantly higher than that of G2, while the uninfested G1 was intermediate. Carcass weight of G2 was significantly lower than those of G1 and G3, which did not differ significantly. Carcass yield, rib eye area and weight of kidney fat of the uninfested G1 were significantly greater than those of G2 and G3. Weights of the adrenal glands, prescapular and precrural lymph nodes were significantly higher for the infested G2 than for the other two groups. Significantly less of leather area from the infested G2 was of usable quality than of the leathers from the uninfested G1 or the infested, treated G3, and the leathers from G2 showed significantly more severe gouging or etching than leathers from the two other groups

MATERIALS AND METHODS

STUDY AREA

The study was conducted in the hide/skin markets and abattoirs of Lahore and Faisalabad and tanneries of Sheikhupura, Kasur and Sialkot (Table 9). The record of various skin diseases and conditions damaging the skin of buffalo, cattle, goat and sheep was made. Lesions, extent and type of damage were recorded (Table 28). At the hide/skin markets and tanneries grading of skins /hides was done as per prevailing system (Table 1, 2, 3 and 4).

Table 1: Showing Grading Criteria for Goat Skins:

Grade 1		Grade 2		Grade 3		Grade 4		Grade 5	
Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion
No Lesion	-	No Lesion	-	Fibrosis Pox Butcher Cut Wound	1-2 1-2 1-2 More than 2	Fibrosis Pox Butcher Cut	3-4 3-4 3-4	Fibrosis Pox Mange	More than 4 More than 4
Skin Length up to 36 inches		Skin Size more than 36 inches		Ticks/lice Infestation	Mild	Mange	Mild	W. Fly Infestation	Severe
		wound	1	Thin skin		Ticks/lice Infestation Improper Curing	Severe Mild	Improper Curing	Severe

Table 2: Showing Grading Criteria for Sheep Skins:

Grade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade X	
e ion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion
ion	-	Butcher Cut	1	Chronic Abscess Pox Butcher Cut Wound	≤ 2	Chronic Abscess Pox Butcher Cut	3-4	Pox	>4	Chronic Abscess	More than 4
		Wound	1	Thin skin	Mild	Mange	severe	Mange	severe		
				Ticks/lice Infestation	>2	Tick/lice infestation	Mild				
						Improper Curing	Mild			Improper Curing	Severe

Table 3: Showing Grading Criteria for Buffalo Hides:

rade 1		Grade 2		Grade 3		Grade 4		Grade 5		Grade X	
	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion
)	-	No Lesion , Rough Skin (Calves)	-	No Lesion (Large Animals)	-	Pox	1-3	Pox	>3	Skin Atrophy Improper curing	Severe
						Butcher Cut	1-2	Butcher Cut	>2		
						Mange,Tick/lice Infestation	Mild	Mange,Tick/lice Infestation	Severe		
						Wounds	1-2	Wounds	>2		

Table 4: Showing Grading Criteria for Cattle Hides:

Grade 3		Grade 4		Grade 5		Grade X	
Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion	Type of Lesion	No. of Lesion
No Lesion	-	Pox	1-2	Pox	>3	W. Fly infestation	Severe
				Ringworm		Improper Curing	
		Butcher Cut	1-2	Butcher Cut	>2		
		Mange, Tick/lice Infestation	Mild	Mange, Ticks/lice Infestation	Severe		
		Wounds	1-2	Wound	>2		

Economic losses (Table E.1 to Table E.5) were calculated on the basis of percentages of different grades of skins/hides obtained in this project. The rates of skins/hides in this study were used prevailing in the year 2008. Market rates of skins and hides are shown in tables 5-8.

Table 5: Showing Grade wise Hide/Skin Market Rates of Sheep Skins.

Grades	Price Rs. Per Sq. Ft.	Average total price Rs. (6.5sq ft)
I	60-65	400
II	50-55	340
III	45	290
IV	30	195
V	30	195
VI	27	180

Table 6: Showing Grade wise Hide/Skin Market Rates of Goat Skin.

Grades	Price Rs. Per Sq. Ft.	Average total price Rs. (7 sq ft/skin)
I	58	400
II	45	315
III	38	260
IV	35	245
V	26	180

Table 7: Showing Grade wise Hide/Skin Market Rates of Cattle Hide.

Grades	Price Rs. Per Sq. Ft.	Average total price Rs. (25sqft/hide)
III	85	2125
IV	65	1625
V	52	1300
REJECTED	40	1000

Table 8: Showing Grade wise Hide/Skin Market Rates of Buffalo Hide.

Grades	Price Rs. Per Sq. Ft.	Average total price Rs. (22.5sqft/hide)
I—III	45	950
IV	37	840
V	34	765
REJECTED	30	675

The data was collected on monthly basis for two years to record seasonal prevalence of various conditions.

STUDY DESIGN

A total of 3918 of skins and 1080 hides were examined at the abattoirs of Lahore and Faisalabad, 6784 Skins and 3677 hides at hide markets and 8091 skins and 4420 hides at Tanneries (Table 9).

DATA MANAGEMENT AND STATISTICAL ANALYSIS

The data was gathered on a questionnaire sheets and were latter 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 (N S) if $P \geq 0.05$. Chi square analysis tables (45-60) are appended in annexure.

RESULTS AND DISCUSSION

Table 9: Showing the Total Data of Goat, Sheep, Cow and Buffalo Collected from Hide/Skin Markets, Abattoirs and Tanneries of Lahore and Faisalabad.

Hide markets		Slaughter houses		Tanneries	
Skins	Hides	Skins	Hides	Skins	Hides
6784	3677	3918	1080	8091	4420

GRADE WISE

Table 10: Showing the Total Grade wise Data of Goat, Sheep, Cow and Buffalo Collected from Hide/Skin Markets, Abattoirs and Tanneries.

Specie/Grade	G-I	G-II	G-III	G-IV	G-V	G-X	Total
Goat	7063	7362	1396	879	759	0	17459
Sheep	601	396	104	68	72	93	1334
Cow	45	29	811	1266	522	205	2878
Buffalo	2777	321	852	1022	186	1141	6299
Total	**10486**	**8108**	**3163**	**3235**	**1539**	**1439**	**27970**

Table 11: Showing the Study Area wise Detail of Total Grade wise Data of Goat, Sheep, Cow and Buffalo Collected from hide/skin Markets, Abattoirs and Tanneries.

Study area	G-I	G-II	G-III	G-IV	G-V	G-X	Total
Goat							
Abattoirs	1213	1572	331	228	94	-	3438
H. Markets	2230	2915	621	264	260	-	6290
Tanneries	3620	2875	444	387	405	-	7731
Total	7063	7362	1396	879	759	-	17459
Sheep							
Abattoirs	190	134	42	10	58	46	480
H. Markets	247	167	39	41	0	0	494
Tanneries	164	95	23	17	14	47	360
Total	601	396	104	68	72	93	1334
Cattle							
Abattoirs	12	14	150	310	72	42	600
H. Markets	0	0	425	562	325	87	1399
Tanneries	33	15	236	394	125	76	879
Total	45	29	811	1266	522	205	2878
Buffalo							
Abattoirs	12	25	80	250	65	48	480
H. Markets	0	286	763	573	103	553	2278
Tanneries	2765	10	9	199	18	540	3541
Total	2777	321	852	1022	186	1141	6299
G. Total	10486	8108	3163	3235	1539	1439	27970

In large cities, the animals are slaughtered in the slaughter houses where antemortem and postmortem 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 cured properly and not handled properly while being transported. Rodríguez *et al.* (1993) described the marketing system of goat and sheep skins in highland Baluchistan. 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.

In the current research project it was found that prevailing grading system in the slaughter houses, hide markets and tanneries was different for each species. The detail of the grading criteria for each species of the animal is given in the tables (table 1 to 4). Different pathological conditions resulting in low grade skins and hides were also recorded on the Proformas.

A total of 27970 skins and hides were studied from the slaughter houses, hide markets and tanneries, out of which 10486, 8108, 3163, 3235, 1539 and 1439 were graded as G-I, G-II, G-III, G-IV, G-V, and G-X, respectively.

In case of goat, skins are graded into grade 1(G-I) to grade 5(G-V) and grade 5 is termed as rejection grade. Total of 17459 skin samples were studied from slaughter houses, hide markets and tanneries, out of which 7063, 7362, 1396, 879 and 759 skins were graded as G-I, G-II, G-III, G-IV, and G-V, respectively.

A total of 3438 goat skin samples were studied from the slaughter houses out of which, 1213, 1572, 331, 228 and 94 were graded as G-I, G-II, G-III, G-IV, and G-V, respectively.

A total of 6290 goat skin samples were studied from the hide markets out of which, 2230, 2915, 621, 264 and 260 samples were G-I, G-II, G-III, G-IV, and G-V, respectively.

A total of 7731 goat skin samples were studied from tanneries out of which, 3620, 2875, 444, 387 and 405 were G-I, G-II, G-III, G-IV, and G-V, respectively.

Sheep skins are graded into six grades, from grade 1(G-I) to grade 6(G-VI) and grade VI is rejection grade. Total of 1334 sheep skin samples were studied from slaughter houses, hide markets and tanneries, out of which 601, 396, 104, 68, 72 and 93 were G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

A total of 480 sheep skin samples were studied from the slaughter houses out of which, 190, 134, 42, 10, 58 and 46 were G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

A total of 494 sheep skin samples were studied from hide markets out of which, 247, 167, 39, and 41 were G-I, G-II, G-III, and G-IV, respectively. None of the samples fell under G-V and G-VI.

A total of 360 sheep skin samples of sheep were studied from tanneries, out of which, 164, 95, 23, 17, 14 and 47 were G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

Cattle hides are graded into six grades, from grade 1 (G-I) to grade 6 (G-VI). In the hide markets G-I and G-II are not considered and grading starts from grade 3 (G-III) and grade 6 (G-VI) is considered as rejection grade. A total of 2878 cattle hide samples were studied from slaughter houses, hide markets and tanneries, out of which 45, 29, 811, 1266, 522 and 205 were G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

A total of 600 hide samples were studied from the slaughter houses out of which, 12, 14, 150, 310, 72 and 42 were G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

A total of 1399 hide samples were studied from hide markets out of which, 425, 562, 325 and 87 were G-III, G-IV, and G-V, respectively.

A total of 879 hide samples were studied from tanneries out of which, 33, 15, 236, 394, 125 and 76 were graded as G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

Buffalo hides are graded into six grades, from grade 1(G-I) to grade 6(G-VI) and grade 6 (G-VI) is considered as rejection grade. A total of 6299 buffalo hides were studied from slaughter houses, hide markets and tanneries, out of which 2777, 321, 852, 1022, 186 and 1141 hides were graded as G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

A total of 480 buffalo hides were examined from the slaughter houses out of which, 12, 25, 80, 250, 65 and 48 were graded as G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

A total of 2278 buffalo hides were examined from hide markets out of which, 286, 763, 573, 103 and 553 were assigned grades G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

A total of 3541 buffalo hides were studied from tanneries out of which, 2765, 10, 9, 199, 18 and 540 were graded as G-I, G-II, G-III, G-IV, G-V, and G-VI, respectively.

Economic losses due to low quality of skins/hides

Table E. 1: Showing Total Skins and Hides Production in Punjab and Pakistan per annum According to Economic Survey of Pakistan, 2007-2008.

Species	Total Livestock Population in Pakistan	Population in Punjab	Percent Share of Punjab	Total Skins/Hides Production in Pakistan	Skins/Hides Production in Punjab
CATTLE	29558812	14412323	48.7%	6032000	29,37,584
BUFFALO	27334985	17747474	64.9%	6074000	39,42,026
SHEEP	26487741	6361767	24%	10251000	24,60,240
GOAT	53786988	19831039	36.8%	21860000	80,44,480

Table E. 2: Showing Grade wise percentage of Skins and Hides in Punjab

pecies	Grade-I		Grade-II		Grade-III		Grade-IV		Grade-V		Grade-X	
ATTLE	1.5%	44063	1.2%	35251	28.1%	825461	43.98%	1292537	18.1%	531703	7.1%	208569
UFFALO	44%	1734491	5.09%	200649	13.5%	532174	16.4%	646492	2.9%	114319	18.11%	713901
SHEEP	45.5%	1119409	29.6%	728231	7.7%	189439	5%	123012	5.3%	130393	6.9%	169756
GOAT	40.45%	3253992	42.16%	3391553	7.9%	635514	5.19%	417509	4.3%	435913	-	-

(Based on data collected from slaughter house, hide markets and tanneries of Punjab)

Table E. 3: Showing Estimated hides & skins value (million Rs.) in Punjab.

Species	Population in Pakistan	Population In Punjab	Percent Share of Punjab	Skins/Hides Production in Pakistan	Skins/Hides production in Punjab	Estimated amount (million Rs.)*
CATTLE	29558812	14412323	48.7%	6032000	2937584	6242.36 (@ Rs. 2125/hide)
BUFFALO	27334985	17747474	64.9%	6074000	3942026	3744.92 (@ Rs. 950/hide)
SHEEP	26487741	6361767	24%	10251000	2460240	984.09 (@ Rs. 400/hide)
GOAT	53786988	19831039	36.8%	21860000	8044480	3217.79 (@ Rs. 400/hide)
*** If all Skin/Hides are graded as "A Grade" then estimated amount in Rs. Million**						**14189.16**

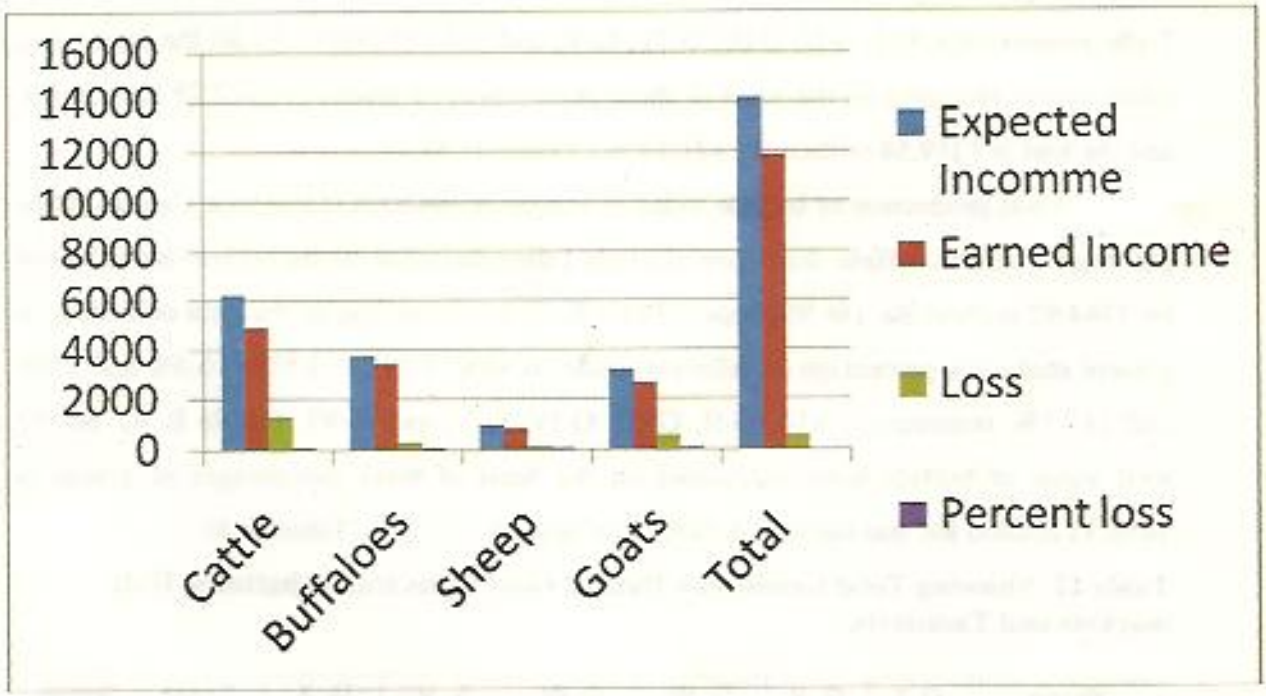
Table E. 4: Showing Economic Losses Due to Skins and hides damage.

cies	Grade-I		Grade-II		Grade-III		Grade-IV		Grade-V		Grade-X	
TLE	1.5%	44063	1.2%	35251	28.1%	825461	43.98%	1292537	18.1%	531703	7.1%	208569
	@2125	93.63M	@2125	74.90M	@2125	1754.10M	@1625	2100.37M	@1300	691.21M	@1000	208.56M
FALO	44%	1734491	5.09%	200649	13.5%	532174	16.4%	646492	2.9%	114319	18.11%	713901
	@950	1647.76M	@950	190.61M	@950	505.56M	@840	543.05M	@765	87.45M	@675	481.83M
EEP	45.5%	1119409	29.6%	728231	7.7%	189439	5%	123012	5.3%	130393	6.9%	169756
	@400	447.76M	@340	247.59M	@290	54.93M	@195	23.98M	@195	25.42M	@180	30.55M
AT	40.45%	3253992	42.16%	3391553	7.9%	635514	5.19%	417509	4.3%	435913	-	-
	@400	1301.59M	@315	1068.33M	@260	165.23M	@245	102.28M	@180	7.84M	-	-

Table E. 5: Showing Percentage of Economic Losses Rs. in Million.

SPECIES	ESTIMATED AMOUNT	ACTUAL AMOUNT	LOSS	PERCENTAGE LOSS
CATTLE	6242.36	4922.78	1319.58	21.13
BUFFALO	3744.92	3456.33	288.59	7.70
SHEEP	984.09	830.23	153.86	15.63
GOAT	3217.79	2645.27	572.52	17.70
TOTAL	14189.16	11854.61	2334.55	16.40

Graph Showing Losses in Hides/Skins Value (Rs. Million).



Total production of goat skins in Punjab is 8044480 (Livestock Census 2006) per year. If all the goat skins are of grade I then the value of the goat skins would be 3217.79 million Rs.(Rs. 400/skin) (Table E. 3) but according to the data collected in recent study, the percentage of different grades is G.I 40.45% , G.II 42.16% , G.III 7.9% , G.IV

5.19% and G.V 4.3% (Table E. 4) . So the total value of goat skins calculated on the basis of these percentages of grades is 2645.27 million Rs. and the loss is 572.52 million Rs. (17.70%). (Table E. 5)

Total production of sheep skins in Punjab is 2460240 (Livestock Census 2006) per year. If all the goat skins are of grade I then the value of the sheep skins would be 984.09 million Rs.(Rs. 400/skin) (Table E. 3) but according to the data collected in this study, the percentage of different grades is 45.5% , 29.6% , 7.7% , 5% and 5.3% and 6.9%, respectively, in G-I, G-II, G-III, G-IV, G-V, and G-VI (Table E. 4) . So the total value of sheep skins calculated on the basis of these percentages of grades is 830.23 million Rs. and the loss is 153.86 million Rs. (15.63%). (Table E. 5)

Total production of cattle hides in Punjab is 2937584 (Livestock Census 2006) per year. If all the cattle hides are of grade I then the value of the cattle hides would be 6242.36 million Rs. (@ 2125/hide) (Table E. 3). According to the data collected in this study, the percentage of different grades is 1.5%, 1.2%, 28.1%, 43.98% and 18.1% and 7.1%, respectively, G-I, G-II, G-III, G-IV, G-V, and G-VI (Table E. 4). So the total value cattle hides calculated on the basis of these percentages of grades is 4922.78 million Rs. and the loss is 1319.58 million Rs. (21.13 %). (Table E. 5)

Total production of buffalo hides in Punjab is 3942026 (Livestock Census 2006) per year. If all the buffalo hides are of grade I then the value of the buffalo hides would be 3744.92 million Rs. (@ 950/hide) (Table E. 3) but according to the data collected in present study, the percentage of different grades is 44%, 5.09%, 13.5% , 16.4% and 2.9% and 18.11%, respectively, G-I, G-II, G-III, G-IV, G-V, and G-VI (Table E. 4). So the total value of buffalo hides calculated on the basis of these percentages of grades is 3456.33 million Rs. and the loss is 288.59 million Rs. (7.7 %). (Table E. 5)

Table 12: Showing Total Grade wise Data of Goat Skins from Abattoirs, Hide markets and Tanneries.

Place	G. I	G. II	G. III	G. IV	G. V	G. X	Total	%age
Abattoirs	1213	1572	331	228	94	-	3438	19.69
H. Markets	2230	2915	621	264	260	-	6290	36.02
Tanneries	3620	2875	444	387	405	-	7731	44.28
Total	7063	7362	1396	879	759	-	17459	100
%age	40.45	42.16	7.9	5	4.3	-	100	

Table 13: Showing Grade wise Data of Sheep Skins from Abattoirs, Hide markets and Tanneries.

Place	G-I	G-II	G-III	G-IV	G-V	G-X	TOTAL	%age
Abattoirs	190	134	42	10	58	46	480	35.9
H. Markets	247	167	39	41	0	0	494	37
Tanneries	164	95	23	17	14	47	360	26.99
Total	601	396	104	68	72	93	1334	100
%age	45.8	29.6	7.7	5	5.3	6.9	100	

Table 14: Showing Grade wise Data of Cattle Hides from Abattoirs, Hide markets, and Tanneries.

Place	G-I	G-II	G-III	G-IV	G-V	G-X	Total	%age
Abattoirs	12	14	150	310	72	42	600	20.8
H. Markets	0	0	425	562	325	87	1399	48.6
Tanneries	33	15	236	394	125	76	879	30.5
Total	45	29	811	1266	522	205	2878	100
%age	1.5	1	28.1	43.98	18.1	7.1	100	

Table 15: Showing Grade wise Data of Buffalo Hides from Abattoirs, Hide markets, and Tanneries.

Place	G-I	G-II	G-III	G-IV	G-V	G-X	Total	%age
Abattoirs	12	25	80	250	65	48	480	7.6
H .Markets	0	286	763	573	103	553	2278	36.16
Tanneries	2765	10	9	199	18	540	3541	56.21
Total	2777	321	852	1022	186	1141	6299	100
%age	44	5.09	13.5	16.22	2.9	18.11	100	

Table 16: Showing Grade Wise Data of Goat Skins from Abattoirs.

City	G- I	G- II	G- III	G- IV	G- V	G- X	Total	%age
Faislabad	613	553	321	224	90	-	1801	52.38
Lahore	600	1019	10	4	4	-	1637	47.6
Total	1213	1572	331	228	94	-	3438	100
Percent	35	45	10	7	3	-	100	

Table 17: Showing Grade Wise Data of Sheep Skins from Lahore Abattoir.

Grade	G-I	G-II	G-III	G-IV	G-V	G-X	TOTAL
	190	134	42	10	58	46	480
%age	39.58	27.91	8.7	2	12	9.5	100

Table 18: Showing grade Wise Data of Cow Hides from Lahore Abattoir.

Grade	G-I	G-II	G-III	G-IV	G-V	G-X	Total
	12	14	150	310	72	42	600
%age	2	2.3	25	51.6	12	7	100

Table 19: Showing Grade wise Data of Buffalo Hides from Lahore Abattoir.

Grade	G.I	G.II	G.III	G.IV	G.V	G.X	Total
	12	25	80	250	65	48	480
%age	2.5	5.2	16.6	52.08	13.5	10	100

Table 20: Showing Grade wise Data (Various Zones of Punjab) of Goat Skins from Hide markets.

City	G-I	G-II	G-III	G-IV	G-V	G-X	Total	%age
Northern Irrigated Region								
Kasur	58	170	28	11	3	-	270	4.29
Lahore	347	507	138	23	5	-	1020	16.21
Shekhupura	14	102	43	9	7	-	175	2.7
Gojra	17	27	14	2	0	-	60	.9
Gujrat	38	42	11	5		-	96	1.5
Hafizabad	96	130	10	15	19	-	270	4.29
Sargodha	74	102	14	4	1	-	195	3.1
M.Bahudin	115	182	27	18	3	-	345	5.4
Faisalabad	426	278	79	47	134	-	964	15.32
Samundri	35	12	3	9	1	-	60	0.9
Gujranwala	264	382	27	4	3	-	680	10.81
Total	1484	1934	394	147	176	-	4135	
Southern Irrigated Region								
Bahawal nagar	139	232	27	0	2	-	400	6.35
Multan	89	115	20	29	7	-	260	4.13
Bahawalpur	99	39	44	10	3	-	195	3.1
Arifwala	40	22	45	13	10	-	130	2
Vihari	4	11	0	0	0	-	15	0.2
S.Abad	1	37	5	2	0	-	45	0.7
Total	372	456	141	54	22	-	1045	
Arid Region								
Mianwali	25	61	4	0	0	-	90	1.4
Chakwal	41	169	66	48	16	-	340	5.4
Rawalpindi	277	273	15	13	2	-	580	9.2
Bhakkar	31	22	1	2	44	-	100	1.5
Total	374	525	86	63	62	-	1110	
G. Total	2230	2915	621	264	260	-	6290	100
Percentage	35.45	46.34	9.8	4.19	4.13	-	100	

Table 23: Showing grade Wise Data of Buffalo Hides from Hide markets.

City	G-I	G-II	G-III	G-IV	G-V	G-X	Total	%age
Northern Irrigated Region								
Gujrat	-	24	141	42	11	37	255	11.19
Sialkot	-	0	15	58	9	8	90	3.95
Lahore	-	65	11	83	8	68	235	10.31
Gojra	-	0	9	41	5	5	60	2.6
Sargodha	-	24	209	11	8	158	410	17.99
Jhang	-	0	192	14	1	73	280	12.29
Jalalpur	-	3	74	2	0	56	135	5.9
Faisalabad	-	66	0	0	0	64	130	5.7
Shekhupura	-	18	45	13	8	46	130	5.7
Gujranwala	-	9	2	69	9	1	90	3.95
Total	-	209	698	333	59	516	1815	
Arid Region								
R. Pindi	-	43	16	27	2	2	90	3.95
D.G. Khan	-	4	5	0	0	29	38	1.66
Total	-	47	21	27	2	31	128	
Southern Irrigated Region								
Multan	-	30	44	213	42	6	335	14.7
G. Total	-	286	763	573	103	553	2278	100
Percent	-	13	33	25	5	24	100	

Table 24: Showing Grade wise Data of Goat Skins from Tanneries.

City	G-I	GII	G. III	G. IV	G. V	G. X	Total	Percent
Northern Irrigated Region								
Jhang	126	34	67	234	0	-	461	5.96
Sailkot	48	40	4	0	0	-	92	1.19
Gujranwala	39	38	16	32	20	-	145	1.87
Kasur	0	40	0	4	7	-	51	.64
Jaranwala	0	43	0	1	4	-	48	.63
M.Bahaudin	44	116	35	23	15	-	233	3.01
Faisalabad	25	24	1	0	0	-	50	.64
Lahore	170	268	27	2	9	-	476	6.15
Sargodha	741	625	0	0	114	-	1480	19.14
Gujrat	1528	0	0	0	145	-	1673	21.64
Samundri	59	81	33	25	8	-	206	2.66
Total	2780	1309	183	321	322	-	4915	
Arid Region								
Rawalpindi	128	216	40	5	1	-	390	5
Mianwali	63	52	32	17	7	-	171	2.21
Khushab	37	68	27	15	14	-	161	2.08
D G Khan	0	314	0	0	22	-	336	4.36
Total	228	650	99	37	44	-	1058	
Southern Irrigated Region								
Multan	612	916	162	29	39	-	1758	22.73
G. Total	3620	2875	444	387	405	-	7731	100
Percentage	46.82	37.18	5.74	5	5.2	-	100	

Table 25: Showing Grade wise Data of Sheep Skins from Tanneries.

City	G-I	G-II	G-III	G-IV	G-V	G-X	Total	%age
Northern Irrigated Region								
Lahore	66	35	0	14	11	24	150	41.66
W.Abad	36	22	3	3	3	23	90	25
Total	102	57	3	17	14	47	240	
Southern Irrigated Region								
Multan	62	38	20	0	0	16	120	33.33
G.Total	164	95	23	17	14	47	360	100
Percentage	45.5	26.38	1.9	4.7	3.8	17.7	100	

Table 26: Showing Grade wise Data of Cattle Hides from Tanneries.

City	G-I	G-II	G-III	G-IV	G-V	G-X	Total	%age
Southern Irrigated Region								
Multan	0	0	12	15	14	4	45	5.11
Chichawati	0	0	13	23	5	3	44	5
Bhawalpur	0	0	8	30	7	0	45	5.11
Total	0	0	33	68	26	7	134	
Northern Irrigated Region								
Kasur	0	0	30	30	20	10	90	10.23
Sialkot	0	0	38	74	31	7	150	17.06
Sargodha	0	0	15	32	3	10	60	6.8
Lahore	13	15	35	60	10	12	145	16.49
Shekhupura	0	0	33	62	13	12	120	13.65
Gujranwala	20	0	52	68	22	18	180	20.47
Total	33	15	203	326	99	69	745	
G. Total	33	15	236	394	125	76	879	100
Percentage	3.75	1.7	26.8	44.8	14.2	8.6	100	

Table 27: Showing Grade wise Data of Buffalo Hides from Tanneries.

City	G-I	G-II	G-III	G-IV	G-V	G-X	Total	%age
Northern Irrigated Region								
Sialkot	0	0	3	51	5	1	60	1.69
Kasur	10	10	5	115	7	3	150	4.2
Total	10	10	8	166	12	4	210	
Southern Irrigated Region								
Multan	1268	0	1	33	6	89	1397	39.45
Chichawatni	1068	0	0	0	0	258	1326	37.44
Bhawalpur	419	0	0	0	0	189	608	17.17
Total	1487	0	1	33	6	536	3331	
G. TOTAL	2765	10	9	199	18	540	3541	100
%age	78	0.2	0.2	5.6	0.5	15.24	100	

DISEASE WISE

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 goats, cattle and buffaloes) 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 antemortem and post mortem. As soon as the animals were skinned (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 microbiological and histopathological investigations.

Data of pathological conditions/other damages affecting goats, sheep, cattle, and buffaloes are given in table 28. The data was collected from the abattoir, hide markets and tanneries mentioned in materials and methods, over a period of two years. The data indicated that out total 27970 skins / hides examined 65.4% were normal and 34.6% were having some sort of damage.

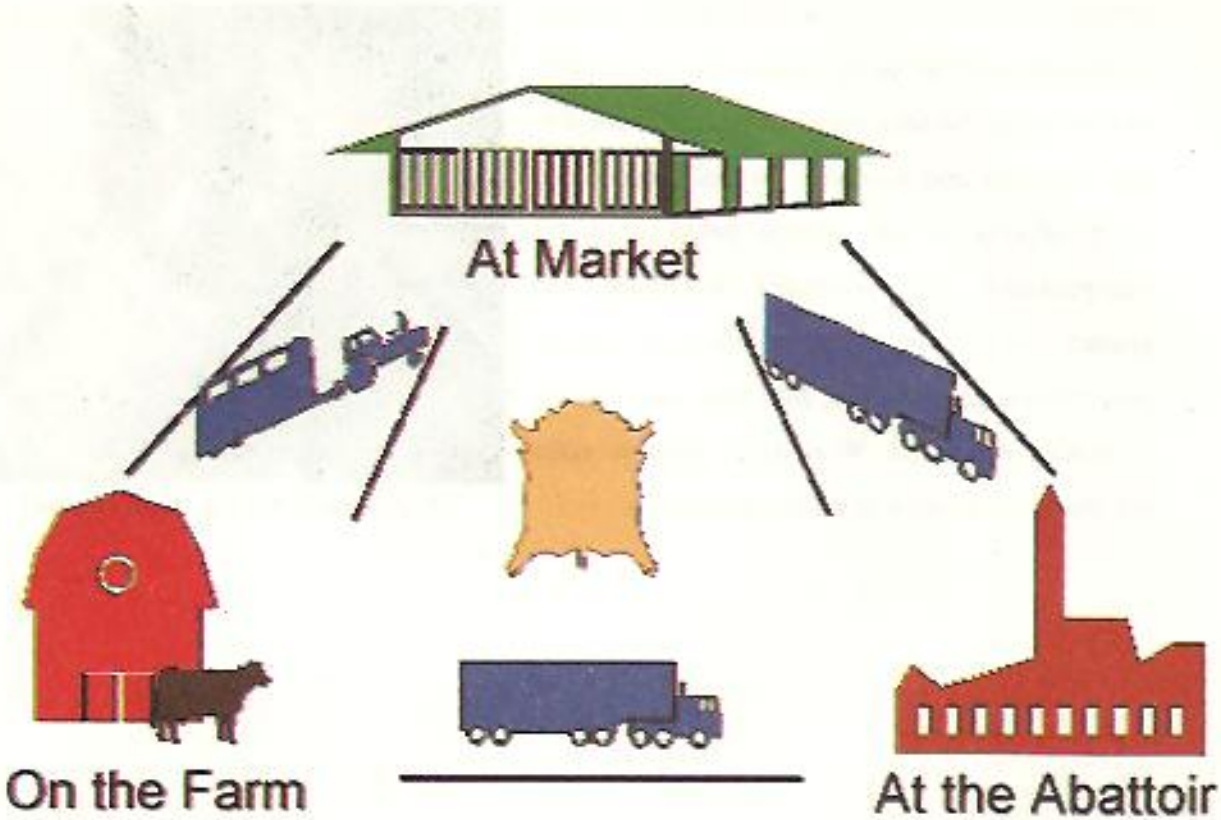
(Grading is being done at an abattoir)

The most common damages observed, overall in all animals, were **wounds 5.2%**, followed in ascending order observed was **atrophy of skin (Thin skin) 4.9%**, lesions of **tick infestation 4.1%**, old lesions of **pox 4.0%**, lesions caused by **mites infestation 3.2%**, **butcher cuts 3.1%**, **scratches 2.4%**, **Jalli (edema) 1.7%**, **decomposition 1.6%**, lesions caused by **warble fly larvae 1.1%**, **charr (fibrosis) 1.0%**, **ringworm infection 0.9%**, **extensive soiling by dung 0.7%**, **chronic abscesses 0.4%**, **and Lice infestation 0.2%**.

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 are shapes were seen in all the ruminants.

(A goat skin having fresh wound)

Points in the life of an animal where damage can occur to the hide or skin



As observed in the abattoir, **skin atrophy (thin skin)** could be due to starvation, parasitic infestations, chronic diseases (tuberculosis, Johne's disease etc.). 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.

Tick infestation was the third common pathological condition which affects the skin of ruminants. Ticks are notorious threat animals causing irritation, allergy, and toxicosis (Niyoonzema and Kiltz, 1986). They are known to transmit diseases, such as babesiosis, anaplasmosis, theileriosis, etc. (Norvan et al., 1984). Ticks also harbor a number of pathogenic bacteria

(Pasteurellae, Salmonellae, Brucellae, etc.), thus act are reservoir and transmit these bacteria to man and animals (Jongejan and Uilenberg, 2004). 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).

(Soft tick, Argasidae)

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.*, (2008) determined the diversity and intensity of tick population infesting domestic ruminants in Districts Layyah and Muzaffargarh of lower Punjab (Pakistan). 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*.

(Hard tick, Ixodidae)

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 sports 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. (2001) reported mild to moderate orthokeratotic hyperkeratosis while hisopathological examination of biopsies of eleven steers infested with lice. They also observed varying degrees of perivascular infiltration of mononuclear cells and cosonophilic 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.

(White Spots on a buffalo hide due to Lice Infestation)

Pox lesions with light brown to dark brown appearance were visible on inner side of the skin externally scabs were seen. Lesions also varied in their size.

(Pox Lesions on the grain surface and Underside of a goat skin)

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.

(Mite)

Hagis and Ginn (2007) have also reported that nodules correspond to follicular cysts that are filled with mites and keratinous material. Rupture of the cysts leads to severe granulomatous dermatitis and damage to the hides and skins.

In cattle and buffaloes lesions were more frequent on the neck, shoulder, and back areas. Buffaloes were affected more than the cattle. Further studies needs to be made on this observation. 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.

Butcher cuts are the result of flaying by unskilled people and due to the use of un-appropriate 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 butcher cuts in all the animals was 3.1 %.

(Goat Skin with Cut due to Flaying by Untrained Personal)

The percentage of occurrence of butcher's 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 butcher 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. Public awareness and provision of facilities of slaughter and cutting the carcasses through modern slaughter houses is recommended to prevent butcher cuts and subsequent huge economic losses.

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.

(Brand marks on a buffalo calf)

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.

(Transportation of skins and hides from the abattoir to the hide market)

Usually the grain surface (epidermis is damaged), rare the scratches are deeper and damage the dermis as well. Improved husbandry practices and good transportation and handling methods can prevent the damage due to scratches. SPCA and NGO organizations dealing with animal welfare can help in public awareness that can be of use in preventing stress to animals and consequently prevent damage to the skin due to wounds and scratches.

Another important cause of damage known locally as **"Jalli"** is only seen in buffalo hides. It is a condition in which ventral side of the skin, particularly at the belly, becomes thin; there is subcutaneous edema which is usually organized (fibrosed). This condition usually is seen in emaciated buffaloes having severe parasitic infestations, suffering from starvation (old unproductive females), and buffaloes suffering from chromic granulomatous diseases. The condition seems to occur due to edema and the wadding habit of buffaloes in mud or water (mostly rural ponds). Excessive amount of contact with water both from inside and outside seems to causes this problem. The hide of such animals fetches almost no price and are usually not processed by the tanneries.

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. Decompositions 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.

The percentage of infestation of **Warble fly** larvae was comparatively more in cattle followed by goat and sheep. In buffalo hides the warble fly larval infestation was not seen. Further investigations are needed to elaborate this finding. 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*.

(Warble Fly)

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 (Soulsby, 2006).

The prevalence of *Hypoderma bovis* is reported to be much more in cattle in Turkey (Karatepe and Karatepe, 2008). There prevalence varies in different areas of the World (Bishopp *et al.*, 1926; Bruce *et al.*, 1938). Ayaz and Khan (1999) examined 3000 buffaloes from DG Khan District of Southern Punjab and found 7 (0.23%) buffaloes affected with hypodermosis. The same workers expanded their study and in 2004 examined 30,000 buffaloes Khan (2009) has reported high prevalence of hypodermosis in cattle and goats from various areas of Pakistan. He did not mention the prevalence in buffaloes and found only seven buffaloes affected with warble fly infestation. It is hypothesized that black skin color and comparatively less hair might distract flies laying eggs on the buffaloes. Further studies needs to be done in this regard.

(Warble Holes in a Hide)

"Charr" (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* (Brauer, 1858). 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 Ayaz (1998) that flies affecting goat are different from the cattle and the larvae emerge from the back of the goats after completing their life cycle.

"Korrh" (ringworm)is a pathological condition of the hides observed only in cattle is characterized by roughly circular areas of discoloration of varying sizes (from 3 cm diameter 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 shinny normal skin. On microscopic examination it was revealed that the lesions were due to ring worm 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 (NADIS, 2007). 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.

Table 28: Showing the total disease wise data of goat, sheep, cow and buffalo 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	16	Total
GOAT																	
Tanneries	5518	310	171	139	160	-	138	361	95	638	126	75	-	-	-	-	7731
Abbatoirs	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	12254	866	449	321	393	19	312	766	213	1353	234	279		-	-	-	17459
SHEEP																	
S.House	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
Tanneries	164	35	27	21	18	-	17	35	0	0	5	-	43	-	-	-	360
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
BUFFALO																	
Tanneries	2499	30	90	92	179	-	204	135	-	-	59	-	-	-	-	253	3541
Abbatoir	92	12	22	22	45	15	145	78	-	-	0	-	-	18	-	31	480
H.Markets	1323	43	62	120	165	-	122	160	-	-	81	-	-	-	-	202	2278
Total	3914	85	174	234	389	15	471	373	-	-	140	-	-	18	-	486	6299
TOTAL	18301	1130	862	685	898	53	1140	1445	320	1384	459	279	100	184	240	486	27970
Percentage	65.4	4.0	3.1	2.4	3.2	0.2	4.1	5.2	1.1	4.9	1.6	1.0	0.4	0.7	0.9	1.7	

1=Normal, 2= Pox, 3= Butcher Cut, 4= Scratches, 5= Mite Infestation, 6= Lice, 7= Ticks, 8= Wound, 9= W. Fly Infestation, 10= Thin Skin (atrophy), 11= Decomposition, 12= Fibrosis, 13=Abscesses, 14=Dung, 15=Ringworm, 16=Jalli (edema)

Goats:

Table 29: Showing Disease Wise Data of Goat Skins from Tanneries, Abattoirs, and Hide markets.

Study area/ Disease	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
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	12254	866	449	321	393	19	312	766	213	1353	234	279		-	-	-	17459
%age	70.1	4.9	2.5	1.8	2.2		1.8	4.3	1.22	7.74	1.3	1.59	-	-	-	-	100

1=Normal, 2= Pox, 3= Butcher Cut, 4= Scratches, 5= Mite Infestation, 6= Lice, 7= Ticks, 8= Wound, 9= W. Fly Infestation, 10= Thin Skin (atrophy), 11= Decomposition, 12= Charr (Linear Fibrosis), 13=Abscesses, 14=Dung, 15=Ringworm, 16=Jalli (edema)

A total of 17459 skins of goat were examined from abattoirs, hide markets and tanneries out of which 12254 (70.1 %) skins were normal, 1353 (7.75 %) skins were atrophied (thin), 866 (4.9 %) had healed lesions of pox, 766(4.39 %) had wound scars, 449 (2.57%) had butcher cuts, 393 (2.25 %) had lesions associated with mite Infestation, 331(1.89 %) were affected with lice infestation lesions, 321 (1.8 %) skins had scratches, 279(1.5 %) showed Charr (Linear focal fibrosis), 234(1.34 %) skin were decomposed due to improper curing, and 213(1.22 %) had lesions of Warble fly infestation.

A total of 7731 skins of goats were examined from tanneries, out of which 5518 (71.37 %) skins were normal, 310 (4 %) were infected with Pox, 171 (2.21 %) had butcher cuts, 139 (1.79 %) skins had scratches, 160 (2.06 %) had Mite Infestation, 138(1.78 %) were with lice infestation, 361(4.66 %) had wound scars, 95(1.22 %) were infected with Warble Fly, 638(8.2 %) skins were Thin, 126(1.6 %) skin were decomposed due to Improper Curing, 75 (0.97 %) showed Charr (Linear Focal Fibrosis). The latter condition as discussed earlier seems to be healed tracts of migrating larvae of warble fly of goats. These lesions are observed on the lateral side of chest, extending from the middle of the rib cage to the dorsal midline near the vertebral column.

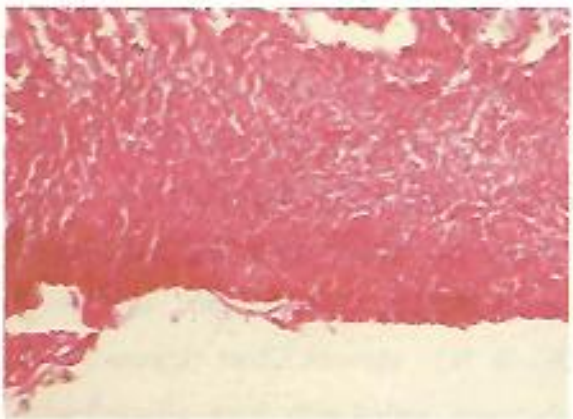
A total of 3438 skins of goat were examined from abattoirs, out of which 2368 (68.87 %) skins were normal, 251(7.30 %) were infected with Pox, 74(2.15 %) had butcher cuts, 77(2.23 %) skins had scratches, 113(3.28 %) had Mite Infestation, 74(2.15 %) were with lice infestation, 173(5.03 %) had wound scars, 36(1.04 %) were infected with Warble Fly, 160(4.65 %) skins were Thin, 112(3.25 %) showed Charr (Linear Focal Fibrosis).

A total of 6290 skins of goat were examined from hide markets, out of which 4368(69.44 %) skins were normal, 305 (4.84 %) were infected with Pox, 204(3.24 %) had butcher cuts, 105 (1.66 %) skins had scratches, 120(1.9 %) had Mite Infestation, 119(1.89 %) were with lice infestation, 232(3.68 %) had wound scars, 82(1.3 %) were infected with Warble Fly, 555(8.8 %) skins were Thin, 108(1.71 %) skin were decomposed due to Improper Curing and 92(1.46 %) showed Charr (Linear Focal Fibrosis). No skin of goat was affected with abscesses, soiled with dung, affected with ring worm, or had 'Jalli' (edema)

The most common pathological condition observed in goats was **atrophy of skin**, which seems to be associated with malnutrition, parasitic infestation, and other chronic diseases. The atrophied skins fetch fewer prices as compared to normal skins and the leather also is not of good quality. The second important disease of skin recorded in the present study was **goat pox**. At post mortem 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 rapidly to raised, 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 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.

Fibrosis (Charr) is another condition causing skin losses were seen in goat skin locally called Charr. The prevalence of Fibrosis is 1.59 %. It leads to thread like structure that is present on the inner side of the skin. The fibrosis is mainly caused by migration of warble fly larvae as it was seen in most cases with warble fly holes in the skin.



(Histopathology of fibrosis showing extensive fibrosis in the hypodermis of goat skin)

(Gross lesion of fibrosis on the inner side of goat skin)

Sheep:

Table 30: Showing Disease wise Data of Sheep Skins from Tanneries, Abattoirs, and Hide markets.

Study area/ Disease	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Tanneries	164	35	27	47	18	-	17	35	2	-	5	-	43	-	-	-	360
Abattoirs	191	41	63	22	21	11	28	24	0	26	0	-	48	-	-	-	480
H.Markets	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
%age	56.44	6	9.6	3.5	3.5	-	4.4	4.8	0.1	2.3	1.3	-	7.4	-	-	-	100

1=Normal, 2= Pox, 3= Butcher Cut, 4= Scratches, 5= Mite Infestation, 6= Lice, 7= Ticks, 8= Wound, 9= W. Fly Infestation, 10= Thin Skin (atrophy), 11= Decomposition, 12= Charr (Linear Fibrosis), 13=Abscesses, 14=Dung, 15=Ring worm, 16=Jalli (edema)