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Major Pre and Post Slaughter Causes of Hide and Skin Defects in Ethiopia: A Review

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Abstract: Ethiopia is believed to have the largest livestock population in Africa. The livestock subsector is a major contributor to the overall economy. It contributes 19% of GDP and 16-19% of the foreign exchange earnings of the country. The role played by livestock in the economy of Ethiopia, as in many developing countries varied but is substantial. It contribute to the production of food (meat, milk, eggs and blood), industrial raw materials (wool, hair, hides and skins) input for crop production (draught power and manure) and export earnings (live animals, skin and hides).The objective of this paper was to review the major pre and post slaughter cause of hide and skin defects in Ethiopia. In Ethiopia hide and skin contribute much to the export earnings from the livestock sector. In addition it has a large contribution to leather industry in the country. However, the economic contribution is below the expected because of defects on hides and skins. The causes for hide and skin defects are classified under pre- and post-slaughter defects. Pre-slaughter defects are those created or acquired during the life of the animal such as: natural or environmental cause (breed, age and sex, poor nutrition and climate) mechanical damage (brand marks, bruises, scars/wound and scratches), parasitic infestation (mange mites, lice infestation, tick infestation, sheep ked and blowfly) skin diseases (fungal disease, bacterial disease and viral disease) while post-slaughter defects are those which occur during and after slaughtering of animals, which consist of flay cut, knife damage, bad bleeding, poor pattern, preservation, storage and transportations defects. To avoid the cause of hide and skin defects, continuous education to livestock owners, local skin and hide traders/collectors, flayers, butchers and abattoir workers about paramount importance of hide and skin. Create public awareness about animal husbandry and strategic animal health service should be strengthened to reduce the impact of ecto-parasites and other skin diseases.

Key words: Defects · Ethiopia · Hide And Skin · Pre-And Post-Slaughter

INTRODUCTION

Ethiopia is believed to have the largest livestock population in Africa. There are 52.13million cattle, 24.2million sheep, 22.6million goats, 44.89million poultry, 1.96 million horses, 6.4million donkeys, 0.37 million mules and 0.99 million camels [1]. Livestock perform multiple functions in the Ethiopian economy by providing food, input for crop production and soil fertility management, raw material for industry, cash income, fuel and employment [2]. The livestock subsector is a major contributor to the overall economy it contributes 19% of GDP and 16-19% of foreign earning of the country. The country's foreign exchange from livestock product is increasing, especially for red meat to gulf and within Africa, as well as leather and other livestock product to Europe. In Ethiopia hide and skin contribute much to the export earnings from the livestock sector. Ethiopia has been exporting hides and skins in the past 100 years [3].

Trade in hides, skins, leather and leather manufactures have been in a great growth at an average of about 12% over the last 30 years, reaching to around US$ 53.8 billion in early 2000. Commodity trade patterns have changed during a period between 1999 and 2008 and practical methods for evaluation and classification of skin are necessary [4]. Hides and skins are the basic raw materials for the leather industry. Currently there are about 27 tanneries in the country and have an average capacity of processing 4, 000 pieces of hides and 30, 000 pieces of skins per day [5]. Based on the off-take rate of 7%, 33% and 35% for cattle, sheep and goat respectively, it is expected to produce 3.1 million hides, 7.8 million sheep skins and 8.2 million goat skins [6].

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In Ethiopia, livestock is the second major source of foreign currency through export of live animals, meat, skins and hides. Livestock hide and skin contribute a significant proportion of domestic leather. However, in recent years, this rank has been relegated to fifth level mainly because of rejection and down grading inflicted on hides and skins mainly due to infestation by external parasites [7], but also due to pre- and post-slaughter skin management problems [8]. Skin and hide defects occur as a result of a variety of causes in the life of the animal, during pre- and post slaughter [9]. These problems include during pre-slaughter (on the farm, during transport, at markets/abattoir) and post-slaughter (at the abattoir/hide market, during storage, preservation). Pre-slaughter defects include: Scratches, cockle brand marks, scars, old age defects and poor substances [10]. Whereas, post-slaughter defects comprise of bruise gouge marks, flay cut, bad bleeding, putrefaction, hair slip and beetle damages [10]. The consequences of all such defects are that every tannery (or trader) had to adopt customized criteria to select/sort quality of incoming raw hides/skins and outgoing finished leather ultimately resulting in price differences among grades [11].

Therefore, the main objective of this seminar paper was to review the major pre and post slaughter causes of hide and skin defects in Ethiopia.

Hide and Skin Definition: Hides are broadly defined as the external integuments of large animals, while skins are the outer coverings of small stock like goats and sheep. The best sources of hides and skins from domesticated animals are cattle hides and sheep-goat skins. However, hides and skins may also be obtained from other species of domesticated and non domesticated animals such as buffalo, horse, camel, elephant etc. and skins from, pig, impala, rabbit, mink, snake, frog, ostrich, shark etc. [12]. Hide and skins in their raw state consist of three layers. This are the epidermis or thin outside layer, a second thicker layer known as the corium or dermis and a third layer of adipose tissue or flesh. In the process of tanning, the first and third layers are removed. The epidermis is made up of cells an under layer of living epithelial cells and an outer layer of dead cells. This outer layer consists mostly of an insoluble protein, keratin and affords surface protection to the body. The aesthetic value of leather comes from the grain layer. The corium layer gives leather its strength and resiliency. It is rich in the protein collagen. Individual collagen molecules combine together in the corium to form very small fibrils that are in turn bound together to form collagen fibers, which are visible under the microscope. The strength of the skin and of leather is due to cross weaving of these fibers [13].

Hide and Skin Production and Utilization in Ethiopia: The raw material of the leather industry is mainly derived from local areas of the country where basic amenities for slaughtering and subsequent marketing are either not in existence or lacking. Additional sources of hides and skins include slaughter slabs, municipal slaughterhouses, the limited number of export abattoirs and meat and meat product processing plants. With regard to skin production, except the export abattoirs engaged in the production of chilled mutton and goat meat for export, the contribution of other slaughtering premises in terms of skin supply is very negligible. About 90 to 95% of the skin production is derived from urban as well as rural backyard slaughters and the remaining 5 to 10% is from major urban slaughter houses and export abattoirs [14].

More widespread use of hides and skins would have required the development of special processing techniques. Raw hides and skins are of little use in their natural state and spoil quickly. The simplest way of protecting and processing them is by drying, which causes major changes in their physical characteristics. Some of the applications for dried hides include the manufacture of personal armour, shields, musical instruments (such as drums) and upholstering chairs. Dried skins have also been used for similar purposes and, because of the abundance of hair, fur or wool that commonly occurs on them, skins have long been used to make clothes particularly suitable for use in cold climates [15]. The introduction of modern system of improvement of hides and skins in an organized form in the country could be looked at in three different stages of development. The first was the establishment of Livestock and Meat Board in 1964 and continued introducing the system of moving the traditional method of preservation of hide and skin (ground drying, smoking and pegging of sheep and goats skins etc.), to modern preservation method is frame drying techniques, so as to promote the production and supply of better quality raw material and to discourage the improperly preserved hides from reaching central market. This resulted in a systematic procedure of marketing [16].The second stage was the establishment of the second Livestock Development project (SLDP) in 1972 for the improvement of livestock marketing infrastructure and quality of hides and skins and has contributed greatly to the proper handling of

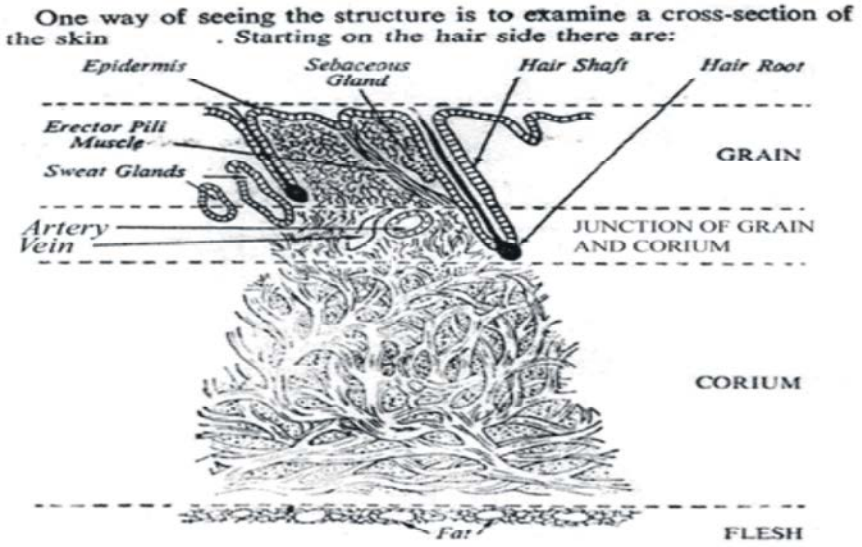

Fig. 1: Cross section of the skin
Source:http://www.assignmentpoint.com/wpcontent/uploads/2013/10/Cross-setion-of-the-skin.png

hides and skins in the country. In the third stage of development, the government tried to have a broader outlook of the hides and skins industries of the country and a detailed work were done [17]. Currently 27 Tanneries in Ethiopia produce all forms of hides and skins and finished leather for the domestic and export markets [18].

Pre Slaughter Cause of Hide and Skin Defect: Skin defects are classified into two main groups. First group being those created or acquired during the life of the animal (Pre-slaughter defects) and second group being those that occur during and after slaughtering of animals (Post-slaughter defects) [19]. Pre slaughters mainly occur during the live stages of an animal and they account for about 30% of the total defects which downgrade the quality of Hides and Skins. Pre-slaughter defects contribute to a huge national economic loss [20].

Defect Due to Environmental /Natural Factors

Breed: Fine wool sheep breeds, such as Merino, produce skins that are thin, have pinhole grain and are extremely ribby. These skins produce only the cheapest type of leather. The skins of hairy sheep have a high proportion of fat in the upper part of the corium and on the flesh side of the skin. Skins from goats in the highlands are poor in substance and open grained. The small size of skin yielded sheep of tropical and mountain area origin is not considered a drawback because of the skin's superior quality of high tensile strength, compact fiber structure and excellent grain. But small size skins that are downgraded due to poor quality are unwanted by tanneries [9].

The breed of animal is of course important, the best hides for leather purposes usually coming from those animals which are bred for beef production, i.e. those which develop carcasses with a high proportion of lean meat in a reasonably short time under conditions of economic feeding. These hides, available from all the beef-producing countries of the world, are very tough and firm, fairly uniform in thickness and having a "square" form, since breeding programs are designed to produce a body conformation with minimal amounts of tissue in the neck, leg and belly regions [21].

Age Sex: The skins from male goats and sheep will be heavy with a coarse grain. Female skins will have better tensile strength. The skin structure of young animals tends to be fine, compact and have tight grain patterns [9]. Age affects the hide in two different ways. Younger animals have good tight grain patterns, but they are damaged easier. Older animals have tougher and coarser grain patterns. Also, the older the animal is the more exposed to scars, brands and scratches it tends to accumulate. Younger animals have the better hide quality [22].

Climate: The climate on which an animal is raised has an effect on substance of the skin and on the grain of the leather. Animals raised in warm climate have a short hair

and leather produced has superior substance, smoother and finer grain patterns, whereas animal raised in cooler climate or higher altitude grow longer wool or hair and resulting leather will be poor substance and have coarse grain this problem is more pronounced in sheep and goat skin than cattle hide [23].

Poor Nutrition: Poor nutrition causes an animal to be smaller and also causes the skin to be thinner, poorer in substance and producing leather which lacks elasticity (ESGPIP, 2009). On the other hand, fat animals can cause too much fat content in the hide, which prevents curing agents from penetrating the hide [21]. Poor nutrition predisposes the skin to low febrile condition where the weight and final quality of leather is affected irrespective of the subsequent efforts of other condition being optimized. The resulting condition is referred to as "papery leather" which is a common problem experienced in the areas where poor or unavailability of pastures and forbs is eminent. Hence animals in such areas are of dilapidated condition affecting subsequently the final quality of leather [24].

Emaciation is the thinness and friability of hides and skins derived from animals suffering from prolonged and bitter starvation, leathers which are produced from such hides and skins are noted for their dryness and flabbiness. Poor nutrition causes an animal to be smaller, the skin thinner and of poorer substance [23].

Defects Due to Mechanical Cause

Brand Mark/ Branding: Branding is mostly done by pastoral communities for animal identification, ornamental and/or for curative purpose [25]. Unfortunately most branding is done using hot irons on areas of hides, example, on the back and rumps, which have high value and spoils leather like wounds. Between 10-40% of the value of the hide is lost by the unsightly and irreparable damage caused by branding [26].

Bruises and Wound: Bruises and wound commonly are referred to as Pre-slaughter defects. Most bruises and wounds are inflicted on animals due to severe beating especially for draught animals and during transportation on trucks for slaughter [27]. Although wounds could be healed, they leave a permanent damage on hides and skins which remain visible in the final leather [20].

Scratches and Horn Rakes: Scratches are amongst the most common mechanical damages found in both hide and skins in Africa including Ethiopia and causing permanent marks. On cattle hides, horn rakes are a general problem as animal husbandry practices in the countries discourage dehorning [28]. They can occur at the farm, during transportation of animals, at the abattoir. Usually the grain surface (epidermis) is damaged; rarely the scratches are deeper and damage the dermis as well [29]. Multiple scratches are therefore quite common. Scratches give leather unaesthetic appearance and if deep, cause considerable loss of tear strength especially on skins. The quality is also degraded as tanners try to obscure the faults on the grains by embossing or printing, which also increase processing costs. Consequently, the raw materials fetch lower prices [28].

Defects of Hide and Skin Due to Infectious Disease: A considerable portion of the pre-slaughter defects that accounts for 65% are directly related to skin diseases caused by the ecto-parasites; or to the secondary damage that occurs when the animal scratches itself to relief the itching. Skin diseases are known to affect the quality of skin. As many as one-quarter to one third of all skins processed at tanneries have various defects and are unsuitable for export purposes [30].

Bacterial Disease: Is a common bacterial disease caused by *Dermatophilus congolensis*, producing suppurative lesions which break out spontaneously or become hardened and resulted damage to the hide and skin. These cause blemishes on the superficial grain tissues [31]. Dermatophilosis in sheep is appearing in the inguinal region, in goats appear especially on the face and on the ears, probably because of goats get infected when feeding on contaminated bushes, at the same time being hurt by the thorn. In cattle, the lesion is commonly seen on the dorsal part of the body. In sheep, when the lower legs are affected the condition is generally referred to as strawberry foot rot [32].

Viral Disease: Warts are growths that emerge as black or brown elevations on the skin. They can cause the tanner problems in several ways. They can drop off, or disrupt the unhearing operation. In the area where warts were on the skin, the leather produced is weak and considered worthless [22]. Lumpy skin disease is a viral disease that affects the skin of cattle. The characteristic gross pathological findings are the skin nodules which sometimes are also found in the subcutaneous tissue. The biggest economical loss is the loss of condition and permanent lesions of skin [33]. Sheep pox is a viral disease of sheep and goats which is highly contagious. Healing

of the skin affected by pox is slow and permanent scars can be left. This causes huge economic losses in the tanning sector [9].

Fungal Disease: Ringworm is a fungal infection of the skin that can affect animals of all ages and is common in many animal species. It occurs in cattle, sheep and goats but not with great frequency. Lesions are most commonly seen on the head, ears, neck, shoulders and often circular with hairless areas and the development of a thickened and crusty skin [9]. A fungus Trichophyton, which is easily spread from animal to animal through spores, causes ringworm. Lesions develop on the animal and begin to spread in all directions. Loss of hair and thickening of the epidermis mark the location of the lesion. Lesions show up in the leather produced from infected animals and appear as smooth, shiny spots. Therefore, ringworm's influence on the hide or skin reduces the value of the leather [22].

Defects Due to External Parasite: Ectoparasites are very common and widely distributed in all agro-ecological zones in Ethiopia [34]. They are one of the major hindrances to the productivity of sheep in the country. Ectoparasites cause a wide range of health problems that confront the productivity of sheep. Lice, sheep keds, ticks, fleas and mange mites are reported to cause great pre-slaughter defects responsible for downgrading and rejection of sheep skins. It is reported that 35% of sheep and 56% of goat skin rejections in Ethiopia are attributed to ecto-parasites [35]. All these established facts imply that ecto-parasites pose serious economic losses to the farmer, the tanning industry and the country as a whole [36].

Mange Mites: Mange mites are common in Ethiopia and therefore reported from many regions and different agro climates. Based on the reports so far, mange mites are most prevalent in four national regional states of Ethiopia namely, the Amhara, Oromia, Tigray and Southern Nation and Nationalities regional states [37]. In all reports, three genera of mites namely, Sarcoptes, Psoroptes and Demodex were reported to affect small ruminants [38]. Mites cause the skin disease known as mange in sheep and goats. This mange enters the hair follicles and sebaceous glands producing chronic inflammation with proliferation and thickening of the epidermis and loss of hair. It can be easily detected at the raw material stage. It can be a major cause of downgrading skin quality at the tannery [39].

Lice Infestation: Lice are small, flat-bodied insects with legs modified for grasping hairs. There are two types of lice affect ruminants, biting (chewing) lice and sucking lice. Biting lice produce itching, irritation and possible hair loss, whereas sucking lice suck blood and can contribute to anemia as well as skin irritation. Heavy infestation of lice on sheep can lead to “ekek”/cockle defect, which is an allergic skin hypersensitivity reaction to lice in processed sheep skins [35].

Ticks Infestation: Tick occurs in the temperate as well as in the tropics and sub tropics regions of the world. Ticks are one of the most serious ecto-parasites in Ethiopia. They cause the greatest economic losses in livestock production. Their effects are various including reduced growth, milk and meat production, damaged hides and skins, transmission of tick-borne diseases of various types and predispose animals to secondary attacks from other parasites such as screw worm flies and infection by pathogens such as *Dermatophilus congolensis*, the causative agent of streptothricosis [40]. The defect due to tick infestation has the shape of tiny holes or unhealed scar. The hole can be seen on the grain surface of the finished leather resembling tiny spot and hollow. The small hole and more or less healed scars mark the smoothness of the grain and detract from the appearance of the finished leather [23].

Sheep Ked: Sheep keds are wingless flies brown in color. They are found on goats but are more commonly seen in sheep. Keds suck blood and can cause anemia as well as skin irritation. Sheep ked *Melophagus ovinus* is more prevalent in highlands than midlands and no cases yet recorded in lowlands in the country. The prevalence of “Ekek”, an Amharic word for itch, lesion in *Bovicola ovis* and *Melophagus ovinus* infested groups of sheep skin were 100% and 95%, respectively. Infestation of sheep with Bovicola ovis and Melophagus ovinus leads to the development of “Ekek” and causes higher proportion of skins to fall into the lower grades [41].

Blowfly Strike (Cutaneous Myiasis): Myiasis is the infestation of the organ or tissue of the host animal by the larval stage of dipterous flies, usually known as maggots or grubs. Myiasis may be caused by screwworm flies and in most cases occur in cattle, goats and sheep. Blowflies, flesh flies and botflies are the three major categories of flies commonly responsible for causing myiasis [33]. Screwworms are transmitted when a female fly lays her eggs on a superficial wound of an animal and can infest a

wide variety of wounds (example tick bites, dehorning or branding wounds, wire cuts and other injuries) and eggs laid in the wound will hatched into larval screwworm, which feed on the living tissue of the animal. The larvae cause great damage to the hides and skin of livestock and affect the appearance of the final leather as well as have the potential to cause death in affected animals [42].

Post Slaughter Defects of Hide and Skin

Defects from Bad Bleeding: If carcasses are not bled out properly at the time of slaughtering, blood remains in the vessels and capillaries of the hides and skins. This blood supplies ideal condition for the growth of bacteria and favors putrefaction along the blood vessel [43].

Knife Cut and Flaying Defects: Damage caused by careless use of a knife during flaying, sometimes cutting through the skin. Complete perforation of the hide or skin accidentally made by knife. Flay cut, gouge marks and scores are caused during flaying period through use of sharp pointed knives. This subsequently reduces the quality and use of leather [9].

Flay defects are very common in Ethiopia because of flaying operation of animals is conducted traditionally and by unskilled persons or without experience. The type of flaying equipment also plays a major role in the production of good quality skins and hides. Almost all slaughter facilities except some modern abattoirs use hand flaying. As a result, flay cuts and gouges are common problems on hides and skins [44].

Defects from Poor Pattern: This is the shape of a skin formed by unaccepted pattern of ripping before flaying. A bad pattern obviously affects the utilization of the leather produced and reduces the marketability of the finished product [9].

Defect from Preservation and Storage: The preservation techniques of hides and skins can be divided into long term preservation (drying methods, ground dried, sun dried, frame dried, shade dried, dry salting, wet slating and re-use of salt, salt additives and brining) and low term preservation (Cooling and Deep freezing). The choice depends mainly on the period of time envisaged for preservation [45]. The fact that most producer respondents reported to sell hides and skins in a fresh state in 12 hour without preservation is encouraged. Delaying preservation of selling without the necessary precaution results in the spoilage of products and degrades their quality [46]. Curing is the process that provides an environment in which bacteria cannot survive. Several curing agents have been reported in literature, examples potassium chloride, silica gel, boric acid and herbal-based products [47]. Salt is a biostatic and acts by inhibiting the growth of bacteria by lowering the moisture content in raw stock. Various methods of salt curing can be applied. Preservation methods such as salting or frame drying are not practical fully by farmers, collectors and traders of hides and skins, as a result of which hides and skins suffer from hair slips, mould and bacterial attacks. Delays in cleaning, drying or curing cause damage through putrefaction [48]. The main constituent of skin is protein. After an animal's death, skin proteins are exposed to bacterial attack that leads to decomposition [49].

Defects Due to Transportation: Inefficient transportation may cause delays in arrival to tanneries or preservation centers as a result of which green or salted hides and skins deteriorate in quality. Poor handling during loading and unloading may damage quality of hides and skins [35].

CONCLUSION

Contribution of skin and hide to the country economy is not as expected despite the large livestock population in Ethiopia. This is due to skin diseases, mechanical defects, backyard slaughtering system and poor marketing system. Skin and hide are the most important items to generate foreign currency for developing countries like Ethiopia. However, many hide and skin processed at tanneries in Ethiopia have various defects and unsuitable for export purpose where most of these defects occur in the pre-slaughter stage of production like from natural or environmental factors, mechanical damage, infectious skin disease and external parasitic infestation. Defects posed by post-slaughter causes related to poor management and treatment of hide and skin after slaughter are also significant. Slaughter and flaying operation of animals is also conducted in many cases traditionally and by unskilled persons resulted in a number of observed post-slaughter defects. Mitigation of the problems associated with pre-slaughter and post-slaughter causes of skin and hide defects is very important if the country has to benefit from the sector.

Therefore based on the above conclusion, the following points are recommended:

- Continuous education about hide and skin problems and their prevention methods is paramount importance and hence should be provided to livestock owners, local skin and hide traders/collectors, flayers and abattoir workers.
- Veterinarians should create public awareness about animal husbandry since it has a great role in decreasing the cause of pre-slaughter defects.
- The government should strengthen strategic animal health service and disease prevention and control practices to reduce the impact of ectoparasites and other diseases of skin.

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