A STUDY ON SOME DAMAGES OF SKIN OF BENGAL GOAT

A Thesis
Submitted to the
West Bengal University of Animal and Fishery Sciences
In Partial fulfillment of the requirements
for the degree of
Master of Veterinary Science
In
Animal Products Technology and Marketing

By

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2004


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CERTIFICATE

This is to certify that the work recorded in the thesis entitled **"A STUDY ON SOME DAMAGES OF SKIN OF BENGAL GOAT"** *submitted by Apurba Chakraborty, in partial fulfillment of the requirements for the master Degree of Veterinary Science in Animal Products Technology & Marketing in the West Bengal University of Animal and Fishery Science, is a faithful and bona fide research work carried out under my personal supervision and guidance. The results of the investigation findings reported in the thesis have not so far been submitted for any other degree or diploma. The assistance and help received during the course of investigations have been duly acknowledged.*

Place: Belgachia
Dated: ..12th..July..2004

[Dr. S. Biswas]
Chairman
Advisory Committee

APPROVAL

OF THE EXAMINERS FOR THE AWARD OF THE

DEGREE OF

MASTER OF VETERINARY SCIENCE (M.V.Sc)

We the undersigned, having been satisfied with the performance of Apurba Chakraborty, in the Viva-Voce Examination, conducted today, the 20/7/.2004 recommended that the thesis may be accepted for the award of the degree of Master of Veterinary Science in Animal Products Technology and Marketing.

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Apurba Chakraborty.

(APURBA CHAKRABORTY)

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CHAPTER- I

INTRODUCTION

INTRODUCTION

Besides Mesopotamia and Egypt, India prides itself on being the oldest continuously existing civilization in the world. It's civilization and cultures are considered to be of great antiquity and the people of India are continuously modernizing themselves keeping alive their traditions and beliefs that go back several millennia.

India's handicrafts from clay and cloth to metal, stone and leather are the facets of these hoary traditions. In ancient times, the *royalty* and *rishis* are known to have used leather mats, while soldiers had leather sheaths for swords. In his record of the arrival of Alexander the great in India in the 4th century B.C, the Greek historian Arrian wrote of the sandals of gold enriched with jewels and boots of white leather with high heels, worn by the wealthy. In the 13th century A.D, the intrepid Venetian traveler, Marco polo, spoke of the 'marvelously beautiful' leather mats he had seen.

Unfortunately, during the British colonial rule, the crafts of India, including leather goods languished. Before the independence in 1947, national leaders like *Rabindranath Tagore* and *Mahatma Gandhi* urged for the regeneration of Indian craft traditions not only with a view of economic empowerment, but also as a mean to reassess the nations identity. Fulfilling their ever-cherished dream, the Indian craft tradition including leather items has seen a remarkable renaissance in the last half a century (D'Souza, 2003).

Today India is flooded with natural bliss. It has undergone a revolution in Agricultural and Livestock resources. We are leading in cattle and buffalo population (209 and 92 millions respectively), third in sheep (56million) and second in goat population (123.5 million) (FAO, 2001). Apart from the meat, milk and wool, the hides and skins obtained from this legendary livestock resource, give enough support to our national economy. Nearly 2.5 million people are engaged directly and 1.5 million indirectly in this industry. There is an annual availability of 65 million raw hides and 170 million raw skins in our country (Ganguly, 2003), which depicts the immense potentiality of this sector.

In this vast domain of livestock resources, goat is one of the unique species who converts the most inedible roughage to high quality edible proteins in the form of meat and milk along with other value-based products like skin and fiber (Nandy, 2003). It is the earliest ruminant species to be domesticated (Zeuner, 1963). Out of the total 60 breeds of goats in the world, India posses 20 defined breeds well distributed in the different agro-climatic zones of the country. Among them, the Bengal goat produces the superior quality skin.

The Bengal goat is distributed mainly in west Bengal, Assam, Bangladesh, part of Bihar and Orissa. They contribute US $ 1.6 billion per year in which 79.3% is contributed by meat and 12.9% by skin (Devendra, 1992).

There is an annual availability of 75,396 thousand goat skins in India, out of which Bengal contributes the highest, i.e. 45% (Ghosh, 1999). Unfortunately, considerable depreciation in the value of these skins in both Indian as well as Foreign markets is faced due to pox marks, thin skins, scratches, hair slip, insects, ticks and mites besides defective processing. This depreciation in value means a loss of several crores of rupees, annually to the country. A very little emphasis has been given to study the probable causes and their extent of damage from a scientific viewpoint, which ultimately help in the prevention and control of such damages or diseases and improve the standards of the skin. This is the main reason that in spite of being endowed with world's highest raw material resources, India's contribution to world export of leather is merely 1.07% (Ganguly, 2003). The exports of leather and leather products from India have shown a downtrend in 2002-03 than 2001-02 (US $ 1936.14million in 2001-02 and US $1814.18 million in 2002-03, Chattopadhyay, 2003).

The scenario stated above needs to be changed. After the ' Green revolution', Operation flood', it is the time to bring a dream tide in development of skin, vis-à-vis leather industry. Without improving the raw material, the valuable final products can't be prepared. These improvements as well as the enhanced value of the improved hides and skins will reflect in turn upon the price of fresh meat and the value of the livestock, two key factors important to the economy of the country. This scenario can effectively be changed with the blessed touch of science and technology.

Keeping the above in view a study has been planned in the following order, which may hitherto give an idea on extent of damage and may help to formulate the remedial measures.

Such studies also have immense importance for the production of wholesome and hygienic meat because of the fact that if skin could be freed from any ailment, the meat produced from such animals also be of better qualities substantiating the saying that 'skin is the mirror of health'.

OBJECTIVES

1) To find out the extent of damages caused by different agents, i.e. diseases and mechanical.

2) To suggest some remedial approaches to improve the quality of skin.

3) To ascertain the type of the defects of the skins.

4) To categorize the regional differences, if any, in terms of damages of the skin, i. e. disease/mechanical and other aspects of damages.

5) To predict the losses in terms of economics for such defects.

CHAPTER II

REVIEW OF LITERATURE

2.1 GOAT AND ITS IMPORTANCE

Goat is such an unique animal that it can be reared in all ecological conditions ranging from rarefied areas of high mountains to low lying planes of sea level.

It is perhaps the most misunderstood species though it plays an important role in rural economy of the country. It provides fluid cash to meet the day-to-day family needs and off farm inputs for production of crops and thus contribute to the sustainability of agricultural food production. In spite of neglect of the species by development planners all over the world, because of misconception of it's role in ecological degradation and desertification, the population of goat has shown a large increase than any other species of livestock importance, particularly in South-East Asia. It provides the most preferred meat particularly in Asian countries and is accepted as sacrificial animal both by Muslims and Hindus. The goat milk is easily digestible and produces much less allergic problems. The browsing habit of goat controls the undesirable growth of brush and forbs. Some goats produce very high quality fibers besides producing the high quality raw material for making quality leathers.

2.1.1 Goat population trend in India, vis-à-vis West Bengal

FAO (2001) estimated that goat population in India to be 123.5 million or 20% of the global livestock. The current mean rate of slaughter of goats is around 41% and the mean rate of mortality around 15.5%.

Animal Resources Development Department of West Bengal (2001-02) estimated the goat population in this state to be 172.25 lakhs. The goat populations of different districts of West Bengal were as follows:

Sl. No.	District	Number
1	Cooch behar	857092
2	**Jalpaiguri**	**581328**
3	Darjeeling	304409
4	Uttar Dinajpur	603108
5	Dakshin Dinajpur	356575
6	Malda	2282009
7	Murshidabad	1451931
8	**Nadia**	**1031237**
9	North 24 Parganas	1031977
10	South 24 Parganas	1167601
11	Calcutta	43454
12	Howrah	299962
13	Hoogly	886807
14	Midnapur	1478337
15	Purulia	743156
16	Bankura	813592
17	Burdwan	1145747
18	Birbhum	844627

Nandy (2002) pointed out that of the total population of goat in India, West Bengal is having the largest population size (population/ sq.Km) comprising 22% of total population, making 256/sq.Km. He also indicated the annual growth rate of goat population in this state to be 10.92%.

Ganguly (2003) indicated that India ranks first in goat population in the world with 144 million goats.

2.1.2 Production of goatskins in India, vis-à-vis West Bengal

Sarkar (1981) reported that the goat skins of North Bihar and Bengal (The Ganges valley) are comparatively small in size yielding about 42 sq. feet of leather per dozen of skins. They have fine grain and are prized all over the world as the finest raw material for superior glazed kid.

Report of All India Survey on Raw Hides and Skins (1992) showed that in 1986, for every 1000 human population in the country, 89.3 goat skins were produced through slaughter.

Ghosh (1999) calculated the annual availability of the goat skins in India, vi-a-vis West Bengal Share which is as follows:

Category	Availability ('000s)	% Slaughter	% Fallen	W.B. % share
Goat skins	75,396	91.30	8.70	45.00

Ganguly (2003) estimated that about 170 million goat and sheep skins are produced in the country annually.

2.2 Indian Leather Industry, Vis-a -vis World Scenario:

Leather Age (2002) reported that the total value of leather goods exported from India for the period of April-2000-March-2001, was to the tune of US $ 443.83 million, out of which, the share of Calcutta was 58%.

Leather Age (2002) indicated that the major exporting countries of leather and their shares were Italy-23.39%, Korea-9.60%, USA-6.80%, Argentina-6.11%, Germany-5.72%, Brazil-4.88%, The UK-2.94%, China-2.88%, where as inspite of huge raw material sources, the share of India in world export of leather was only 2.35%.

Ganguly (2003) tabulated the global scenario and Indian share in exporting major leather products:

Share%	Leather	Leather footwear	Garments leather	Leather goods	Harness and saddleries	Non-leather footwear
India	1.07	1.19	4.96	7.77	8.86	0.06
Italy	23.70	21.13	6.58	19.43	3.49	6.22
China	NA	13.96	28.70	20.18	12.82	27.16
Germany	5.90	3.68	8.95	3.54	12.46	NA

He also listed the major importing countries of Indian leather and leather products (value in million US $), which are as follows:

Country	1999-2000 (million US $)	Share in total exports % in 1999-2000
Germany	296.46	18.81
UK	266.73	16.92
USA	251.71	15.97
Italy	162.82	10.33
France	83.91	5.32
Spain	66.79	4.24
Hongkong	53.30	2.70
Australia	30.52	1.94
South Africa	26.34	1.67
Russia	25.79	1.64
Sweden	18.86	1.20
Others	250.37	15.89
Total	1576.12	100

2.3 Quantitative aspects of goat skin:

Khan *et.al.* (1992) studied 300 Bengal goats and opined that skin weight was not significantly affected by sex but, the body weight was significantly correlated with age, body length and heart girth. There were also significant correlation of body weight with skin length, skin weight and dressing percentage.

Zegao *et.al.* (1992) comparatively studied Sichuan goat skin and found that the skin thickness of the rump and belly were not clearly differentiated among the breeds, but the Ma and Jiangchan Black were slightly thicker than Chuandong White in the skin thickness of the neck, and their positional differences were also big.

Parthasarathy and Muralidharan (1992) classified the goat skins as per the sizes given below and their length in inches from neck to the root of the tail:

Kids or small- below 28 inches.
Light- 28-32 inches.
Medium- 32-36 inches.
Heavy- 36-40 inches.
Extra heavy- 40 inches and above.

Terpack (1998) made some comments about the thickness of goat skin. He said that the goat skins were thin, the neck and shoulders were no thicker than the thinnest flank of a deer skin. The skin was so thin that one could see the sunlight through it at its thickest part.

Muralidharan and Thiagarajan (2000) Studied the skin thickness of Jamnapuri, Tellichery and Tellichery crossbreed goats at different ages and growth stages in both the sexes and concluded that the skin thickness increased with advancing age. The mean skin thickness of Tellichery adult goats and kids was significantly correlated with body weight.

2.4 DAMAGES OF THE SKIN

Various agents and factors so far have been identified which are responsible for surface defects of goat skins. It is also possible that the etiological agents for an unknown or less known defect have not yet been properly identified. Information are very much lacking about the incidence of various surface defects in goats, especially Black Bengal goat. Before initiating any step to improve upon the quality of such defective skins, precise knowledge about the defect, their prevalence and deteriorating effects on skin quality is to be obtained.

2.4.1 Classification of damages

Furlong (1937) categorized the defects of the skin as: a) Defects in living animals-I) diseases ii) mechanical, like, barbed wire scratches, goad marks, thorn scratches, brand marks, curry comb scratch etc. b) flaying defects c) defects causing during preservation and subsequent handling.

Wilson (1941) explained the causes of the hide and skin damage as:

a)Damages occurring on living animals, i.e. mechanical damages, like, scratches, wire damages, brands and damages by parasites and diseases, like, grubs, lice, ticks, fleas, mange, scabies, stephanofilariasis, pox, ring worm, scars, worts.

b) Damages occurring after slaughter- flaying damage, butcher cuts, poor pattern, grain cracks, curing damages, salt stains, bacterial and putrefactive damages, shipping damages, scratches and abrasions, welting, over-heating, localized drying, contamination.

Picture showing badly flayed goat skin.
Source: The hide, leather and allied trades improvement society, 1931

Sharphouse (1958) classified skin defects as:

a) Damages caused during life.

b) Damages caused after death.

Das (1959) detailed the common defects of goat skin:

a) Warble marks or holes- about 80% of the goat skins from Sind, Punjab, United provinces and Orissa have this damage.

b) Mange or scruf- skins from all parts of India are affected to the extent of about 10% of the total supply.

c) Barsati or dana- it appears at the beginning of the rainy season.

Stather (1931) classified the defects under six different categories, like, damage due to mechanical factors, parasitic attack to the animal, pathological changes to the skin, bacterial attack of raw hides and skins, physical factors and chemical factors to which hides and skins are susceptible.

Venkatesan *et. al.* (1977) recorded the seasonal variations in surface defects of goat and sheep skin around Madras. Out of the total 23,429 goat skin, 7,835 goat skin were found affected. He concluded that demodecosis, abscess, fire marks and rainy season defects are mainly responsible for surface defects in goat skin.

Venkatesan (1989) vividly classified the different surface defects of hides and skins.

Sarkar (1981) illustrated the damages of hides and skins in two categories, i.e, ante-mortem damage and post mortem damage.

Report of All India Survey on Raw Hides and Skins (1992) classified the factors affecting the quality of skins as-a) shape and pattern b) substance, thickness and plumpness c) grain d) curing e) mechanical defects f) biological defects g) other factors like, age of the animal, tick marks etc.

Abadi (2000) elaborated the main problems contributing to downgrading of skin and hides in Ethiopia as natural defects (scratches, disease, ectoparasitic defect (Ekek) and man made defects (brand marks, ripping and flaying problems, preservation, transportation, storage and bad handling). They also calculated the % of various defects, which were as follows:

Defects of ectoparasites (Ekek/Disease)-> 50%

Putrefaction- 20%

Flay cuts- 15%

Other defects-15%

2.4.2 The Diseases and other conditions

Venkatesan et. al. (1977) recorded the seasonal variations in surface defects of goat and sheep skin around Madras. Out of the total 23,429 goat skin, 7,835-goat skin were found affected. He concluded that demodecosis, abscess, fire marks and rainy season defects are mainly responsible for surface defects in goat skin.

Source: R.A.Venkatesan, 1977

Sarkar (1981) made a clear demarcation in quality of thick and thin skin. According to him, the substance means the thickness of the skin, toughness of the fibre and the closeness of the texture of the fibre. Skins thicker in measure and closure the texture of the fibre, the better are they in leather making properties. The thinner hides containing looser and emptier fibre texture are termed as "hides of poor substance" or thin skin.

Sarkar (1981) reported that the Bengal goat skins are free from warble infection.

Smith (1981) categoriesed the caprine dermatological problems as louse and kid infestation, Psoroptes mange, Sarcoptic mange Chorioptic mange, Demodectic mange, other parasitic diseases like warble fly, staphylococcal infection (Dermatitis, Impetigo and furunculosis) Dermatophilosis, interdigital fusiform infection, ring worm, neoplasm, nutritional skin diseases and environmental insults.

Karim (1983) reported out break of pox in Sept. and Oct in 1977, in a herd of 300 Sannen goats imported from Netherland, in Iraq of which 62% had skin lesions.

Frolov and Larionov (1984) found signs of demodectic mange in 4 to 9% the 3493 goat skins examined at tanneries; the incidence depending on area and season.

Chakraborty and Choudhury (1984) reported that about 17% of 300 goats had mange infections. Nearly all goat mites were Sarcoptes.

Sahoo and Tripathy (1984) found that the incidence of Dermatomycosis was higher in Black Bengal (13%) that in Ganjam goats (9%) and in young animals (8%) compared with adults (5%).

Sharma and Lonkar (1985) reported an outbreak of demodectic mange caused by Demodecid Demodex caprae in Rajasthan, India.

Nooruddin *et.al.* (1987) investigated 5073 goats in different districts of Bangladesh and found 1361 goats were affected with either 1 (89.9%), 2 (1.3%), 3 (1.3%) or 4 (0.1%) types of skin diseases. Diseases included dermatophilosis (3.8%), derrmatophitosis (2.8%), Contagious ecthyma (1.2%), goat pox (0.4%) seborrhea sicca (2.1%), strenal alopecia (5.1%), demodex (0.5%) sarcoptes scabie (1.0%) Psorptes ovis (0.2%), chorioptes (2.8%), trombiculid mite (5.7%), tick (1.4%) and lice (2.6%).

Nooruddin and Barik (1989) made epidemiological studies in urban and rural areas of seven districts in Bangladesh where 5771 goats of different breeds (Bengal, Jamunapuri, Alpine, Beetal, Barbari, Anglo-Nubian and Sanen) were examined. 1.3% had contagious ecthyma and 0.6% had pox. Diseases occurred mostly in animals on the plains and mature goats were primarily affected.

Pratap *et.al.* (1991) studied 200 Black Bengal goats in Orissa, India, among which 160 (80%) harbored 20 species of ectoparasites. Demodex caprae was found on 85% of goats, Hyalomma Kumari on 82%. Linognathus stenopsis on 68% . Boophilus microplus on 60% and Rhipicephalus haemaphysaloides on 52%.

Mage (1992) reported that scratching and depilation in goat are not always due to mange. Serum analysis in four goats indicated a lack of Ca and P.

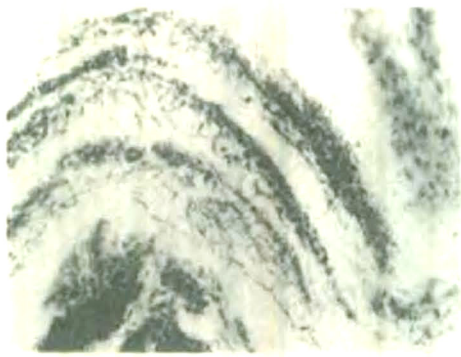
Ahmed *et.al.* (1994) studied goats, comprising 1729 males and 4318 females in and around Ranchi, Bihar, out of which 313 males (17.5+ 1.5%) and 837 females (18.74 + 1.11%) were infested with Sarcoptic mites.

Dorny *et.al.* (1994) Surveyed the importance of mange in the etiology of skin in goat in Peninsular Malayasia and observed mange mites in 88% of the goat farms. Chorioptes texanus was found in 20.7%, psoroptes Cuniculi in 19.3%, Sarcoptes scabie in 18.6% and Demodex canis var caprae in 0.4% cases. He also indicated that age did not affect incidence or distribution of skin lesions.

Banerjee and Banerjee (1996) revealed that in goat skins at Suri, Birbhum, West Bengal, India- Psoroptes Caprae was primarily responsible for rainy season defects.

Ghosh (1999) listed the main defects in goat skin as pox marks, thin skins, scratches and hair slips in Gujrat. In Maharastra, he found pox, warbles holes, dermatitis and hair slips. In Kerala, he found ticks, thorn marks or scratches, pox and hair slips.

Langridge (2002) reported that parasites cause superficial damages to the skin and irritation, which leads to the animal rubbing against barbed wire fencing to relieve the itching. This causes additional scratches to the skin.



Picture showing dermatophylosis
Source: British Leather Confederation ID-114

Papadopoulous *et.al.* (1997) reported that goat hypodermosis caused by Przhevalskiana silenus was common in Greece causing serious losses in animal production and breeding. Around 54.2% of the skins in slaughterhouses were affected. The mean number of wholes found per skin was 27.07.

Schrooer (2000) reported that few of the causes of skin defects are ectoparasites, sucking and biting etc.

Ihuoma *et.al.* (2001) explained the common skin diseases or defects in Nigerian livestock as: ring worm, streptothricosis, demodectic mange, pox, dermatitis, anthrax, nutritional diseases, scratches, whip lashes, brand marks, score marks, flay cut, hair slip, putrefaction, insect damage, bruising, rubbed grain etc.

Mauricio (2002) described ticks as one of the most important ectoparasites affecting livestock in tropical and sub-tropical countries.

2.5.1 Mechanical defects of goat skins

Stather (1931), Tancous et. al (1959) and Sengupta (1964) referred to the mechanical damages to hides and skins of the living animals caused by nail and barbed wire scratches, production damage and brand marks. Flay cuts of skin during slaughter also contribute as a factor of mechanical damage.

Picture showing Barbed-wire scratches on skin

Source: British Leather Confederation, ID-114

Das (1959) reported that considerable depreciation in the value of raw goat skins I produced by bad flaying. Bengal goat skins suffer more from this than any other part of India which may be due to the fact that people in other parts of India are stronger in physique and are to pull-off the skin rather than slash it away from the carcass by a knife as the weaker people in Bengal often do.

Sarkar, (1981) viewed that in some countries, cattles are kept in ranches enclosed by barbed wire fences. Cattles coming in contact with the barbed wire gets scratches. These scratches cause wounds and leave indelible long marks on the hides even when they heal up.

Sarkar, (1981) observed that a large number of slaughtered hides and skins produced in India contain defects due to careless and inefficient use of the flaying knife. Due to these faulty flaying cuts, holes and scores are produced which greatly diminishes the value and beauty of the leather.

Picture showing flay-cuts on goat skin Source: British Leather Confederation, ID-114

Report of All India Survey on Raw Hides and Skins (1992) revealed that flay cut and hair slips are the major man-made defects of goat skins in India.

FAO- Committee on commodity problems (ME/HS 2001) illustrated the principal causes of mechanical injuries affecting hides and skins:

Type	Cause
Brands	Effect of severe heat or cold (hot-iron and freeze branding)
Scratches	Thorn bushes, rough fencing and others
Fighting scars	Fighting (biting)
Horn rakes	Fighting
Abscesses	Injections
Cauterization marks	Heat sealing of other injuries
Yoke and harness scars	Improper design or fitting
Goad damage	Excessive use of sharp or heavy sticks
Dung irritations	General dirt and filth
Vegetation damage	Penetration of some weed seeds into the surface
Shearing scars	Improper techniques and/or excessive haste

2.5 Examination of goat skin:

2.5.1 Normal histology of goat skin

Manabe *et.al.* (1982) made sections of epidermis taken from fifty sites of the body surface and found that the epidermis was thick and Langerhans cells were located at the base of the Malphigian layer. L-cells were unevenly distributed through out the body.

Parthasarathy and Muralidharan (1992) gave a brief idea about the histological structures of goat skin and graded them in between calf skin and sheep skin. He also stated that the epidermis is thicker than the ship skin and covers 1.5-1.8%,

thermostat layer covers 24-54% and the corium layer covers 45-75% of the total skin thickness. It has straight hair follicle and the hair is less deeply rooted. The collagen fibre bundles in the corium layer are much more fuller and firmer than the sheep skin.

Ying *et.al.*(1996) studied the histological structures of kid skin in Yimengs black goat and found both the epidermis and dermis of the skin were thickened from birth to the first month of age and the growth of reticular layer was faster than that of papillary in dermis the number of primary follicles tended to decrease and secondary follicle increased with the age. The elastic fibers were closely and crosswise in papillary layer, openly and horizontally in reticular layer. The elastic fibers were only distributed around follicle in papillary layer.

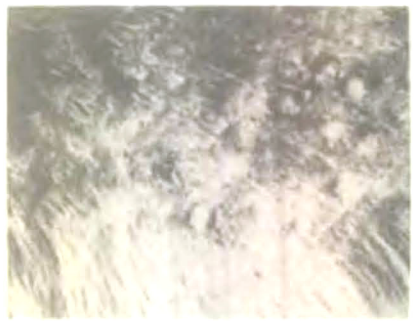
Raheem and Al-Hety (1997) made histological and morphometrical study of the skin of black goat and found that the thickness of epidermis varied inversely with hair density. Primary follicle produces long, course overcoat hairs. Secondary follicles were smaller and shorter than primary, producing short, fine, undercoat hairs. The S/P ratio was high on the back and side, moderate on the abdominal region and low in the scrotal region. Sebaceous glands were associated with primary and some secondary follicles.

Dutta (1999) explained the grain patterns of different hides and skins and showed that in goat skin, two types of hair pores are distinct. Fine hair pores are more in number than coarse hair pores. Coarse pores are mostly arranged in a group of three followed by rows of fine hair pores. The grain surface appears flat and smooth.

Bhattacharya *et.al.* (2003) studied the gross histology of the skin of black Bengal goat.

2.5.2 Gross changes in the skin.

Venkatesan *et.al.* (1977) grossly examined the skin for pox and found circular or semi-circular spots on the flesh side without having any unhealed scab or hairless patches



Picture showing goat pox lesions

Venkatesan *et.al.* (1977) also found a correlation between the incidence of flay cut and abscess as the flay cuts were found more in abscess affected areas of skin.

Venkatesan *et.al.* (1977) reported that in fire-marks of goat skin the affected areas were covered by a dark coloured, thick, hard scab which was in the process of healing and in early stage the lesions showed reddish or reddish brown areas assembling the granulation tissue of a healing wound.

Sarkar (1981) reported that the first symptom in living animals with pox , affecting the skin is a general inflammation and small red spots at the inner thigh, abdomen and sides. The red spots develop into small vesicles or blister like eruptions containing watery serum or lymph. The preparation of Empire hides and skins, London- observed that the diseases of pox group cause disfigurement on goat skin leather in the form of round scars, sometimes slightly depressed.

Yeruham (1984) studied demodecosis in local goats in Israel. The skin lesions appeared as papules, 3-6mm in diameter on the ears, face, eyelids and shoulders. Infested goats were apparently healthy. Some waxy secretions were there.

Nooruddin and Barik (1989) found dry and crusty lesions in oral commissures, lips, nose and ears in contagious ecthyma in goat skins in Bangladesh.

Nooruddin. *et.al.* (1989) diagnosed that in pox infection in goat, there was cutaneous eruptions beginning with erythematous areas (macules) specially noticeable in hair or wool free parts of the body. Lesions then evolved into papules. Papules desiccate and formed crusts. Rarely the papules transformed into vesicles. Papules give rise to nodules involving all the layers of the skin and sub-coetaneous tissue.

Chatterjee (1989) reported that kids are most susceptible to goat pox virus. The crust contains virus particles and during the stage of decrustation, the entire shed becomes contaminated. The stages of goat pox in skin are red spots in different parts of the body → in 3-4 days vesicles are formed→ in 4-5 days vesicles turn to pustules.

Kambarage (1992) studied sarcoptic mange infection in goat in Tanzania and found crusty alopecic patches around muzzle extending towards and around eye, scrotam, and medial aspect of thigh to hock joints, brisket and axillary region. Lacerations, small papules, thickening and wrinkling of skin, dandruff was also observed.

Batta *et.al.* (1999) reported the presence of cutaneous eruptions in the form of minute papules on almost all parts of the body in goat pox. Characteristic lesions in the form of vesicles and crusts were also observed in 70% of the affected goats.

Bithu *et.al.* (2003) found papules, alopecia, scales, crusts, excoriation and lichenification in the buffalo skins affected with pyoderma.

2.5.3 Microscopical changes in the skin:

Venkatesan *et.al.* (1970) suggested that ecto-parasites were responsible for ' rainy season defects' and found different stages of mites, e.g. egg, larvae, nymph, pubescent female, adult male, adult female and ovigenous female. The damages were restricted to epidermis, the grain layer and the upper part of dermis.

Venkatesan *et.al.* (1977) studied the histological changes in fire-mark infected areas of goat skin and found marked collagenisation with dense collagen fibre bundles in the region of firing. The collagen fibre bundles close to the epidermis were oriented horizontally with loss of characteristic angle of weave pattern. Marked parakeratosis and hyperkeratosis were observed in the epidermal region of fire marked areas. Development of 'Keloid'-like structure and distention of superficial lymphatic vessels were also found.

Cheema (1977) viewed formation of thick walls of chronic,non-suppurative granulomatous reactions second and third instar larvae in the back. In the early stages, there were mainly granulocytic leukocytes, later replaced by lymphocytes, plasma cells, macrophages and giant cells. Large mono-nuclear cells with coarse, pink cytoplasmic granules were seen near the larvae. The wall was partly lined by squamous epithelium growing down from the margins to the opening in the skin.

Nesbitt (1983) acanthosis, occasional parakeratosis, necrosis, ulceration, perifolliculitis, dermal oedema and infiltration of neutrophils and mononuclear cells in the dermis in pyoderma infection in canines and felines.

Ross and Reith (1985) reported that the skin where the epidermis is thinner is known as thin skin, which contains hair except in certain locations. They also pointed out that in thin skin, the stratum lucidum layer is absent and the stratum granulosum layer may not form a complete or continuous layer.

Nooruddin and Barik (1989) reported that in pox, skin lesions may involve the full depth of epidermis, dermis and adjacent muscles. Microscopically, the affected skin revealed an initial epithelial hyperplasia followed by coagulation necrosis. The cells appear stellate and boundaries poorly defined and undergo hydropic degeneration with the formation of micro-vesicles.

Banerjee and Banerjee (1996) reported that mites restricted to the epidermis and upper part of dermis causes psoroptes mange infection.

Sadhukhan *et.al.* (1999) reported that the skins of goat affected with pox showed hyperkeratosis, acanthosis and epidermal hydropic degeneration. The sebaceous glands revealed hypertropic and hyperplastic changes. The blood vessels were found to be packed with thrombi with evidence of median hypertrophy.

Vegad and Katiyar (2003) reported that the sites of multiplication of goat poxviruses are visible by light microscopy, as inclusion bodies. The matured virions may be released by budding in which case they are enveloped or after cell lysis, where they lack an envelope. Localized acanthosis (thickened epidermis) and hyperplasia followed by vesiculation were also reported. The underlying oedematous dermis and subcuts contain many distinctive cells called ' cellules claveleuses' of Borrel or 'Sheep pox cells'. These cells are reported to be concentrated mainly around vessels and between collagen bundles. They contain nuclei with marginated chromatin, nucleoli and large vacuole in the center of the nucleus. Most of the cells contain cytoplasmic eosinophilic inclusion bodies.

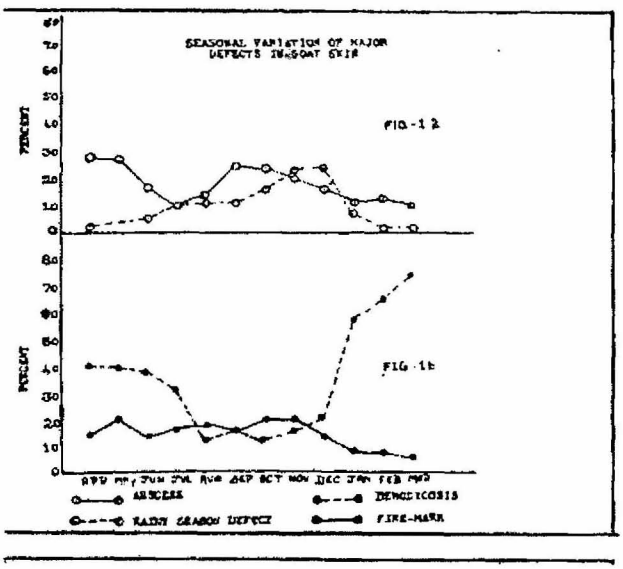
2.6 Seasonal influence on skin defects:

Das (1945) indicated the causative agents for ' rainy season defects' in goat skin and mentioned that some kind of stomach disorder, as a result of ingestion of a particular type of grass, was responsible for the defects.

Bhaskaran *et.al.* (1968) recorded a low incidence of demodecosis in September and high incidence (50%) during hot weather.

Venkatesan *et.al.*(1977) found that the incidence of abscess in goats were maximum during the month of April and May and a second peak during September. Rainy season defects were significantly low in the months from February to April. The incidence of Demodecosis reached the highest peak during March. Fire-marks in goat skin was fairly constant during the months of April to December and showed a downward trend in the months of January to March. The minor defects in goat skin, like pox and flay cut were consistently present throughout the season, whereas subcutaneous hemorrhages were present in all other months except April and May.

Sarcoptes was found to occur during post-monsoon and winter months and among the goats, which had the opportunity to graze in forest areas. The incidence of goat dermatitis was noted during post-monsoon period.



Picture showing seasonal variation of major defects of goat skin.

Source: R.A. Venkatesan, 1977

Venkatesan *et.al.*(1977) divided the entire year into four seasons e.g. Winter (January and February), hot weather (March to May), monsoon (June to September) and post-monsoon (October to December), and found that demodecosis is encouraged during winter and early hot weather when the rainfall is practically nil and the prevailing of temperature is low.

Sarkar (1981) reported that the substance of the skin not only varies with the breed but also due to variation in climate and vegetation and he also stated that goat skins in summer are inferior in quality to those of winter.

Report of All India Survey on Raw Hides and Skins (1992) suggested that among goat skins, the natural defects constitute 78% in rainy, 72% in winter and 67% in

summer season. It also revealed that flay cut and hair slips are the major man-made defects.

Neog *et.al.* (1992) found that mange mite infection was highest (31.03%) in winter, although the infestation was recorded throughout the year in 311 goats examined in Assam.

Ahmed. *et.al.* (1994) found that among the bucks, maximum infestation of sarcoptes scabiei occurs in monsoon period, followed by spring, winter and summer, similarly in goats, except there was higher incidence in winter than spring.

Banerjee and Banerjee (1996) reported that the defect in goat skin due to psoroptes mange appears annually for about three months immediately after rainy season when optimum condition for mite development occur-R.H. 85-90% and 30-37°C.

Ghosh (1999) reported that skins obtained during summer are worst in quality as due to tremendous heat and scarcity of water, the health of the animals go down. Different skin diseases like scabies, ticks etc develop. During rainy season, defects like ' barsati-dana' are prevalent. During winter the animals remain comparatively healthy and few skin diseases are found during the season.

2.7 Economic aspects of loss:

Lowden (1931) estimated that the loss to butchers in UK, caused by bad flaying and careless preservation of hides was at least £ 500,000 per annum. It also reported that the damage to cattle and their hides, resulting from the warble fly in Great Britain was estimated to be in the neighborhood of £ 1,000,000per annum.

Sharma (1960) reported that the loss of national wealth resulting from the damages causedto the Indian hides and skins due to tick and warble was estimated at Rs. 5 crores per annum.

Kumar (1968) explained the constraints in raw materials. He explained that the raw materials worth of Rs.600 crores are lost due to unhygienic practices of gathering skins and processing. Large quantities of raw hides and skins, around 35-40% are smuggled out from Eastern region to neighboring countries and making the problem more acute.

Rahbari and Ghasemi (1997) studied the economic aspects of goat grubs in Iran and revealed that a loss of value to each skin caused by 1-10 warble holes was estimated to be 100 Rials, with an extrapolated annual loss of 400 million rials in the study area.

Basu (1999) said that considerable depreciation in value of hides and skins both in Indian as well as foreign markets is faced due to damages caused by insects, lice, ticks, mites besides defective processing.

Bayou (2000) reported that in Ethiopia, over 50% of the skins are rejected or downgraded due to parasitic mange.

Brown (2003) viewed that warble flies damage to the $ 1.5 billion export value of US hides as much as $ 16-23 per hide and other large scale losses such as estimated UK losses of $ 12 million due to direct effect and further $ 30 due to associated causes of lice.

2.5 REMEDIAL MEASURES

Lowden (1931) with the help of diagram explained the directions for the 'Ripping' of hides, which was as follows:

They also indicated that except for ripping, no knife must be used in removing the skin from the goat. All skins must be pulled off.

Picture showing the correct lines for ripping

Source: The hide, leather and allied trades improvement society

Karim (1983) vaccinated the goats during an outbreak of goat pox in Iraq, after which only 22%showed the clinical sign of pox.

Jackson *et.al.* (1983) proved HCH (BHC) effective when supported by therapy with topical corticosteroids and emollients in sarcoptic mange infection in England, but at least 5-10 treatments are required.

Euseby *et.al.* (1984) recommended pour-onapplication of trichlorphon for the treatment of demodecosis in goat.

Sahoo and Tripathy (1984) achieved clinical cure from dermatomy cases in goats with Quadriderm (tolnaltate,betamethasone, valerate, gentamycin sulphate, iodochlorohydroxyquine)Jadit-H (buclosamide, salicylic and hudrocortisone) and Himax in 100,67 and 67%.

Sharma and Lonkar (1985) treated demodectic animals with5% melathion solution but in spite of a reduction in the size of the nodules, there was no complete recovery.

Dakkak and Ouhelli (1986) treate a herd of 84 local goat breeds, kept on rough pasture in Morocco and infected with sarcoptic mange with a single dose of s/c Ivermectin (0.2mg/kg) which resulted in a complete clearance of the mange lesions within 3 weeks.

Nooruddin and Barik (1989) outlined some points, which are extremely useful in controlling goat pox:

a) Isolation of infected herd and sick animals for at least 45 days after recovery.
b) Slaughtering of the infected herd.
c) Proper disposal of cadavers and products.
d) Stringent disinfection.
e) Quarantine before introducing into the herd.
f) Animal and vehicle movement control.

He also prescribed both live attenuated and inactivated vaccines in the prevention and control of goat pox.

Mage (1992) successfully recovered goats from scratching and depilation through subcutaneous injection of Ca and P.

Rahbari and Ghasemi (1997) controlled goat grubs in Iran with a test of subcutaneous ivermectin (Ivimec, 100µg/kg. body Wt) and pour- on ivermectin (Ivomec,pour-on 1ml/10 kg body wt).

Basu (1999) reported that application of Gamaxene-D.919 at the concentration of 2.5% proved satisfactory in controlling beetles.

He also suggested arsenical dips, application of DDT, BHC and other tickicidal agents as well as introduction of biological methods by liberation of Hunterellus Hookeri in controlling ticks.

Bayou (2000) reported that mange can be controlled by using an insecticide like, Diazinon. The 60% concentrated should be mixed in the dipping tank at 1:1600 and the animals should be treated three times at 10 days interval.

Crowther and Logic (2001) suggested selective breeding for improving hides and skin quality through-

a) Consistent and maximized area with regular shape.
b) Minimizing growth marks, wrinkles and other skin defects.
c) Avoiding vertical fiber defect, which drastically degrades tearing resistance.
d) Providing consistency in hide thickness.

He also recommended diets enriched with Vit.C to improve the quality of hides and skins.

Parthasarathi (2001) reported that a thorough knowledge of various kinds of defects and damages which reduce the value of the raw material and leathers to the tanners is absolutely essential as it only will enable the tanners to handle the raw hides and skins to his best knowledge.

CHAPTER III

MATERIALS AND METHODS

MATERIALS AND METHODS

3.1 Sources of the raw material:

Skins from the freshly slaughtered goats from the markets were collected from two agro-climatic zones of West Bengal, i.e. Terai region (North Bengal) and Alluvial zone (South Bengal). Purposively, amongst the different districts of Terai and Alluvial zones, the Jalpaiguri and Nadia districts were selected as sources of raw materials because of their high population of Bengal goat. The skin samples were collected from Maynaguri, Dhupguri, Nagrakata, Mal and Moulali regions in Jalpaiguri and from Mohanpur, Jagulia, Birohi, Gayeshpur regions within the Nadia district, during the months of February to April, 2004. The meteorological records in these two districts during the three months of 2000 (Bureau of Applied Economics and Statistics, 2002), are given below:

★ **Month of February 2000.**

Name of the districts	Max Temp. °C	Min. Temp. °C	Relative humidity	Rainfall
Jalpaiguri	26	12	77	17
Nadia	26	14	87	53

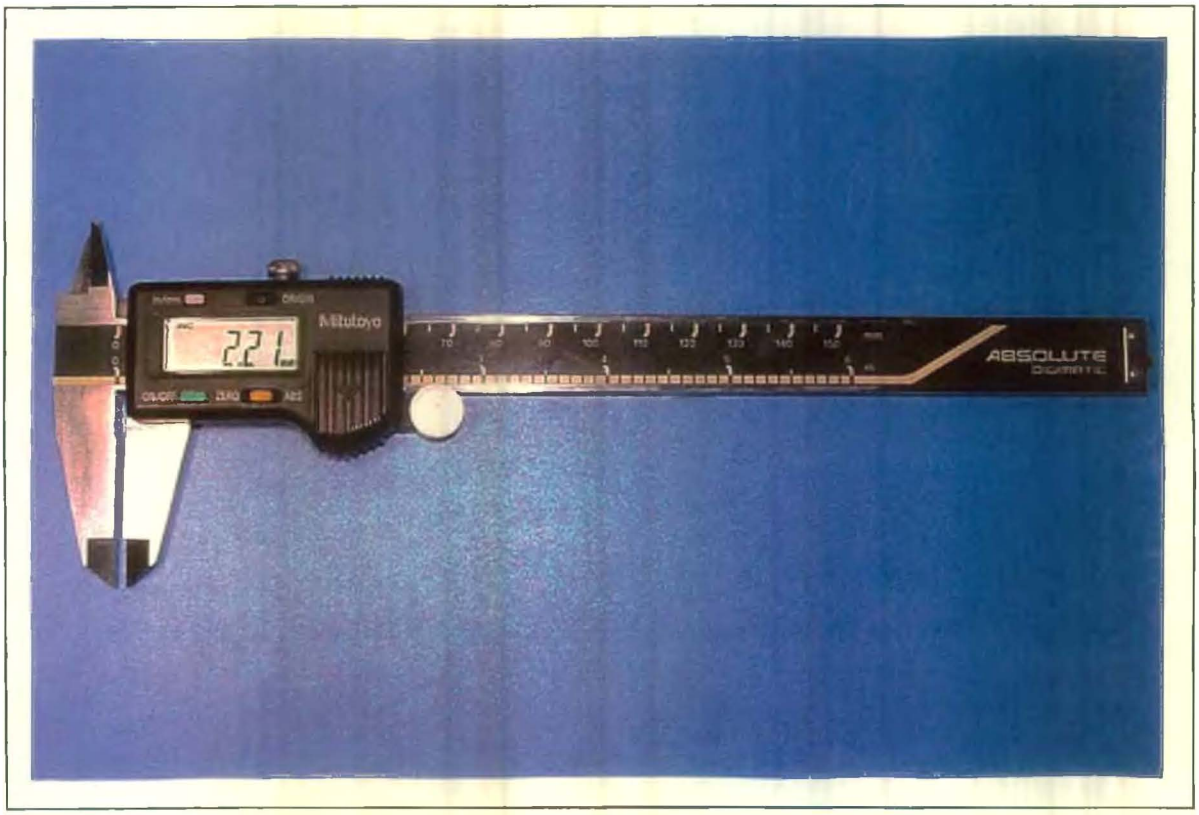


Plate 1 **Mitutoyo digimatic caliper**

★ **Month of March 2000.**

Name of the districts	Max Temp. °C	Min. Temp. °C	Relative humidity	Rainfall
Jalpaiguri	30	16	65	15
Nadia	33	19	84	3.0

★ **Month of April 2000.**

Name of the districts	Max Temp. °C	Min. Temp. °C	Relative humidity	Rainfall
Jalpaiguri	32	21	71	152
Nadia	36	24	86	63

During daytime, the different slaughter markets and storehouses of skin were visited and the skins were examined under broad daylight. The gross morphometric study was done on fresh collected skin samples. The topographic structures of the skins of Bengal goat were studied on naked eye and by stage microscope. This morphometric study was done to determine the superficial quality of that raw material. The hair patterns, presence of pox nodules, scratch marks, flay cuts, presence of abscesses were examined along with the depth of the defects and the areas affected. The thickness of different skins i.e. normal and defective, in 4 regions of the body, namely neck, belly, chest and tail end were measured with the help of 'Mitutoyo digimatic caliper' (Plate1). The area of the skins were measured using the formula L X W, where 'L' was the

length of the midline from the base of neck to butt region.'W' was measured from the width of the shoulder (FAO, 1995).

Collection of data at the field level

The weight of the entire skin was measured by an 'Electronic weighing balance', (Welltronics system). The lengths of the skins were measured with the help of a measuring tape in inches from neck to the root of the tail (Parthasarathy and Muralidharan, 1992). The body weight and age of the animal from which the skin was collected was noted as per the information from the butchers and farmers. The prices of the skins were assessed by personal interviews conducted with the traders and butchers. A total of 115 each skin samples were examined in those two agro-climatic zones. The final format of the data collection at the field level is placed at Annexure I.

3.2 Collection of the skin samples:

Freshly slaughtered skin pieces of 1 sq. cm both normal as well as affected, were cut with an 8" scissors. In case of affected skins the lesions were placed in the center of the cut piece.

3.3 Preservation of the sample:

After collection of the samples, the tissues were preserved in 10% Neutral buffer formalin (NBF) for histological and special staining.

3.4 Staining procedure:

3.4.1 Special staining: - Van Gieson's Method.(Luna, 1968),

Van Gieson's solution: - (Annexure-2)

Staining procedure: -

1) Deparaffinize the section by dipping in Xylol for 5 minutes, twice repeated change.
2) Rehydrated to distilled water.

Absolute alcohol – 2 min.

90% alchol –2 min.

70% alchol –2 min.

50%alchol - 2 min

Distilled water - 2 min

3) Dip the section in Weigert's hematoxylin solution for 10 minutes. (Annexure-3)
4) Washed in distilled water.
5) Van Gieson's solution for 5 min.
6) Dehydrated in 95% alchol, absolute alchol.
7) Cleaned in Xylol with twice change for 2 min. each.
8) Mounted with DPX mountant.

Results: -

Collagen – Red

Cornified epithelium – Yellow

Nuclei – Blue or black.

3.4.2 Routine staining procedure: -

After proper fixation with 10% neutral buffered formalin at the laboratory the pieces of skin (1cm length, 1cm breath) and enough thickness were washed in running tap water for overnight with the object of removing formalin from the tissues.

Then the tissues were dehydrated through ascending grade of alcohol (50%, 70%, 80%, 90%, absolute alcohol, no.1 and no.2) for one hour each and cleared in Xylene followed by ceder wood oil.

The cleared transparent tissues were subjected to routine Paraffin embedding techniques and blocks were prepared. The blocks were into 3-5μ thickness in microtome machine.

The sections were fixed in clean glass slide with Mayer's egg albumin. After proper drying, the fixed slides were stained with H & E method described by Luna (1968), which is as follows-

1) Mayer's Hematoxylin composition (Annexure-4).
2) Counter stain for Hematoxylin: 1% aqueous stock solution of alcoholic Eosin (Annexure-5).
3) Staining procedure:
    a) Deparaffinization by Xylol with twice change for 5 minutes each.
    b) Rehydration by passing it through ascending grade of alcohol, starting from absolute alcohol, 90% alcohol, 70% alcohol, 50% alcohol and distilled water for 2 minutes each.
    c) Stained with Mayer's Hematoxylin for 10 minutes.
    d) Rinsed in tap water for 5 minutes.
    e) Differential staining with 1% Eosin solution for 2 minutes.
    f) Dehydrated in 95% and absolute alcohol, 2 changes for 2 minutes each, with intermediate checking under microscope.
    g) Xylene, 2 changes of 5 minutes each.

h) The sections were mounted over cover slip with the help of Canara balsam mountant and examined under microscope.

3.5 Statistical methods used:

The statistical methods used in the study include percentage analysis, co-efficient of correlation and Independent sample t- test.

Percentage analysis:

The percentage was calculated for making simple comparison. For calculating percentage, the frequency of a particular cell was divided by the total number of respondent in that particular category and multiplied by 100. Percentage was calculated up to two places after decimal point.

Co-efficient of correlation:

When two variables change together in such a way that an increase in one variable is accompanied by an increase in the other, the variables are said to be positively correlated (Panse and Sukhatme, 1967).

The intensity of correlation is measured by a co-efficient, usually indicated by the symbol of σ which is computed according to the formula:

$$\gamma = \frac{\sigma x \gamma}{\sigma_X X \sigma_Y}$$

Should an increase in one variable go hand in hand with a decrease in the other, these two variables are said to be negatively correlated. If there is no relationship between two variables, they are said to be independent or un-correlated.

Independent Sample 't' Test:

Experimenters have found that the null hypothesis is a useful tool in testing the significance of differences. In its simplest form, this hypothesis asserts that there is no true difference between two population means. Let us consider two samples with mean X_1 and X_2. We are interested to know whether there is any actual difference between these two populations' means. In such situation 't' test is applied. In the present study the means are uncorrelated or independent. So the following formula was employed:

$$T = \frac{\overline{X} - \overline{Y}}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2}}}$$

$\bar{X}$ and $\bar{Y}$ = Means of two samples.

S_1^2 and S_2^2 = Sum of squares of two samples.

N_1 and N_2 = Sizes of two samples.

The calculated values were compared with the Table values for 't' test from Fisher and Yates (1979) Table with $(N_1 + N_2 - 2)$ degrees of freedom.

CHAPTER IV

RESULTS AND DISCUSSION

RESULTS & DISCUSSION

Assessments of defects: The frequency Table (Table 1) shows that in North Bengal region, among the different defects, thin skin % is most (11.4%) followed by flay - cuts (8.8%), abscess (3.5%) and goat pox (1.8%). 74.6% of the total 115 skins examined is found to be normal.

In contrast, in the frequency Table (Table 2) of South Bengal region, thin skin % is most (12.2%) followed by flay- cut%(10.4), abscess%(3.5) and scratches% (1.7). Normal skins are found to be 72.2%.

In a cumulative % of the defects, it is seen that the defect % is more in South Bengal (27.8%) than in North Bengal (25.4%). The result is significantly different owing to the fact that meteorological data (Bureau of Applied Economics and Statistics, 2002) concerning temperature and humidity are more in South Bengal than North Bengal. This may be a reason for such higher observation of defect in the skin of South Bengal region.

When compared categorically of the different defects, namely thin skin, flay-cut, abscess, goat pox and scratches, the highest category of defects was of thin skin (12.2%) in South Bengal, followed by 11.4% in North Bengal.

The reason behind such observation may be the lack of pasture in South Bengal region leading to malnutrition.

When flay-cut % is compared, it was more in South Bengal region (10.4%) than North Bengal region (8.8%). The reason behind the difference can be explained with the observation of Das (1959) where he reported that the people in other parts of India are stronger in physique and are able to pull-off the skin rather than slash it away from the carcass by a knife as the weaker people in Bengal often do.

There is no difference in the defects of the skin due to abscess in both North and South Bengal region where both the observations were 3.5% each. Venkatesan (1977) pointed out abscess as one of the cause of defects of goat skin and here the similarity of the percentage of observation of this defect has also be identified and

Table 1. Distribution of different Skin Defects in North Bengal

Skin Defects	Number	Percent
Thin Skin	13	11.4
Flay Cuts	10	8.8
Goat Pox	2	1.7
Abscess	4	3.5
Normal	85	74.6

Table 2. Distribution of different Skin Defects in South Bengal

Skin Defects	Number	Percent
Thin Skin	14	12.2
Flay Cuts	12	10.4
Abscess	4	3.5
Scratches	2	1.7
Normal	83	72.2

Table 3. Comparison of different attributes of skin in between two zones in relation to Thin Skin.

Traits	Category	Mean ± SE	t-value	df	Sig. Level
Economic Loss	North Bengal South Bengal	81.79 ± 6.13 60.54 ± 4.44	2.771	25	0.010
Defect area	North Bengal South Bengal	672.2 ± 55.189 642.1 ± 49.932	0.400	25	0.692
Body wt	North Bengal South Bengal	9452.14 ± 628.15 8656.15 ± 717.96	0.838	25	0.410
Skin Wt	North Bengal South Bengal	859.29 ± 57.1 786.92 ± 65.27	0.838	25	0.410
Total Skin Area	North Bengal South Bengal	672.2 ± 55.819 642.1 ± 49.932	0.400	25	0.692
Thickness of skin in Neck region	North Bengal South Bengal	1.821 ± 0.064 1.808 ± 0.064	0.143	25	0.887
Thickness of skin in Belly region	North Bengal South Bengal	1.451 ± 0.059 1.477 ± 0.046	-0.347	25	0.731
Thickness of skin in Tail End region	North Bengal South Bengal	1.791 ± 0.058 1.825 ± 0.086	-0.331	25	0.744
Thickness of skin in Chest region	North Bengal South Bengal	1.484 ± 0.062 1.442 ± 0.085	0.396	25	0.699

N.B. * ***indicates significance at 5% level;*** ** ***indicates significance at 1% level***

Fig. No. 1. Bar Diagram Showing the distribution of Skin defects in North Bengal

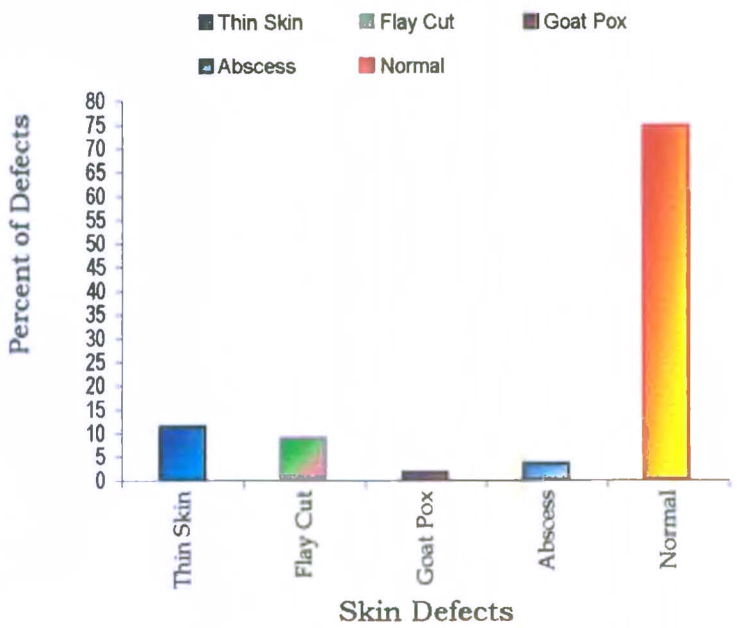


Fig. 2. Bar Diagram showing the Skin Defects in South Bengal

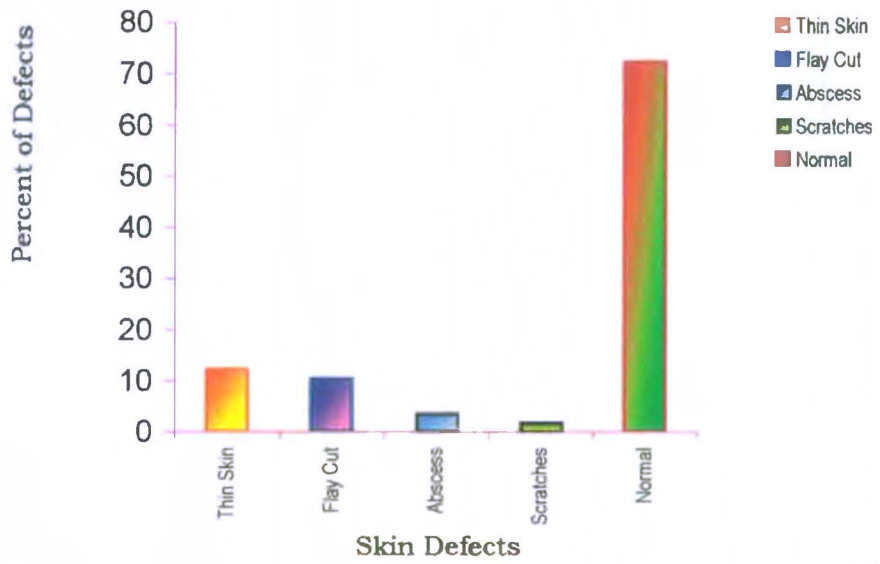
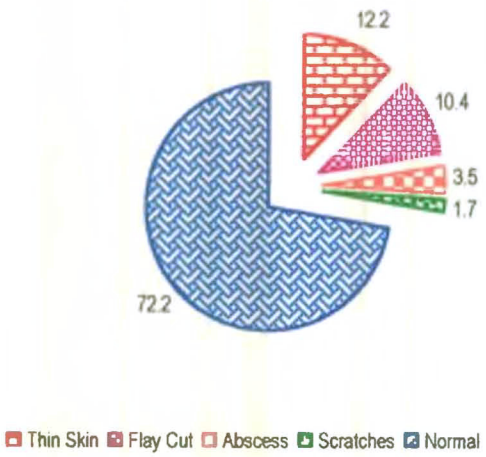


Fig. 3. Pie Diagram showing the distribution of Skin Defects in North Bengal

Fig. No. 4. Pie Diagram showing the distribution of Skin Defects in South Bengal



similar ambient temperature in both the region (North and South Bengal) could be the reason for such observation.

Incase of goat pox, which has been noted as a common defect of skin of goat (Report of All India Survey on Raw Hides and Skins, 1992), has only been observed in the North Bengal region (1.8%) in the present study.

The presence of this defect is though very common in both the region (Bureau of Applied Economics and Statistics, 2002). But scanty in observations of data may be responsible for non-availability of this case in South Bengal region.

Scratches (Plate 2) are also common defect of skin, particularly in cattle (Sarkar, 1981) where they are kept in ranches enclosed by barbed wire fences. But, in goat, this type of practice is not commonly used in their management. That is why, defect of goat skin due to scratches is not very significant in the two regions of West Bengal. Only 7% of the skins were found to be affected by scratches in the goat skins of South Bengal.

Comparison of different attribute in between two agro- climatic zones of study in relation to thin skin is given in Table 3. The Table shows that economical loss due to thin skin is more in North Bengal than South Bengal as observed through the mean ± SE values of both the regions (81.79± 6.13 and 60.54± 4.44). This differences significant as observed through t-values (2.771) against the value of significant level, (0.010). As pointed out by Ghosh (1999), the thin skin as one of the main defects of goat skin, such relationship of this type of defect to economical loss is of importance. Similar region wise, significant differences of observations can also be seen in body weight and skin weight of the animal with that of thin skin in both the cases, t-values are significantly higher against 0.410(value of sig. Level) to 0.838 (t-value). When mean ± SE values are compared in both the cases, it was higher in North Bengal than South Bengal (8656.15±717.96) in case of skin weight (859.29±57.1) in N.B, and 786.92±65.27 in South Bengal. This observation can be substantiated as a general principle of decrease or increase in weight of the skin and subsequent body weight of an animal if the skin is thick or thin.

Thereby the present observations are also in conformity with the above principle and can also be observed by several workers (Khan. *et al,* 1992) who were in opinion that there were significant correlation of body weight with skin weight of

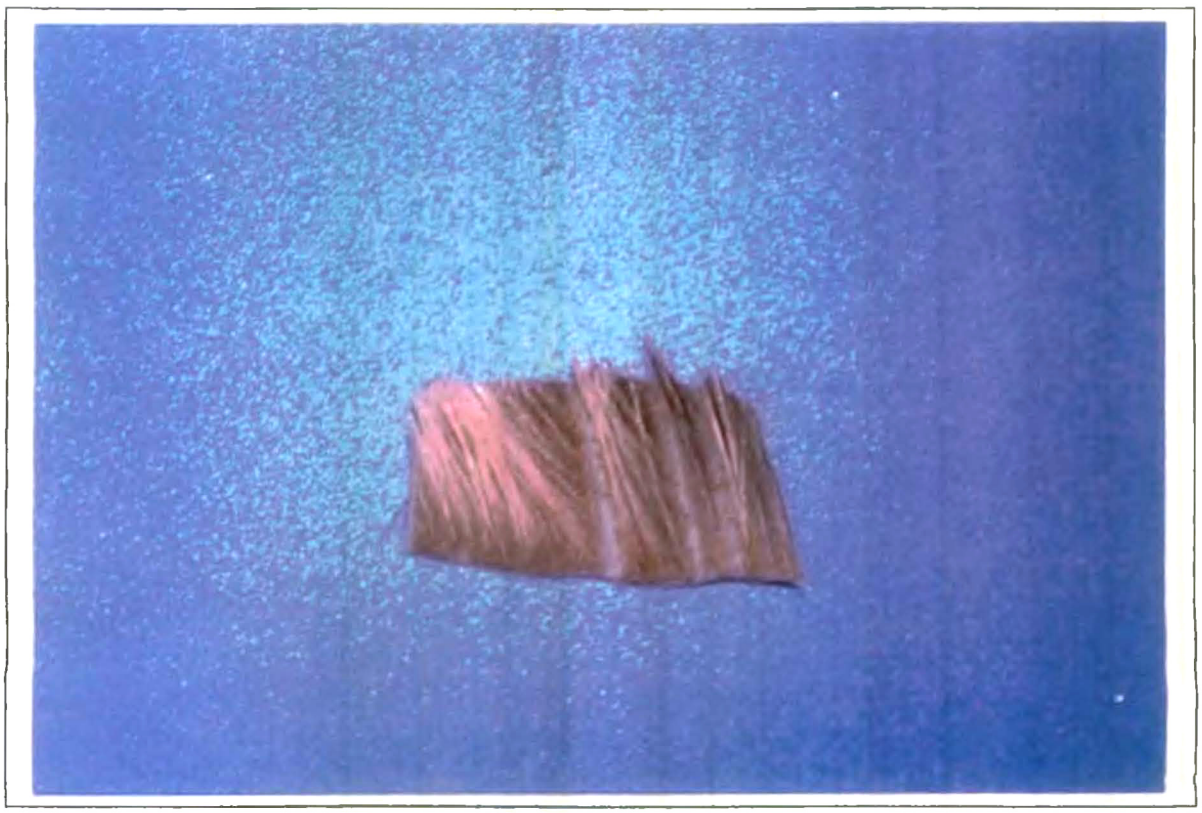


Plate 2 **Mark of scratches in goat skin**

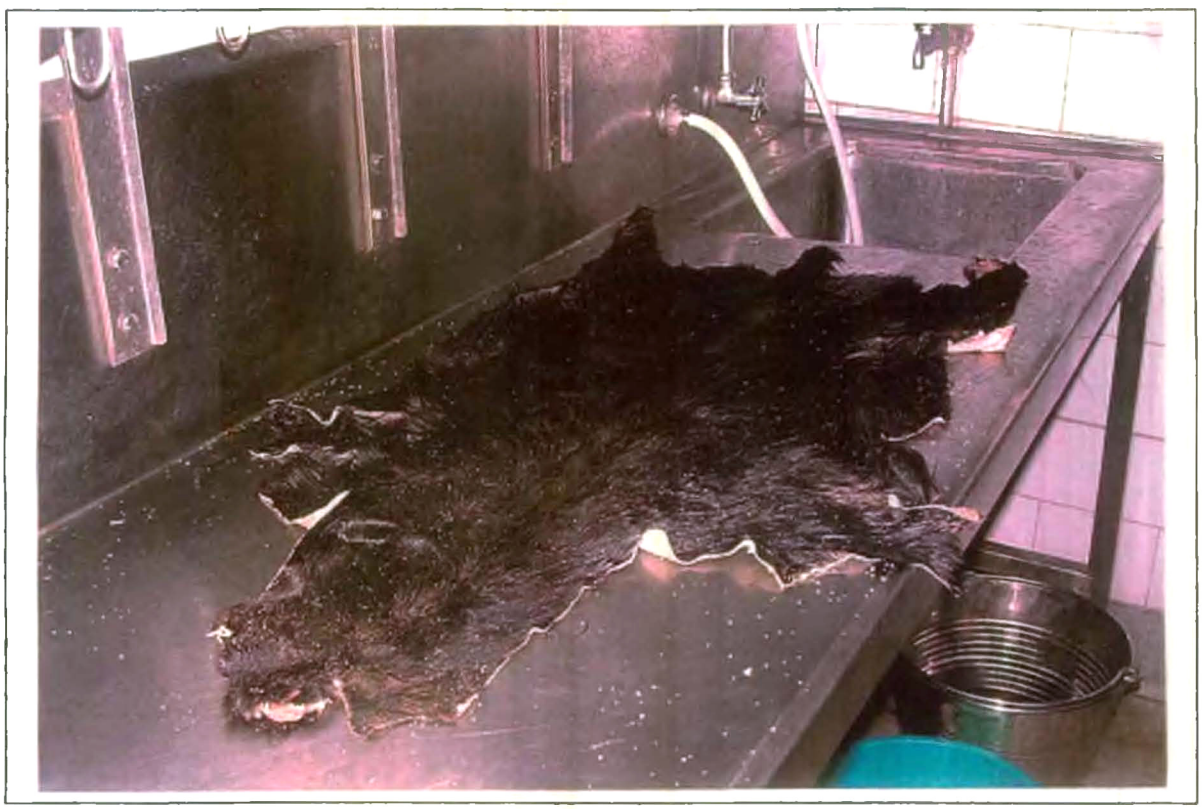


Plate 3 **Normally flayed goat skin**

Bengal goats slaughtered at the average 10.61 kg body weight and 10.08months of age in their studies on relationship of body measurement with meat and skin yields characteristics in free-range reared Bengal goat.

Other attributes of skins, namely, defect area, total skin area, thickness of the skin at neck, belly, tail end and chest region were studies and compared and results were tabulated in Table 3 with the observation of non significant differences through t-values.

Similarly, comparison of the different attributes of skin in between two zones of study in relation to flay-cut is given in Table 4. The Table shows that economical loss due to flay-cut is more or less in North and South Bengal and there is no significant difference as observed through the mean ± S.E. values of both regions (55.42 ± 4.54 and 59 ± 8.02) in the present study.

The differences in defect area, body weight, skin weight, thickness of the skin in neck, belly, tail end and chest region in relation to the flay-cut are found to be significant in the two zones of study.

In case of defect area, body weight and skin weight, the t values are significantly higher against 0.415, 0.346 and 0.346 (values of significant level) to 0.833, 0.965 and 0.965 (t value).

In terms of thickness of skin in the different areas, viz, neck, belly, chest and tail end regions the t values are also higher (1.408, 2.206, 1.878 and 1.517 respectively) in comparison to the significance level (0.174, 0.056, 0.075 and 0.346 respectively).

When mean ±SE values are compared in both the zones, it is seen that it is higher in North Bengal (53.37 ±32.88) than South Bengal (23.2 ±2.00) in case of defect area, higher in North Bengal (9052.08±585.15) than South Bengal (8151±744.56) in case of body weight and also in case of skin weight, it is higher in North Bengal (822.92±53.2) and South Bengal (741±67.69).

The mean ±SE values, in case of thickness of skin in different regions, are higher in North Bengal than South Bengal like neck, belly, tail end and chest (1.912±0.048 and1.797±0.066, 1.555±0.036 and 1.452±0.056, 1.883±0.033 and 1.763±0.058, and 1.601±0.035 and 1.504±0.057 respectively). Thereby the present

Table 4. Comparison of different attributes of skin in between two zones in relation to Flay Cut.

Traits	Category	Mean ± SE	t-value	df	Sig. Level
Economic Loss	North Bengal South Bengal	55.42 ± 4.54 59 ± 8.02	-0.389	20	0.703
Defect area	North Bengal South Bengal	53.37 ± 32.88 23.2 ± 2.00	0.833	20	0.415
Body wt	North Bengal South Bengal	9052.08 ± 585.15 8151 ± 744.56	0.965	20	0.346
Skin Wt	North Bengal South Bengal	822.92 ± 53.2 741 ± 67.69	0.965	20	0.346
Total Skin Area	North Bengal South Bengal	685.25 ± 58.347 649.56 ± 58.314	0.429	20	0.673
Thickness of skin in Neck region	North Bengal South Bengal	1.912 ± 0.048 1.797 ± 0.066	1.408	20	0.174
Thickness of skin in Belly region	North Bengal South Bengal	1.555 ± 0.036 1.452 ± 0.056	2.026	20	0.056
Thickness of skin in Tail End region	North Bengal South Bengal	1.883 ± 0.033 1.763 ± 0.058	1.878	20	0.075
Thickness of skin in Chest region	North Bengal South Bengal	1.601 ± 0.035 1.504 ± 0.057	1.517	20	0.346

Table 5. Comparison of different attributes of skin (24-26 Size) in between two zones.

Traits	Category	Mean ± SE	t- value	df	Sig. Level
Body wt	North Bengal South Bengal	4891.07 ± 75.94 5518.33 ± 202.17	-2.826**	27	0.009
Skin Wt	North Bengal South Bengal	444.64 ± 6.9 501.67 ± 18.38	-2.826**	27	0.009
Total Skin Area	North Bengal South Bengal	349.74 ± 7.81 355.36 ± 8.99	-0.472	27	0.641
Thickness of skin in Neck region	North Bengal South Bengal	1.491 ± 0.048 1.489 ± 0.037	0.035	27	0.973
Thickness of skin in Belly region	North Bengal South Bengal	1.149 ± 0.028 1.205 ± 0.044	-1.037	27	0.303
Thickness of skin in Tail End region	North Bengal South Bengal	1.529 ± 0.057 1.526 ± 0.021	0.055	27	0.956
Thickness of skin in Chest region	North Bengal South Bengal	1.219 ± 0.029 1.245 ± 0.034	-0.555	27	0.583

N.B. **** indicates significance at 5% level; ** indicates significance at 1% level***

observations are also in confirmatory with the observation by Khan *et al,* (1992) and Zegao (1992).

Other attributes like total skin area is studied and compared and results are tabulated in Table 3 with observation of non- significant differences through t- values. The skin thickness in different area of goat carcass and this is due tom difference in thickness of collagen fibril, plaiting inseparableness and grease content of the different site of the skin.

Other factors also playing for this differences are sweat gland, elasticity fibril and muscle tissues i.e. erector pili.

Comparison of different attributes of skin to its size in different zones of West Bengal:

The results tabulated in Table 5 depicts that body weight, skin weight and thickness of skin belly region are their major attributes influencing the skin size 24-28". The mean ±SE values of all these attributes are more in South Bengal (5518.33 ±202.17, 501.67±18.38, 1.205±0.044) than North Bengal (4891.07±75.94, 444.64±6.9, 1.149±0.028).

The results of the present studies collated with the observations made by Khan *et al*, (1992) where they were in opinion that there were significant correlation of body weight with skin length, skin weight and dressing percentage of the Bengal goats as it is also been observed in some case of the present study as elucidated in the Table 5-10. The other contributing factor like total skin area, thickness of the skin in the neck and belly region are found to be insignificant in the zones are observed through their t values.

The results tabulated in 7 depicts that body weight, total skin area, thickness of the skin in belly and tail end region are the major attributes influencing the skin of 30 inches size.

The mean ± SE values in case of body weight and total skin area are more in South Bengal (7912.14±148.1 and 642.54±8.73) than North Bengal (7311.56±86.89and 602.69±10.79).

Table 6. Comparison of different attributes of skin (28 Size) in between two zones.

Traits	Category	Mean ± SE	t- value	df	Sig. Level
Body wt	North Bengal South Bengal	5867.81 ± 91.99 6945.71 ± 63.18	-9.980**	35	0.000
Skin Wt	North Bengal South Bengal	533.44 ± 8.36 631.43 ± 5.74	-9.980**	35	0.000
Total Skin Area	North Bengal South Bengal	428.8 ± 4.49 436.53 ± 7.91	-0.781	35	0.440
Thickness of skin in Neck region	North Bengal South Bengal	1.599 ± 0.034 1.647 ± 0.019	-1.282	35	0.208
Thickness of skin in Belly region	North Bengal South Bengal	1.313 ± 0.036 1.349 ± 0.026	-0.823	35	0.208
Thickness of skin in Tail End region	North Bengal South Bengal	1.596 ± 0.040 1.706 ± 0.028	-2.293*	35	0.028
Thickness of skin in Chest region	North Bengal South Bengal	1.301 ± 0.035 1.410 ± 0.026	-2.557*	35	0.015

Table 7. Comparison of different attributes of skin (30 Size) in between two zones.

Traits	Category	Mean ± SE	t- value	df	Sig. Level
Body wt	North Bengal South Bengal	7311.56 ± 86.89 7912.14 ± 148.1	-3.605**	28	0.001
Skin Wt	North Bengal South Bengal	664.69 ± 7.9 719.29 ± 13.46	-3.605	28	0.519
Total Skin Area	North Bengal South Bengal	602.69 ± 10.79 642.54 ± 8.73	-2.819**	28	0.009
Thickness of skin in Neck region	North Bengal South Bengal	1.881 ± 0.019 1.778 ± 0.028	3.115	28	0.004
Thickness of skin in Belly region	North Bengal South Bengal	1.518 ± 0.016 1.448 ± 0.029	2.166*	28	0.039
Thickness of skin in Tail End region	North Bengal South Bengal	1.875 ± 0.019 1.783 ± 0.029	2.720*	28	0.011
Thickness of skin in Chest region	North Bengal South Bengal	1.555 ± 0.042 1.521 ± 0.029	0.653	28	0.519

N.B. **** indicates significance at 5% level; ** indicates significance at 1% level***

The other contributing factors like skin cot, thickness of the skin neck region and chest region are found to be insignificant in both the zones as observed through their t- values.

The results tabulated in the Table 8, depicts that body weight, skin weight, total skin area and thickness of the skin in belly region are the major attributes influencing the skins of 32-34 inches size.

The mean ± SE values, in case of all of the above mentioned attributes are found to be higher in SB (9582.83±120.11, 871.17±10.92, 738.01±9.83,1.534±0.016) than that of NB (8624.25±198.79, 784.03±18.07, 666.26±10.64 and 1.479±0.013).

The other contributing factors like thickness of the skin in neck, tail end and chest regions are found to be insignificant in both the zones as observed through their t-values.

The results tabulated in Table 9, depicts that body weight, skin weight, total skin area, thickness of the skin in belly and tail regions are the major attributes influencing the skin of 36 inches size.

The mean ±SE values of all these attributes are more in SB (11373.42±170.1,1033.95±15.460, 830.61±10.98, 1.604±0.022 and 1.984±0.031) than that of NB (10100±143.87, 918.18±13.080, 760.38±12.96,1.536±0.021 and 1.898±0.016).

The other contributing factors like, thickness of the skin in neck and chest regions are found to be insignificant in both the zones as observed through their t-values.

The results tabulated in Table 10, depicts that body weight, skin weight, total skin area, thickness of the skin in neck and tail end regions are the major attributes influencing the skins of 38-40 inches size.

The mean ± SE values of body weight, skin weight, thickness of the skin in neck and tail region are found to be more in NB (12661±252.79, 1151±22.98, 2.164±0.028, 2.166±0.047) than that of SB (12268.44±170.45, 1115.31±15.5, 2.129±0.027, 2.088±0.045).

Table 8. Comparison of different attributes of skin (32-34 Size) in between two zones.

Traits	Category	Mean ± SE	t- value	df	Sig. Level
Body wt	North Bengal South Bengal	8624.25 ± 198.79 9582.83 ± 120.11	-4.094**	59	0.000
Skin Wt	North Bengal South Bengal	784.03 ± 18.07 871.17 ± 10.92	-4.094**	59	0.000
Total Skin Area	North Bengal South Bengal	666.26 ± 10.64 738.01 ± 9.83	-4.945**	59	0.000
Thickness of skin in Neck region	North Bengal South Bengal	1.837 ± 0.024 1.888 ± 0.013	-1.874	59	0.066
Thickness of skin in Belly region	North Bengal South Bengal	1.479 ± 0.013 1.534 ± 0.016	-2.651*	59	0.010
Thickness of skin in Tail End region	North Bengal South Bengal	1.850 ± 0.037 1.868 ± 0.014	-0.447	59	0.657
Thickness of skin in Chest region	North Bengal South Bengal	1.587 ± 0.035 1.568 ± 0.018	0.471	59	0.639

Table 9. Comparison of different attributes of skin (36 Size) in between two zones.

Traits	Category	Mean ± SE	t- value	df	Sig. Level
Body wt	North Bengal South Bengal	10100 ± 143.87 11373.42 ± 170.1	-5.756**	39	0.000
Skin Wt	North Bengal South Bengal	918.18 ± 13.080 1033.95 ± 15.460	-5.756**	39	0.000
Total Skin Area	North Bengal South Bengal	760.38 ± 12.96 830.61 ± 10.98	-4.062**	39	0.000
Thickness of skin in Neck region	North Bengal South Bengal	1.929 ± 0.024 2.007 ± 0.032	-1.988	39	0.054
Thickness of skin in Belly region	North Bengal South Bengal	1.536 ± 0.021 1.604 ± 0.022	-2.248*	39	0.030
Thickness of skin in Tail End region	North Bengal South Bengal	1.898 ± 0.016 1.984 ± 0.031	-2.544*	39	0.015
Thickness of skin in Chest region	North Bengal South Bengal	1.604 ± 0.024 1.658 ± 0.027	-1.522	39	0.139

N.B. **** indicates significance at 5% level; ** indicates significance at 1% level***

Table 10. Comparison of different attributes of skin (38-40 Size) in between two zones.

Traits	Category	Mean ± SE	t-value	df	Sig. Level
Body wt	North Bengal South Bengal	12661 ± 252.79 12268.44 ± 170.45	1.303	29	0.203
Skin Wt	North Bengal South Bengal	1151 ± 22.98 1115.31 ± 15.5	1.303	29	0.203
Total Skin Area	North Bengal South Bengal	906.88 ± 6.65 928.71 ± 10.28	-1.758	29	0.089
Thickness of skin in Neck region	North Bengal South Bengal	2.164 ± 0.028 2.129 ± 0.027	0.889	29	0.381
Thickness of skin in Belly region	North Bengal South Bengal	1.697 ± 0.034 1.683 ± 0.025	0.356	29	0.725
Thickness of skin in Tail End region	North Bengal South Bengal	2.166 ± 0.047 2.088 ± 0.045	1.193	29	0.243
Thickness of skin in Chest region	North Bengal South Bengal	1.748 ± 0.028 1.728 ± 0.022	0.572	29	0.572

Table 11. Comparison of Thin skin and Normal skin of size 24-26 inch in relation to different attributes of skin

Traits	Category	Mean ± SE	t-value	df	Sig. Level
Body wt	Thin Skin Normal Skin	5426.67 ± 708.15 5214.52 ± 138.91	0.484	22	0.633
Skin Wt	Thin Skin Normal Skin	440.00 ± 30.00 474.05 ± 12.63	-0962	22	0.347
Total Skin Area	Thin Skin Normal Skin	343.47 ± 20.68 354.57 ± 6.64	-0.581	22	0.567
Thickness of skin in Neck region	Thin Skin Normal Skin	1.476 ± 0.061 1.484 ± 0.038	-0.073	22	0.942
Thickness of skin in Belly region	Thin Skin Normal Skin	1.090 ± 0.000 1.188 ± 0.031	-1.198	22	0.244
Thickness of skin in Tail End region	Thin Skin Normal Skin	1.453 ± 0.043 1.517 ± 0.036	-3.231	22	0.004
Thickness of skin in Chest region	Thin Skin Normal Skin	1.163 ± 0.088 1.241 ± 0.026	-1.08	22	0.292

N.B. **** indicates significance at 5% level; ** indicates significance at 1% level***

The mean ± SE value of total skin area was higher in SB (928.71±10.28) than that of NB (906.88±6.65).

The other contributing factors like, thickness of the skin in belly and chest regions are found to be insignificant in both the zones as observed through their t-values.

The results of the present study collated with the observations made by Khan *et.al.*, (1992), where they were in opinion that there were significant correlation of body weight with skin length, skin weight and dressing percentage of the Bengal goats, as it is also been observed in some cases of the present study as elucidated in the Table 5-10.

Further, the present study can also be explained with the study on the quality of Sichuan goatskin, by Zegao *et.al.* (1992), where they could identify some histological, physical and chemical structures of goat skin with a comparative study to announce the intensive qualities like, fresh skin weight, tensile strength, skin thickness and position difference, thickness of collagen fibril fasciculus and plaiting inseparableness, grease content, sweat gland, elasticity fibrils and muscle tissues of the goat skin. In the present study, the attributes like, body weight, skin weight, total skin area and thickness of the skin in different regions are related to length of the skin in significant and insignificant manner, as the case may be, can also be looked through the opinion of Zegao *et.al.* (1992).

Comparison of thin skin and normal skin of different sizes in relation to different attributes.

The results tabulated in Table 11-14 depicts the comparison of thin skin and normal skin (Plate 3) of different sizes in relation to different attributes like body weight, skin weight, total skin area, thickness of the skin in neck area, belly, tail end and chest region.

In case of skin of 24-26 inches, the results tabulated in Table 11 shows that body weight, skin weight, total skin area, thickness of the skin in neck area, belly, tail end and chest region are the major attributes and these attributes are different by observing t values between thin skin and normal skin.

The significant variation and their corresponding mean ± SE values for the thin skin and normal skin are (440.00±30.00, 474.05±12.63, 343.47±20.68, 354.57±6.64, 1.090±0.000, 1.188±0.031, 1.453±0.043, 1.517±0.036, 1.163±0.088, 1.241±0.026).

The other contributing factors like body weight and thickness of the skin in neck region are found to be insignificant in this case as observed through their t values.
The results tabulated in Table 12 shows that in case of skin area of 28 inches size, skin weight, total skin area, thickness of the skin in neck area, belly, tail end and chest region are the major attributes and these attributes are different by observing t- values between thin skin and normal skin.

The significant variation and their corresponding mean ± SE values for the thin skin (Plate 4) and normal skin are (500±24.83, 584.48±10.15, 450.50±14.50, 434.29±6.16, 1.555±0.051, 1.628±0.021, 1.480±0.093, 1.674±0.026, 1.185±0.076, 1.386±0.024).

In case of skin of 30 inches, the results tabulated in Table 13 shows that body weight, skin weight, total skin area, thickness of the skin in neck area, belly, tail end and chest region are the major attributes and these attributes are different by observing t values between thin skin and normal skin.

The significant variation and their corresponding mean ± SE values for the thin skin and normal skin are (8712.00±356.70, 9058.37±164.55, 748±17.15, 823.49±14.96, 679.24±19.74, 699.12±10.40, 1.776±0.054, 1.876±0.016, 1.986±0.134, 1.863±0.019).

The other contributing factors like body weight and thickness of the skin in neck region are found to be insignificant in this case as observed through their t values. In case of skin of 32-34inches, the results tabulated in Table 14 shows that body weight, skin weight, total skin area, thickness of the skin in neck area, belly, tail end and chest region are the major attributes and these attributes are different by observing t values between thin skin and normal skin.

The significant variation and their corresponding mean ± SE values for the thin skin and normal skin are (9826.57±325.90, 10709.03±169.82, 873.33±1.02, 973.55±15.44, 680.267±2.083, 785.097±10.504, 1.623±0.111, 1.566±0.016)

Table 12. Comparison of Thin skin and Normal skin of size 28 inches in relation to different attributes of skin

Traits	Category	Mean ± SE	t-value	df	Sig. Level
Body wt	Thin Skin Normal Skin	6380.00 ± 414.02 6429.31 ± 111.66	-0.147	31	0.884
Skin Wt	Thin Skin Normal Skin	500.00 ± 24.83 584.48 ± 10.15	-2.922	31	0.006
Total Skin Area	Thin Skin Normal Skin	450.50 ± 14.50 434.29 ± 6.16	0.926	31	0.361
Thickness of skin in Neck region	Thin Skin Normal Skin	1.555 ± 0.051 1.628 ± 0.021	-1.211	31	0.235
Thickness of skin in Belly region	Thin Skin Normal Skin	1.338 ± 0.053 1.338 ± 0.026	-0.010	31	0.992
Thickness of skin in Tail End region	Thin Skin Normal Skin	1.480 ± 0.093 1.674 ± 0.026	-2.498	31	0.018
Thickness of skin in Chest region	Thin Skin Normal Skin	1.185 ± 0.076 1.386 ± 0.024	-2.881	31	0.007

Table 13. Comparison of Thin skin and Normal skin of size 30 inches in relation to different attributes of skin

Traits	Category	Mean ± SE	t-value	df	Sig. Level
Body wt	Thin Skin Normal Skin	8712.00 ± 356.70 9058.37 ± 164.55	-0.693	46	0.492
Skin Wt	Thin Skin Normal Skin	748.00 ± 17.15 823.49 ± 14.96	-1.692	46	0.097
Total Skin Area	Thin Skin Normal Skin	679.24 ± 19.74 699.12 ± 10.40	-0.633	46	0.530
Thickness of skin in Neck region	Thin Skin Normal Skin	1.776 ± 0.054 1.867 ± 0.016	-1.832	46	0.073
Thickness of skin in Belly region	Thin Skin Normal Skin	1.514 ± 0.042 1.501 ± 0.012	0.327	46	0.745
Thickness of skin in Tail End region	Thin Skin Normal Skin	1.968 ± 0.134 1.863 ± 0.019	1.453	46	0.153
Thickness of skin in Chest region	Thin Skin Normal Skin	1.582 ± 0.114 1.577 ± 0.023	0.063	46	0.950

N.B. **** indicates significance at 5% level; ** indicates significance at 1% level***

Plate 4 **The comparison between Normal (N) and Thin skin (T) through light tranparency**

Plate 5 **Goat skin with Flay cut**

The other contributing factors like body weight and thickness of the skin in neck region are found to be insignificant in this case as observed through their t values. In case of skin of 36 inches, the results tabulated in Table 15 shows that body weight, skin weight, total skin area, thickness of the skin in neck area, belly, tail end and chest region are the major attributes and these attributes are different by observing t values between thin skin and normal skin.

The significant variation and their corresponding mean ± SE values for the thin skin and normal skin are 12331±377.62, 12613±194.76, 921±16.31, 1146.67±17.71, 908.08±17.598,925.692±7.795, 1146.67±17.71, 908.08±17.598, 926.692±7.795, 2.062±0.0456, 2.165±0.024, 1.624±0.038, 1.711±0.027, 1.988=0.067, 2.178±0.038, 1.682±0.44, 1.760±0.21.

Correlation of age and body weight with the area of thin skin and incidence of flay-cuts.

The correlation study of age and body weight of the Bengal goats with the area of thin skin and incidence of flay cut (Plate 5) shows a positive correlation (Table. 16). in all the cases concerned both the regions of Bengal. This relationship can be explained with the views of Muralidharan and Thiagarajan (2000), who were in opinion that the skin thickness increases with the advancement of age. The results of the present study are also in confirmation with the above finding. While considering the body weight and area of thin skin, a positive correlation is natural because thin skin, to a particular animal having a direct relationship with the body weight and the similar observation in the present study are therefore seems to be logical.

While explaining the incidence of flay cut and body weight of the carcasses, the observation of Das (1959) seems to be relevant and according to him, the people in other parts of India are stronger in physique and are able to pull-off the skin rather than slash it away from the carcass by a knife as the weaker people in Bengal often do. Therefore, the condition will be much more prone towards the damage of the skin by flay cut, when the body weight of the animal as well as the weight of the skin is more.

The correlation between the extent of economic losses due to different skin defects and areas affected in two study areas:-

The values depicted in Table.17, clearly indicate that there is a positive correlation between the quantum of economic losses due to different skin defects and

Table 14. Comparison of Thin skin and Normal skin of size 32-34 inches in relation to different attributes of skin

Traits	Category	Mean ± SE	t-value	df	Sig. Level
Body wt	Thin Skin Normal Skin	9826.67 ± 325.90 10709.03 ± 169.82	-1.575	32	0.125
Skin Wt	Thin Skin Normal Skin	873.33 ± 12.02 973.55 ± 15.44	-1.988	32	0.055
Total Skin Area	Thin Skin Normal Skin	680.267 ± 2.083 785.097 ± 10.504	-3.061	32	0.004
Thickness of skin in Neck region	Thin Skin Normal Skin	1.996 ± 0.129 1.965 ± 0.022	0.395	32	0.695
Thickness of skin in Belly region	Thin Skin Normal Skin	1.623 ± 0.111 1.566 ± 0.016	0.942	32	0.353
Thickness of skin in Tail End region	Thin Skin Normal Skin	1.930 ± 0.064 1.937 ± 0.023	-0.090	32	0.929
Thickness of skin in Chest region	Thin Skin Normal Skin	1.643 ± 0.136 1.635 ± 0.020	0.114	32	0.910

Table 15. Comparison of Thin skin and Normal skin of size 36 inches in relation to different attributes of skin

Traits	Category	Mean ± SE	t-value	df	Sig. Level
Body wt	Thin Skin Normal Skin	12331.00 ± 377.62 12613.33 ± 194.76	-0.641	24	0.527
Skin Wt	Thin Skin Normal Skin	921.00 ± 16.31 1146.67 ± 17.71	-6.003	24	0.000
Total Skin Area	Thin Skin Normal Skin	908.08 ± 17.598 925.629 ± 7.795	-0.970	24	0.342
Thickness of skin in Neck region	Thin Skin Normal Skin	2.062 ± 0.045 2.165 ± 0.024	-1.893	24	0.070
Thickness of skin in Belly region	Thin Skin Normal Skin	1.624 ± 0.038 1.711 ± 0.027	-1.488	24	0.150
Thickness of skin in Tail End region	Thin Skin Normal Skin	1.988 ± 0.067 2.178 ± 0.038	-2.211	24	0.037
Thickness of skin in Chest region	Thin Skin Normal Skin	1.682 ± 0.044 1.760 ± 0.021	-1.601	24	0.122

N.B. **** indicates significance at 5% level; ** indicates significance at 1% level***

Table 16. Correlation of Age and Body weight with area of thin skin and incidence of Flay cuts.

		Area of thin skin	Incidence of Flay cut
Age	NB	0.986**	0.786
	SB	0.898**	0.659
Body weight	NB	0.955**	0.891**
	SB	0.888**	0.901**

Table 17. Correlation between the extent of Economic losses due to different skin defects and the areas affected in two study zone.

		Economic loss due to Thin Skin	Economic loss due to Flay cut	Economic loss due to Abscess
Defect Area	NB	0.929**	1.000**	0.258
	SB	0.925**	0.932**	1.000**

N.B. * *indicates significance at 5% level;* ** *indicates significance at 1% level*

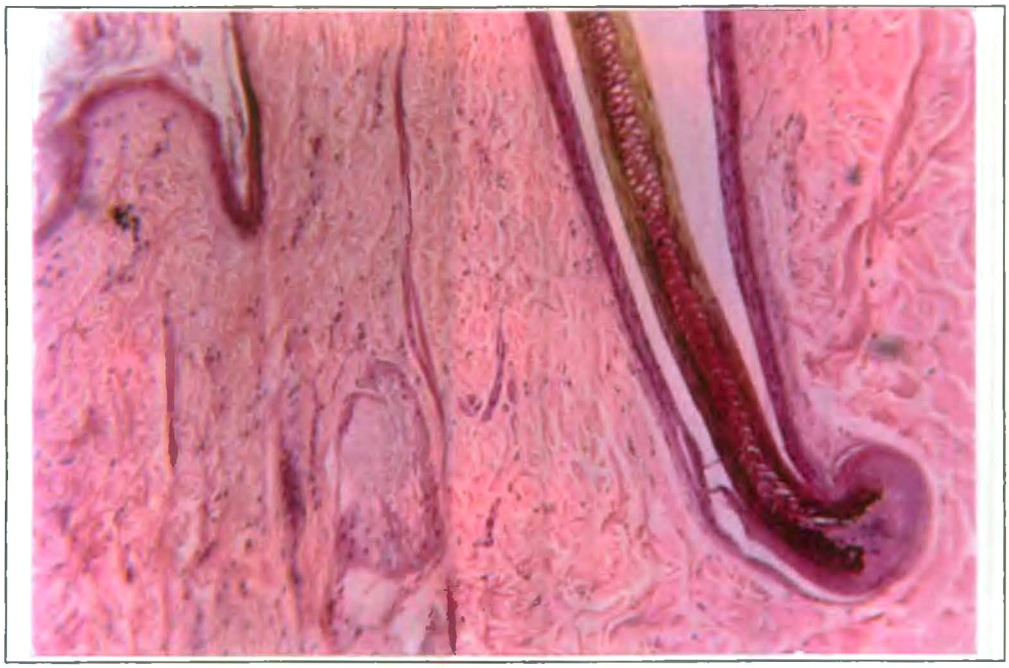


Plate-6 **Photomicrograph showing hair follicle and sebaceous gland of normal Bengal goat skin. H&E X 100.**

Plate-7 **Section showing normal goat skin. Van Gieson X 100.**

The affected skin revealed hyperplasia (Plate 8) and hypertrophy of the sebaceous gland with development of thrombi. (Plate 9-10).

The sections of skin also revealed pock lesions in epidermis and in some cases in the dermis layer. (Plate 11). In some parts of skin the sections showed bursting of vessels along with collagenous proliferation.(Plate 12).

The lesions were in conformity with the observations of Mahamed *et.al.* (1982) and Sadhukhan *et.al.* (1999).

2) Thin skin:
    a) Macroscopical observations: The skin appeared to be very thin almost throughout the entire body. It was much more transparent than the normal when observed against sunlight.
    b) Microscopical observations: The epidermal layer was found to be thin (Plate13). In some parts, the stratum granulosum layer was found to be discontinuous. The stratum lucidum was absent and the stratum corneum was very thin.
3) Abscess:
    a) Macroscopical observations: There were appearance of papules on the surface of the skin with excoriation and lichenification at later, (Bithu *et.al.*2003).
    b) Microscopical observations: The superficial lesions include epidermal hyperplasia, ballooning degeneration (Plate14), and infiltration of neutrophils, lymphocytes in the dermis and around blood vessels.

    In few, the sections showed epidermal microabscess, microvesicles, dermal oedema and fibroblastic cells. There were neutrophilic aggregations along the central debris, which is structureless mass. (Plate15).

    In some section of skin, there were hyper proliferation of collagen. (Plate 16)

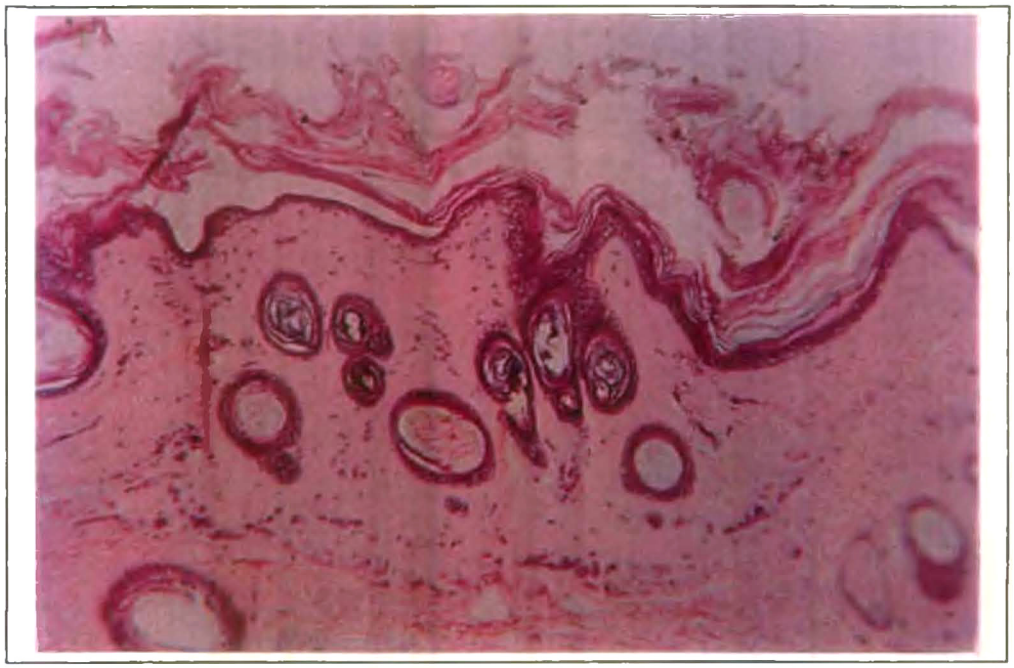


Plate 8 **Photomicrograph showing hyperplasia and epidermal hydropic degeneration. H&E X 100.**

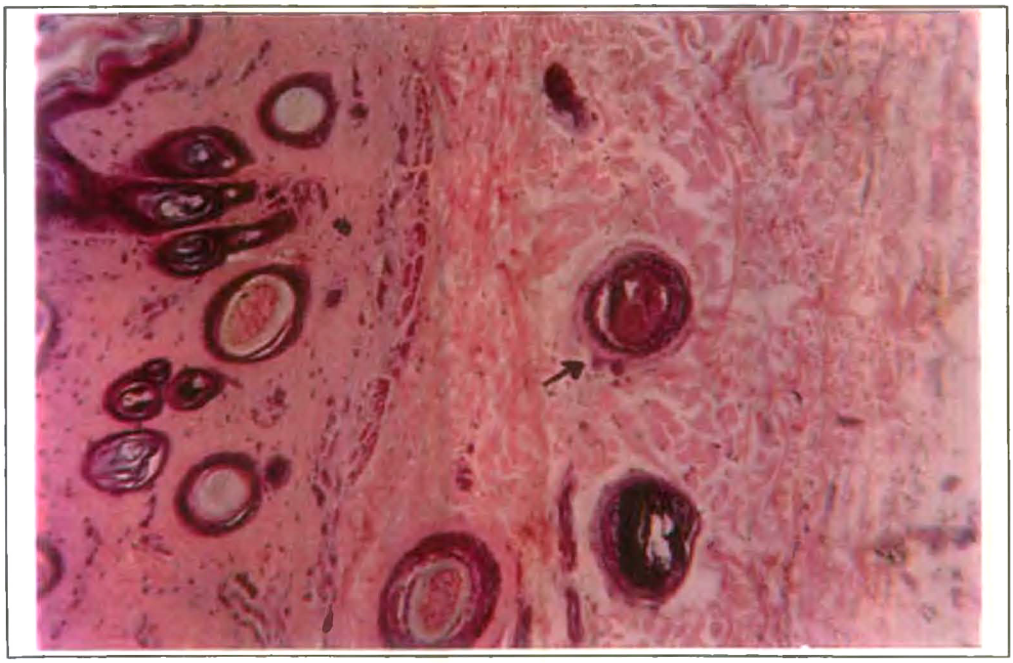


Plate 9 **Section of goat skin depicting thrombi. H&E X 100.**

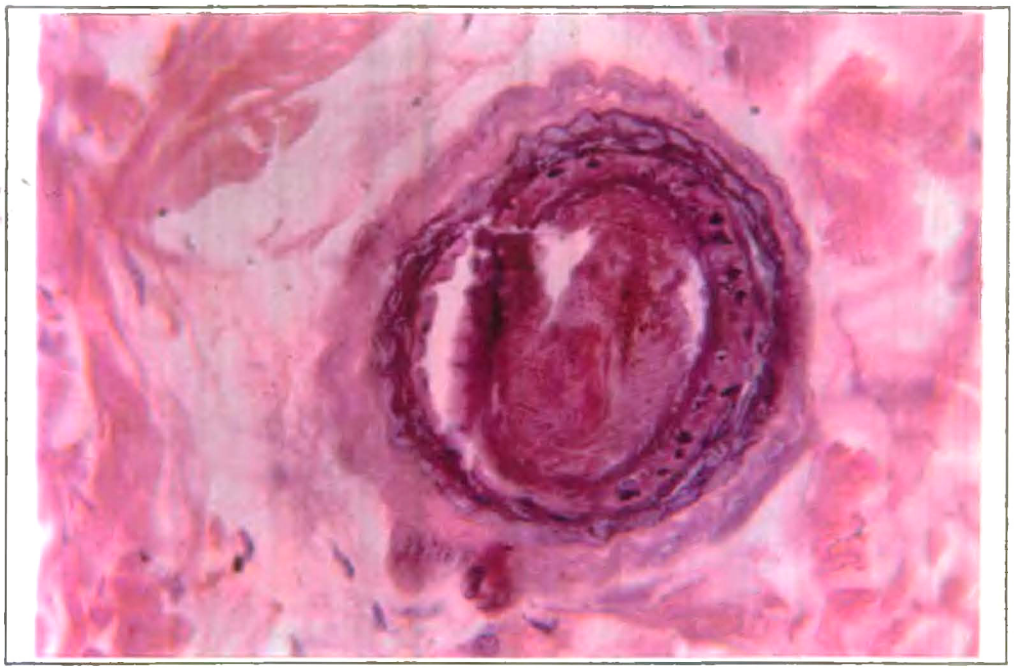


Plate 10 **Section of goat skin depicting thrombi. H&E X 450.**

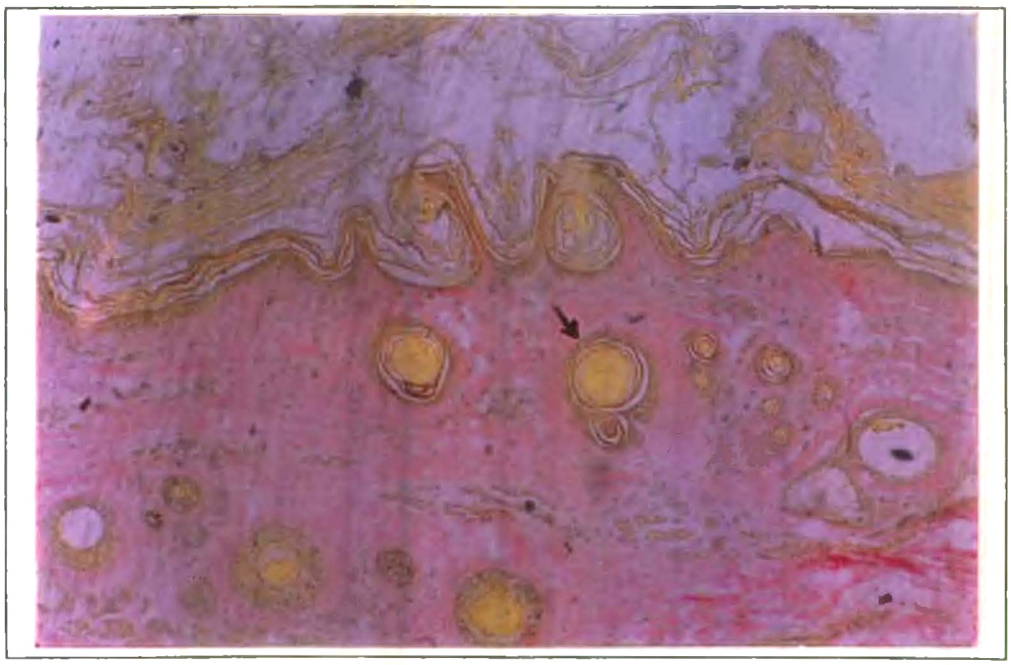


Plate 11 **Section showing pock lesion on epidermis, as well as in dermis. Van Gieson X 100.**

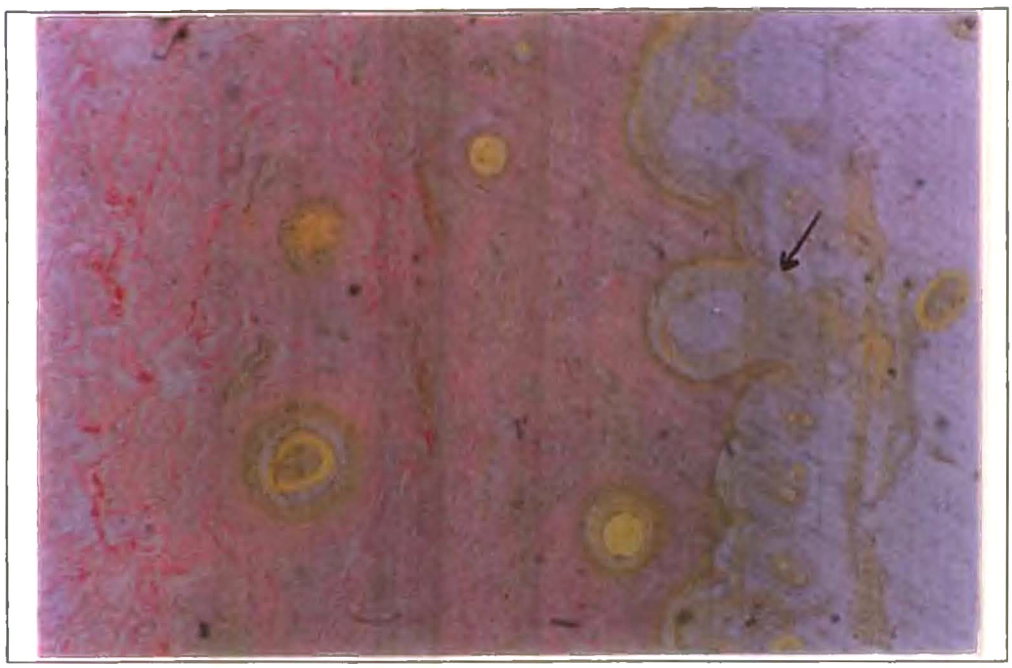


Plate 12 **Section showing the bursting of vesicles along with collagenous proliferation. Van Gieson X 100.**

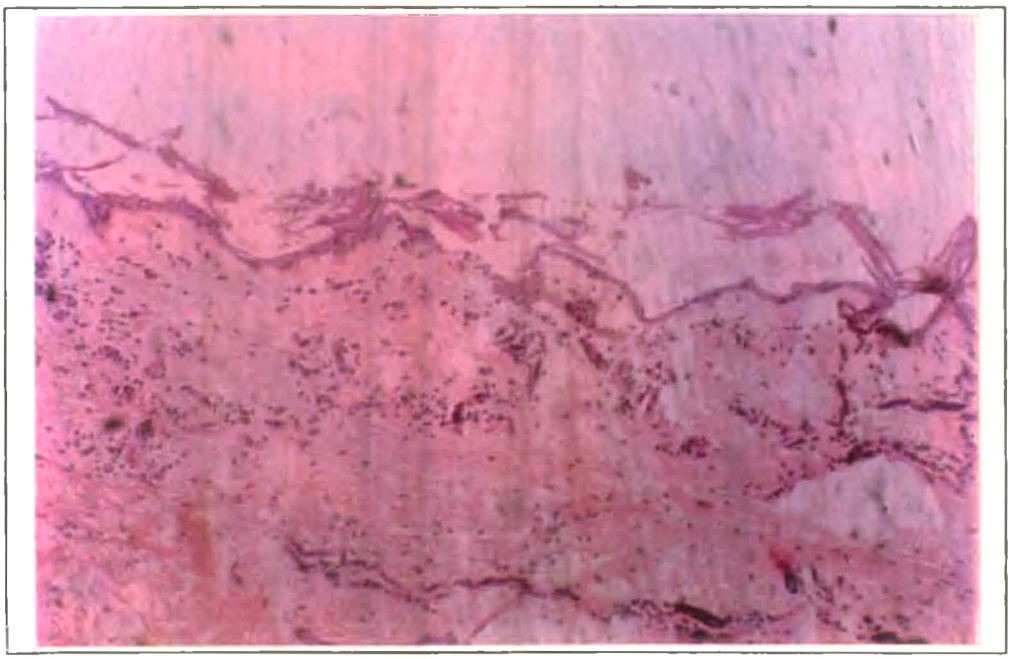


Plate 13 **Skin section showing thin epidermal layer. H&E X 100.**

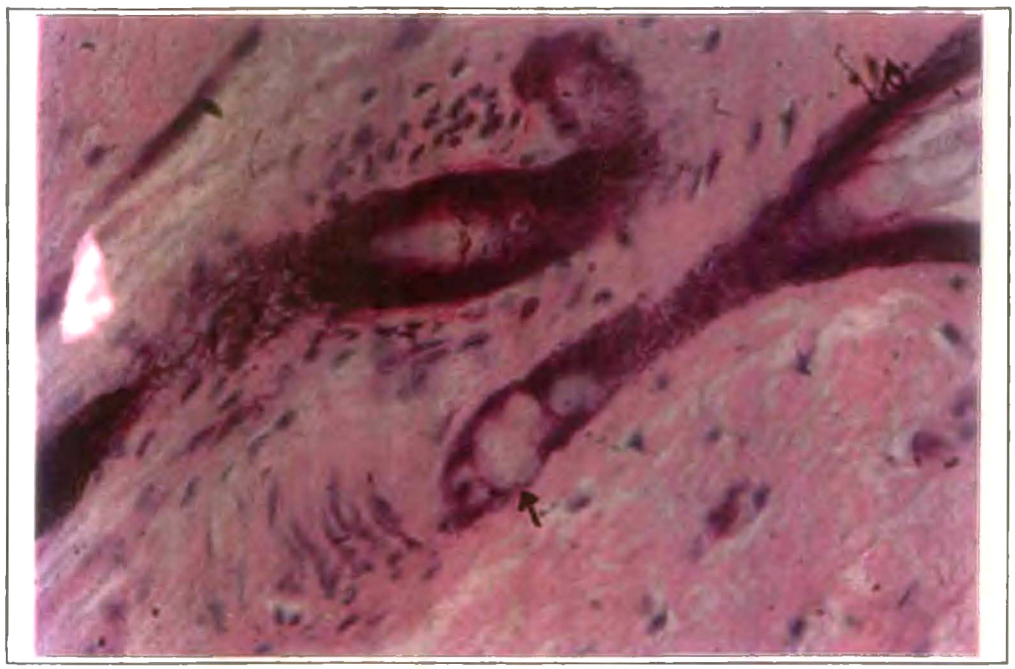


Plate 14 **Skin section showing vacuolation of epidermal cells' cytoplasm. H&E X 100**

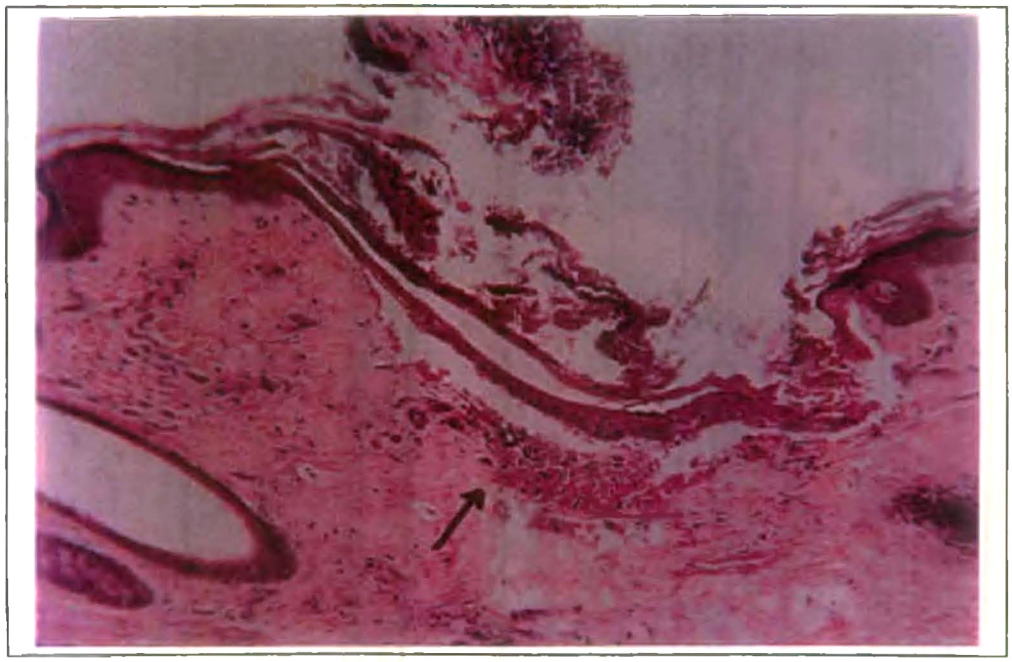


Plate 15 **Skin section showing dermal oedema and neutrophilic aggregation along the central debris. H&E X 100.**

These observations were in conformity with those described by early workers, like, Bithu *et.al.* (2003) and Nesbitt (1983).

4) Flay cut:

   a) Macroscopical observations: There were complete perforations or holes of different diameter or length in various parts of the body particularly in the tail end and belly regions.

   b) Microscopical observations: The sections of the skins with flay cut revealed discontinuation of the epidermal layer (Plate17). In few cases, the discontinuity extended upto the deeper layer of the skin.

Plate 16 **Skin section showing hyperproliferation of collagen in abscess. Van Gieson X 100.**

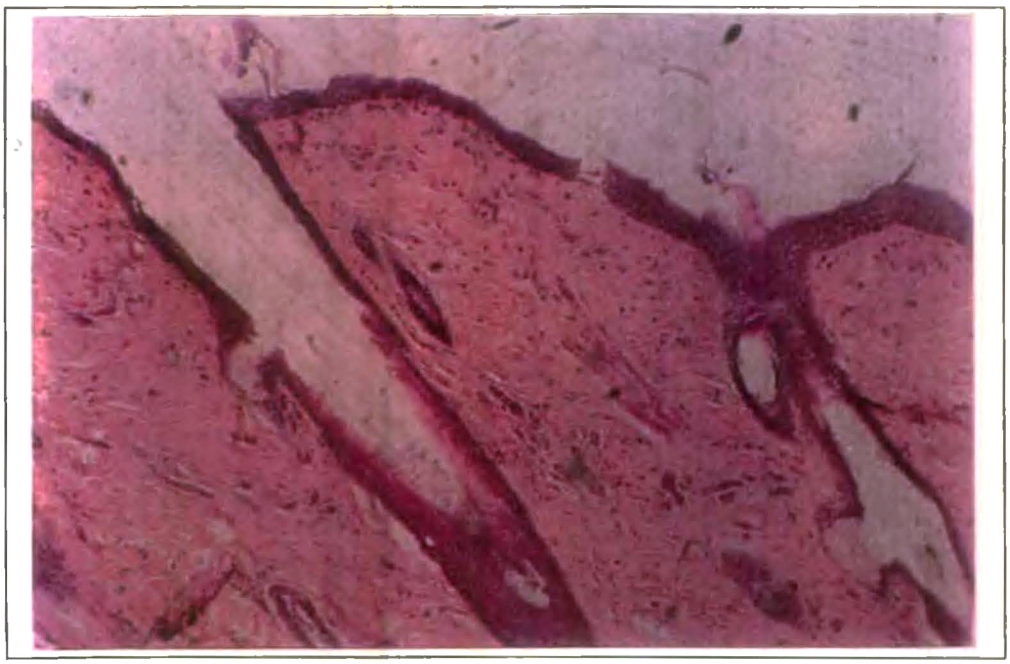


Plate 17 **Section of flay cut skin showing micro-discontinuation of epidermal layer. H&E X 100.**

CHAPTER V

SUMMARY AND CONCLUSION

SUMMARY AND CONCLUSION

With an aim to provide a boost to the thriving goat population, to give better economic return to the goat rearers and to bring back a revolutionary upgradation in the leather industry, vis-à-vis, the Indian economy, the present study may be of immense help.

Goats, the natural bliss to our poor people, may obtain their unique position in the vast domain of livestock species through their proper management, improvement and value addition through their meat, milk, fiber and particularly the skin, which was almost neglected till date.

In India, as the highest availability, i.e.45% of the goat skins is in West Bengal where the geo-climatic parameters are quite variable in the North and South regions, the present study was having an aim to make a qualitative assessment of the skins obtained from these two different zones of Bengal, i.e. North and South Bengal.

The goat skins were studied from freshly slaughtered animals and the defects were observed irrespective of age and sex. The observed defects were categorized into two: Biological defects and man made defects.

It is also apparent from the results obtained that, the surface defects affecting the quality of goat skin are mainly caused by different biological agents as well as man-made damages. The survey indicates that the incidence of thin skin, flay cuts, Abscess, scratches and goat pox are prevalent in these two study zones during the months from February to April. Comparative analysis revealed that the defect% is more in South Bengal (27.8%) than in North Bengal (25.4%).

When causes of the defects are listed, following order of maximum to minimum% of defects are observed in South Bengal- Thin skin- 12.2%, flay cuts-10.4%, abscess-3.5% and scratches-1.7%. Similarly, such observation of North Bengal is thin skin-11.4%, flay cuts-8.8%, abscess-3.5% and goat pox-1.8%.

In skin of goat pox, the histological lesions were hyperkeratosis, acanthosis, epidermal hydropic degeneration and formation of micro thrombi. In thin skin, the epidermal layer was found to be thin and discontinuous in some parts. Epidermal

hyperplasia, ballooning degeneration, infiltration of neutrophils, micro-abscess, microvesicles and fibroblastic cells were found in the sections of abscess-affected skins. In flay cuts, the discontinuation of the epidermal layer, sometimes upto the deeper layer was found.

Such notes could help to identify the cause of damages of skin by histopathology, where observations are clear in the slides, but the reasons are unknown. Therefore, such study could help to identify the damaging factors including the diagnosis of the disease with other clinical signs through such microscopical study.

The differences in defect area, body weight, skin weight, thickness of the skin in neck, belly, tail end and chest regions in relation to different defects are found to be significant in both the zones of study. The correlation study of age and body weight of the Bengal goats with the area of thin skin and incidence of flay cuts shows a positive correlation.

The histopathological studies also confirm the different defects, their macroscopic and microscopic aspects and the extent of damages.

The above study therefore is having immense importance to identify the types of defects encountered in goat skin processing. If, the causes could be appreciated and the extent of damage being evaluated and calculated in terms of losses in the leather industry, more intensive studies could be directed to minimize the causes with various approaches, like, ante-mortem inspection, efficiency of flaying, veterinary aid, better animal husbandry practices and overall dissemination of technologies through Veterinary extension techniques.

CHAPTER VI

FUTURE SCOPE

FUTURE SCOPE

Whenever speaking about the benefits and bliss, the mankind obtains from livestock resources; always emphasis is laid on meat, milk, and fiber and to some extent, edible offals. The memories never consider the returns that can be achieved from the skin and the subsequent leather. If estimated, the value of this product is no way less, even more than that of other major products from livestock. In spite of this, this treasury is often ignored resulting 'a lost ground' for the veterinarians. This idea inculcated and prompted as a maiden attempt towards regaining the ground through a process of initiation of identifying some of the common and major factors causing defects of goat skin in two locations of West Bengal. The work often crippled with number of constraints and time-bound completion of the project for the purpose it is planned has been figured as major. The work can be widened into the following areas under this heading:

1) More intensive studies can be made comparing the skin of Bengal goat with the other species of goat in India and abroad.
2) The study can be elaborated in the all six agro-climatic zones of West Bengal.
3) A more intensive study can also be made starting from the rearing of goats in optimal managemental conditions, proper ante-mortem inspection, correct flaying and then processing into leathers.
4) It can also be studied whether the defects found in the skins and their bearing on finished leather.
5) Histochemical studies can also be made to study the changes in composition of skin during the leather making process.
6) Economical losses due to such defects and remedial measures thereafter can also be studied more elaborately.

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ANNEXURE-I

DATAMETICS OF THE SKIN (BLACK BENGAL GOAT)

1. **Thickness (mm)**

Sl. no	Neck	Belly	Tail end	Chest
	Raw	Raw	Raw	Raw
1				
2				
3				
4				

2. **Measurement of skin weight and area.**

Sl. No.	Weight (gm)	Area (sq. inch)
1.		
2.		
3.		
4.		

3. **Damaged skin**

Sl no	Mark on the skin						Depth of defect	Location	Surface area affected
	Tick bite	Scratches	Flay cut	Thin skin	Goad marks	Pox marks			
1									
2									
3									
4									

4. **Adult/kid skin**

Sl. no	Adult skin		Kid skin	
	Size (inch)	Price (Rs)	Size (inch)	Price (Rs)
1				
2				
3				
4				

5. **Age and body weight:**

Sl. No.	Age (day)	Body weight (gm)
1		
2		
3		
4		

ANNEXURE-II

Van Gieson's Solution:

Acid fuchsin, 1% aqueous—2.5ml.
Picric acid, saturated aqueous—97.5ml.

ANNEXURE-III

Weigert's Iron Hematoxylin Solution:

Solution-A
Hematoxylin crystal-1.0 gm.
Alcohol, 95%-100.0 ml.
Solution-B
Ferric Chloride, 29% aqueous-4.0 ml.
Distilled water-95.0 ml.
Hydrochloric acid, concentrated-1.0 ml.
Working Solution
Equal parts of Solution-A and Solution-B.

ANNEXURE-IV

Mayer's Hematoxylin:

Hematoxylin crystals-1.0 gm.
Distilled water-1000.0 ml
Sodium Iodate-0.2 gm
Ammonium alum-50.0 gm
Citric acid-1.0 gm
Chloral hydrate-50.0 gm.

ANNEXURE-V

1% Stock Alcoholic Eosin:

Eosin Y, water soluble-1.0 gm.
Distilled water-20.0 ml.
Dissolve and add:
Alcohol, 95%-80.0 ml.
Working Eosin solution:
Eosin stock solution-1 part.
Alcohol, 80%-3 parts.