Histomorphological Features in the Differentiation of Skin of Spotted Deer (Axis axis), Cattle (Bos indicus) and Goat (Capra hircus)

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ABSTRACT

The histological study was conducted on the skin of spotted deer, goat and cattle. There were three
layers in the epidermis of spotted deer, four layers in goat and all the five layers in cattle. The skin thickness was
thinnest in spotted deer. The distribution of hair follicles in the horizontal sections of the skin was the most
significant and species characteristic feature. Hair follicles in spotted deer were arranged in linear position with
only primary follicles. In goat, there was a single row of primary hair follicles associated with 1-2 secondary hair
follicles. In cattle, there were only primary follicles scattered in the dermis. Distinct elastic fibres were seen
between the follicles in spotted deer only. Sweat glands were present at the junction of the dermis and hypodermis
in spotted deer. In case of goat, both sweat and sebaceous glands were located at the base of the hair follicles.
Nerve fibres were more distinct in goat as compared to cattle and spotted deer.

Key words: Histomorphology, Skin, Spotted deer, Cattle, Goat

Many of the wild animals such as tiger, leopard, spotted deer, etc. are poached for their products and as a
result these animals are facing the threat of extinction and have been considered endangered species (Parij and
Bhattacharya, 2001). The present study was undertaken to identify the histological features of skin of spotted deer,
cattle and goat which will be helpful to differentiate skin samples.

MATERIALS AND METHODS

Skin samples from spotted deer were obtained from
the confiscated skins received from forest and police
officials and also from Zoo and National Park of
Bannerghatta, Bangalore. Cattle and goat skin samples
were procured from the slaughter house, Bangalore. Six
skin samples from each species (spotted deer, cattle, and
goat) were used for this study. Skin samples from the
lateral abdominal region were collected and fixed in 10%
neutral buffered formalin for a minimum of 48 h. The skin
samples were processed for paraffin embedding and 6 µ
thick horizontal and vertical sections were stained with
hematoxylin and eosin Phloxine (Singh and Sulochana,
1996) for morphological studies, Weigert’s resorcine
fuchsin for elastic fibres, Van Gieson stain for collagen
fibres, Bielschowsky's stain for nerve cell and their process
and Gomori’s silver impregnation (Culling, 1981) for reticular fibres, Masson's trichrome for keratin granules,
phophotungstic acid-hematoxylin stain for skeletal
muscle fibres (Luna, 1968).

RESULTS AND DISCUSSION

The thickness of skin in cattle and goat was 6 mm
and 2.9 mm, respectively as reported by Goldsberry and
Calhoun (1959) in cattle and Sar and Calhoun (1966) in
goat. However, no reports were available to compare the
skin thickness of spotted deer which was 2.4 mm in the
present study. The above observations revealed that the
average skin thickness of the spotted deer was thinner
than that of cattle and goat.

The strata basale, spinosum, granulosum, lucidum
and corneum were found in the epidermis of cattle (Fig.
1) whereas stratum lucidum was not observed in the goat
(Fig. 2). However, stratum basale, stratum spinosum and
stratum corneum were present in the spotted deer (Fig.
3). The melanin pigment was seen in the stratum basale
of goat skin as reported by Dellmann and Brown (1981),
Goldsberry and Calhoun (1959) in cattle and Sar and
Calhoun (1966) in goat. However, these were absent in
the abdominal skin of cattle and spotted deer.

The dermis of all the species was consisted of stratum papillaris and stratum reticularis. However, the stratum reticularis was not so distinct and there was no clear demarcation between the two layers. The stratum papillaris consisted of interlacing elastic fibres and small collagen bundles extending in between the hair follicles. However, distinct elastic fibres present in between layers of hair follicles in the spotted deer were not observed in the cattle and goat.

The hair follicles in the spotted deer were densely distributed, arranged in a linear fashion and were encapsulated with elastic fibres in addition to collagen bundles. This characteristic arrangement might be useful for the identification of species. In the cattle, the distribution of hair follicles was irregular and isolated; while in the goat primary hair follicles were associated with 1-2 secondary hair follicles. The concentration and number of hair follicles were more in goat as compared to cattle.

The sweat glands were distributed frequently in the deeper part of the dermis in cattle. These were sacular, coiled with a large lumen and were lined by simple cuboidal epithelium. The cytoplasm of the epithelial cells was highly eosinophilic. The nuclei of these cells were rounded and
the cell boundaries were indistinct (Fig. 4). In case of
spotted deer, the simple tubular sweat glands were
observed at the junction of the dermis and hypodermis.
In the goat, sweat glands were frequently seen at the
base of the hair follicles which were similar to those of
cattle. Goldsberry and Calhoun (1959) described the
morphological group of sweat gland as sacular, coiled and
compound tubular in cattle.

The sebaceous glands were present on either side
of hair follicles in cattle whereas in between the hair
follicles in goat. These had a large segment supported by
two minor segments of the glands. In case of spotted
deer, the sebaceous glands were present at the base of
the hair follicles which were divided into two major
segments. Nerve fibres penetrating through the root of
hair follicles were distinctly observed in goat as compared
to spotted deer and cattle. Reticular fibres were uniformly
distributed surrounding the hair follicles in all the species
under study. The cellular populations of connective tissue
was highly concentrated just below the epidermal layer
whereas, the deeper part was more fibrous and less cellular
in all the three species.

REFERENCES
Culling, C.F.A. 1981. Hand Book of Histological and
Goldsberry, Steve and Calhoun, M.L. 1959. The comparative
histology of the skin of Hereford and Aberdeen Angus
Luna, L.G. 1968. Manual of Histologic Staining Methods of the
Armed Forces Institute of Pathology. 3rd edn., McGraw-
Parij, S.C. and Bhattacharya, S. 2001. Guest editorial, the tragedy
of tigers: Lesson to learn from Nandankanan episode. Indian Journal of
Medical Microbiology 19: 116.
Sar, M. and Calhoun, M.L. 1966. Microscopic anatomy of the
and Histochemical Techniques. 2nd edn., Premier
Publishing House, Hyderabad.