Explor Anim Med Res,
Vol.4, Issue - 2, 2014, p. 183-187

ISSN 2277- 470X (Print), ISSN 2319-247X (Online)
Website: www.animalmedicalresearch.org

Research Article

A COMPARATIVE HISTOLOGICAL STUDY ON THE SWEAT GLAND OF CATTLE (*B. INDICUS*) AND YAK (*P. POEPHAGUS*)

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ABSTRACT: Yak and cattle are the species of different habitats, but are of the same genus *Bos*. In order to adapt to different habitats some changes may occur in cellular organizations, sweat gland morphology being one of the part of this cellular organization. The skin samples were collected from six adult nondescript male cattle and yak from five different anatomical regions *viz*., neck, dewlap, abdomen, back and prepuce. Sweat glands appeared tubular consisting of a secretary coil which was embedded in the dermis in cattle. In yak, the glands were saccular in the neck and dewlap regions and tubular in other regions. The sweat gland number (1729±3.44) in cattle was almost three times higher (P<0.01) than yak (615.82±3.44).Highest number of sweat gland population was found in back (1563.24±5.44) and lowest in abdomen (900.26±5.44) in both the species. Descending order of sweat gland number was detected in dewlap, neck and prepuce respectively in both the species. In cattle the sweat gland diameter was significantly (32.78±0.38 µm) higher as compared to yak (27.68±0.38 ìm). The sweat gland number and nuclear diameter in cattle was more than yak. Acidophilic secretory granules of the glands were numerous in the supra-nuclear cytoplasm in case of cattle. These results suggest the hyper activity of sweat gland in controlling the thermo dynamics in cattle as compared to yak.

Key words: Cattle, Yak, Skin and Sweat gland.

INTRODUCTION

Just like cattle on plains, Yak is a unique bovine species of economical importance in high altitude and snow bound areas in India. Yak and cattle are the species of different habitats, but are of the same genus *Bos*. In order to adapt to different habitats some changes may occur in cellular organizations. The outermost organ skin, which attracts first, is having a great importance in preventing the organism from desiccating and protecting it from its environment. Skin and coat problems are a common source of concern in animal husbandry practice. The skin is metabolically very active and is the largest organ of the body. Thus its demand on bodily nutrition and metabolism are large. It is estimated that one quarter of the protein consumed daily is utilized by the skin in the production of new hair and epidermis. Protein is also a component of the secretions of the skin glands and in remodeling the dermis. The creation of the new cells and skin secretory

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activity also requires an appropriate lipid supply. Thus, the present study was undertaken to explore structural variations, if any, in the sweat gland of these two species.

MATERIRALS AND METHODS

For the purpose of present study, skin samples were collected from adult nondescript male cattle and yak, six in each group, irrespective of body weight after giving local anesthesia. The wound was treated with aerosol spray. The samples were collected from five anatomical regions from each animal *viz*., neck, dewlap, abdomen, back and prepuce and quickly fixed in 10% NBF. The tissue samples were processed for paraffin block preparation and sections of 5µ were cut, taken on a clean grease free glass slides and stained with haematoxylin and eosin (Luna 1968) to reveal the histological structure of sweat glands in both the species.

Micrometry and photography was done by Leica Qwin Image Analyzer software in Lecia DM 2000 Microscope. The data obtained from micrometrical observations was analyzed statistically by two way ANOVA using SPSS version 20.

RESULTS AND DISCUSSION

Histological observations:

In the present study, apocrine glands (Fig. 1 & 2) were found in both the species throughout the hairy part of the skin. The secretory tubules were found to be rested on a basement membrane containing circular reticular fibers. The glands appeared as tubular in all the regions of cattle consisting of a secretary coil embedded in the dermis, however, in yak, the glands were observed to be saccular in the neck and dewlap regions and tubular in other regions.

In both the species the cytoplasm of the

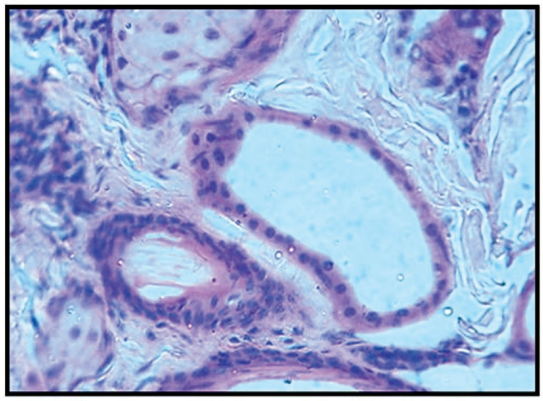

Fig. 1. Photomicrograph showing sweat gland of cattle X 45x

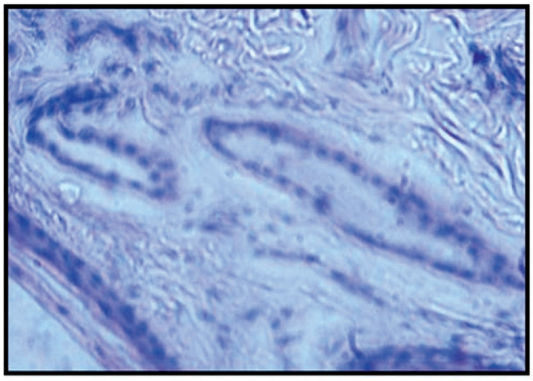

Fig. 2. Photomicrograph showing sweat gland of yak X 45x

secretory cells was somewhat opaque and the matrix contained granules of different size. Acidophilic secretory granules were numerous in the supra-nuclear cytoplasm in case of cattle. The secretory coils were lined by cuboidal to low columnar cells. The shape of the cell was variable. This might be due to the secretory activity of the glands. In some glands, the entire tubules were so distended that their epithelium was cuboidal or even squamous in appearance. The epithelial cells rested upon a bed of large loosely dove-tailed myo-epithelial cells. There was a thick hyaline basement membrane outside the gland. Some binucleated secretory cells were detected near the base. There was paucity of mitotic figures in the secretory cells in both

the species. This might be due to the fact that the adult apocrine cells do not usually divide. At their base the cellular cytoplasm had normally stippled fine basophilic granules while the rest of the cytoplasm was weakly basophilic. The luminal border of each cell was relatively free of basophilic granules. The diameter of the nucleus was 2-3 µm in cattle whereas 2 µm in yak. In cattle the diameter of the secretary tubules measured more. The shape of the tubules was serpentine and in some cases rolled into a ball.

Pan (1994) reported that sweat gland shape varied over the body in cattle. Montogomery and Jerikinson (1982) identified that sweat gland duct was divided into two main parts- intra-follicular region and intra-dermal region. These findings were in accordance with the present results. The results observed in case of yak fully agreed with the previous reports of Barari *et al.* (1995).

Micrometrical observations:

Sweat gland number

From the present study it was revealed that the sweat gland number (1729±3.44) in cattle was almost three times higher ($P<0.01$) than yak (615.82±3.44). Sweat gland number also varied significantly in different regions of skin within the species (Table 1). Highest number of sweat gland population was found in back (1563.24±5.44) and lowest in abdomen (900.26±5.44) in both the species. Descending order of sweat gland number was detected in dewlap, neck and prepuce respectively. Interaction of region and species was non-significant.

Barari *et al.* (1995) reported that in yak the average sweat gland density was 506.25±19.74 /cm^2 with minimum in the ear (338 /cm^2) and maximum in the forehand (807 /cm^2). The average sweat gland number in case of yak in the current study was higher than the above mentioned report. However, the other regions which were studied by the same workers showed almost same number of sweat gland density in yak. Back region where the gland was highest, was not reported in the previous work. This might be the reason where the average density of sweat gland increased in the present findings.

Bhayani *et al.* (1989) reported that the average sweat gland number in Kankrej breed of cattle was 1248.01±33.54 /cm^2. Findlay and Yang (1950) also reported a considerable variation in the number of sweat gland amongst different areas of skin of Ayrshire cow, which was in agreement with the present observations where the sweat gland number varied significantly in different regions.

Sweat gland diameter

In cattle the sweat gland diameter was significantly (32.78±0.38 µm) higher as compared to yak (27.68±0.38 µm). The sweat gland diameter also varied significantly region wise (Table 1). It was found to be 26.74±0.60 µm in prepuce which was significantly lowest than neck, dewlap and abdomen. The sweat gland diameter of abdomen was higher and significantly not different with the sweat gland diameter of back region, where the value was 32.02±0.60 µm.

From the result of interaction of species and region it was observed that sweat gland diameter was significantly lowest in all the regions of yak. The diameter in different regions for cattle and yak did not provided any conclusive effect region wise. Whatever the variations were observed that was only due to species difference.

Barari *et al.* (1995) reported the average diameter of sweat gland was 50.0±2.04 µm in

yak, which was slightly higher than the previous report. Bhayani *et al.* (1989) found the sweat gland diameter was 0.203±0.009 mm in cattle. This finding was almost in agreement with the current results.

Sweat gland length

The study of sweat gland length revealed no variation amongst the individual in species nor it varied region wise in both the species. Although a significant ($P<0.01$) variation in cattle and yak had been observed. Sweat gland length was 108.73±1.22 µm and 82.79±1.22 µm in cattle and yak respectively (Table 1).

Barari *et al.* (1995) reported that sweat gland length was 133.5±4.64 µm. But the result which was obtained in the present investigation was less as compared to the earlier report in case of yak. Bhayani *et al.* (1989) reported that length of sweat gland was 0.506±0.012 mm in cattle. This observation was not in accordance with present findings. Pan (1994) also reported that the length was 70% more in Zebu as compared to Jersey. Agarwal and Singh (1983) found that the average sweating range in temperature ranging between 37-45^{0}C was 21.7±2.2 g/m^2/h in male cattle. This might be due to higher capacity of sweat gland in cattle. Benjamin (1971) explained that the volume of sweat gland increased during winter indicating inactivity of the sweat glands and the glands become smaller in volume during functional activity. This statement could not stand for explaining this result. The less size of sweat gland in yak might not be an indication of hyperactivity in temperate region.

Bhayani *et al.* (1990) also reported the same findings where the sweat gland volume was also much smaller and depth was also less indicating the peak thermo-regulatory activity of sweat gland. The role of sweat gland in yak was not established. Therefore, it was difficult to establish the effect of sweat gland volume in thermo-regulation in yak. Benjamin and Nair (1963) reported that the less sweat gland depth indicated the functional activity of sweat gland. Sweat gland located superficially in warmer moths and deeply in months of autumn. Though this parameter was not being considered in the present investigation, still the apparent histological appearance showed the depth was less in yak as compared to cattle. Thereafter this statement could justify the lower activity of this gland in yak in terms of thermo-regulation.

CONCLUSION

The sweat gland number in cattle was almost three times higher than yak. Acidophilic secretory granules of the glands were numerous in the supra-nuclear cytoplasm in case of cattle. The diameter of the nucleus was more in cattle than in yak. In cattle the diameter of the secretary tubules measured more. These results suggest the hyper activity of sweat gland in controlling the thermo dynamics in cattle as compare to yak.

ACKNOWLEDGEMENT

The authors acknowledged the support and facilities extended by the Director, NRC on Yak , Dirang, Arunachal Pradesh while conducting the project.

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Table 1: **Mean with SE of characteristics of sweat gland in Cattle & Yak.**

Character	Species	Neck	Dewlap	Abdomen	Back	Prepuce	Species Mean
Sweat gland number	Cattle	1646.28±7.70	2230.88±7.70	1478.96±7.70	1793.58±7.70	1500.23±7.70	1729.99±3.44^{b}
	Yak	453.05±7.70	484.30±7.70	321.55±7.70	1332.10±7.70	487.30±7.70	615.82±3.44^{b}
	Region mean	049.66±5.44^{c}	1357.59±5.44^{d}	900.26±5.44^{a}	1563.24±5.44^{e}	993.77±7.70^{b}	
Sweat Gland Diameter (um)	Cattle	30.80±0.85^{e}	31.58±0.85^{f}	31.86±0.85^{f}	34.13±0.85^{g}	31.80±0.85^{f}	32.78±0.38^{b}
	Yak	27.70±0.85^{c}	26.14±0.85^{b}	29.24±0.85^{d}	29.92±0.85	21.70±0.85^{a}	27.68±0.38^{b}
	Region mean	29.25±0.60^{b}	28.86±0.60^{b}	30.55±0.60^{bc}	32.02±0.60^{c}	26.74±0.60^{a}	
Sweat gland length (um)	Cattle	109.11±2.72	111.50±2.72	104.67±2.72	108.28±2.72	110.11±2.72	108.73±1.22^{b}
	Yak	79.09±2.72	88.17±2.72	79.47±2.72	84.58±2.72	82.69±2.72	82.79±1.22^{b}
	Region mean	94.10±1.93	99.82±1.93	92.07±1.93	96.43±1.93	96.40±1.93	

Note- Mean values bearing different superscripts varied significantly, where P<0.01

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*** Cite this article as**: Das P, Ranjan R, Paul S (2014) A comparative histological study on the sweat gland of cattle (*B. indicus*) and yak (*P. poephagus*). Explor Anim Med Res 4(2): 183-187.