Skin morphology of Thai native cattle

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ABSTRACT: Morphology of skin and skin components of Thai native cattle were the aim of this study. Skin samples were biopsied and prepared for histological study with hematoxyline and eosin staining. Measurements were made on skin thickness, sweat glands, hair follicles, blood vessels, and nerve fibers of five Thai native cattle. Results showed that skin thickness was 0.034 ± 0.011 mm and 0.816 ± 0.249 mm for epidermis and dermis, respectively. Sweat gland was 168.46 ± 79.13 μm in length and 84.93 ± 34.46 μm in diameter. Hair follicle was 2.357 ± 2.454 mm in length and 56.0 ± 17.4 μm in diameter. A number of nerve bundle were 36.1 ± 1.15 per cm^2 whereas the area of capillaries bed was 4.34 ± 2.34 cm^2.
Keywords: Heat dissipation, skin components, thermotolerance, *Bos indicus*

Introduction

Bos indicus, as a thermotolerance genotype cattle, has been investigated extensively on its physiology and morphology related to regulating body temperature (Carvalho, 1995; Finch, 1986). Thai native cattle, also *Bos indicus*, have been reported to use sweating as their physiological responses to heat stress (Koatdoke, 2008). It is suggested that skin and skin components play some roles on thermotolerance of Thai native cattle. Moreover, skin has been reported to involve in heat dissipation as well as heat load and heat storage (Finch, 1986). However, little attention has been paid to the skin morphology of Thai native cattle. This study aims to study the skin and skin components including sweat gland, blood vessel and nerve bundle to reveal the possible relation to thermotolerance of Thai native cattle.

Materials and Methods

Skin samples were collected by biopsy puncher (diameter = 1 cm) from shaved-hair skin at shoulder back of Thai native cattle (N = 5) at KKU-Beef farm. Skin samples were fixed in 10% formalin for more than 24 h, and then washed with running water for 30 min to remove formaldehyde. The processes of making skin samples for histological study, and the paraffin embedded block of skin was serial sectioned by microtome for 6 µm. thickness and staining with hematoxylin and eosin followed Klangchamnan (2010).

Measurements were made on skin thickness, length and diameter of sweat glands and hair follicles under microscope with 10x and 100x magnifier, following Klangchamnan (2010). Density of nerve fiber was counted on the number of nerve bundle per cm^2. Area of blood vessels was calculated by the following: $S = \frac{\pi}{2} dC \times n$ per cm^2 where S = capillary surface, d = average diameter of the capillary, C = average circumference of the capillary loops, n = number of hair follicle (Findlay and Yang, 1948).

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Results and Discussions

Skin morphology of Thai native cattle was showed in **Figure 1 and Figure 2**. The detail of thickness, diameter, length, and area of skin components were showed in **Table 1**.

The thickness of skin found in Thai native cattle was thinner than that reported in native cattle to Brazil, Simmental cattle also Bos indicus, (7.15 ± 0.12 mm) reported by Carvalho (1995). Moreover, study in Holstein Friesian crossbred (Bos taurus), born and raised in Thailand, reported the thickness of epidermis and dermis as 1.19 ± 0.13 mm and 0.046 ± 0.005 mm (Klangchamnan, 2010). Both diameter and length of hair follicles and sweat glands (Table 1) of Thai native cattle in this study were quite different from that reported in Zebu (Bos indicus) by Hayman and Nay (1958). In their report, length and diameter of hair follicle were 2.02 mm in length and 44.2 ± 8.1 µm while sweat gland were 928 ± 276 µm in length 107 ± 21 µm in diameter. It should be pointed that there were a few giant hair follicles that were characterized by a low hair follicle density, long thick hairs, and large sweat glands found in the skin of Thai native cattle in this study. Number of nerve bundle and area of capillaries were determined as showed in Table 1. Skin capillaries and nerve fibers play important roles on sweating rate, and so heat dissipation. Thus this information will be of value for the future understanding on the thermotolerance of Thai native cattle related to evaporative heat loss.

Conclusion

Skin morphology of Thai native cattle has been observed with thin skin, small sweat gland, as well as, giant hair follicle. The mean value was 0.034 ± 0.011 mm and 0.816 ± 0.249 mm for epidermis and dermis, respectively. Sweat gland was 168.46 ± 79.13 µm in length and 84.93 ± 34.46 µm in diameter. Hair follicle was 2.357 ± 2.454 mm in length and 56.0 ± 17.4 µm in diameter. Additionally, nerve bundle were 36.1 ± 1.15 per cm^2 whereas the area of capillaries bed was 4.34 ± 2.34 cm^2.

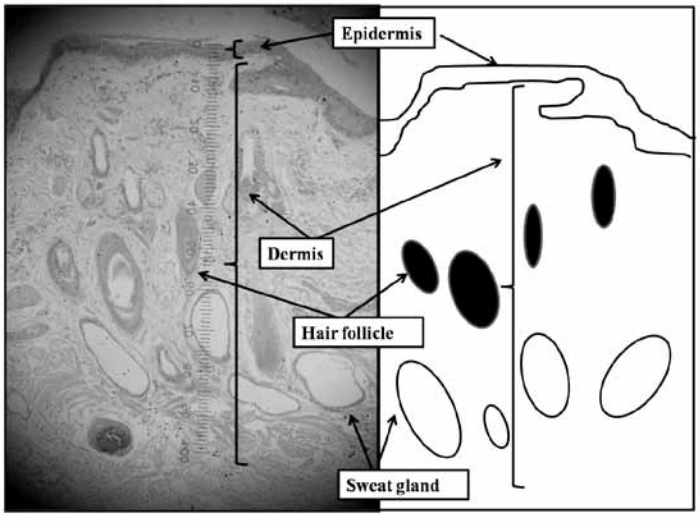

Figure 1 Longitudinal section of skin of Thai native cattle, showing skin components (100 x)

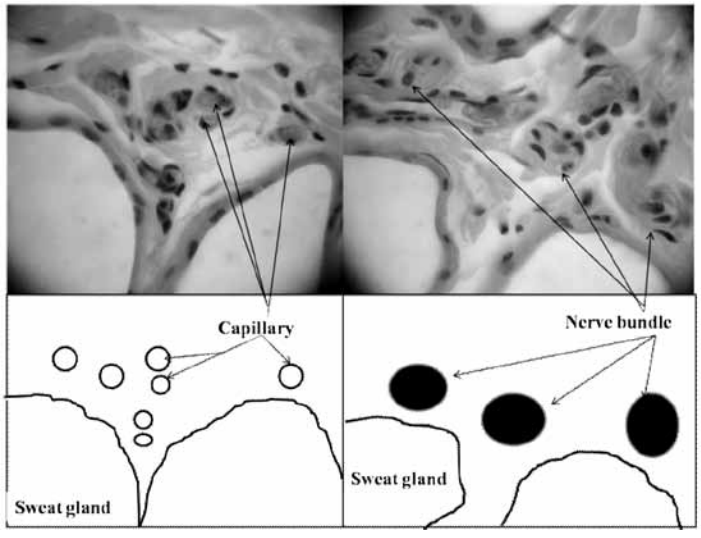

Figure 2 Capillaries and nerve bundle fibers in the skin of Thai native cattle (1000 x)

Table 1 Measurements of skin components of Thai native cattle. (Mean ± SD)

	Thickness (mm)	Length	Diameter (μm)	Density (per cm^2)	Area (S; cm^2)
Epidermis	0.03 ± 0.01	-	-	-	-
Dermis	0.82 ± 0.25	-	-	-	-
Sweat gland	-	168.46 ± 79.13 (μm)	84.93 ±34.46	-	-
Hair Follicle	-	2.36 ± 2.45 (mm)	56.0 ± 17.4	-	-
Capillary	-	-	5.55 ± 1.99	-	4.34 ± 0.22
Nerve bundle	-	-	-	36.11 ± 0.32	-

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