

HISTOLOGICAL FEATURE OF THE SKIN AT DIFFERENT REGIONS AND IN DIFFERENT AGES OF *LORI-BAKHTIARI* SHEEP

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ABSTRACT

For this study, 24 Lori-Bakhtiari sheep were selected and divided into four age groups: 1-10 days, 5-8 months, 1-2 years and 3 and more years. In each age group, six animals (3 of each sex) were used. The specimens of eight different skin regions were collected. They were fixed in 10% formaldehyde solution and processed through routine paraffin embedding, cut at 5-7 μ m and stained with haematoxylin and eosin, Masson trichrome, Ayoub-Shklar, Verhoeff and Foot's method for reticulum. Histologic studies on these sections were carried out using light microscope. It was found that sex showed no significant effect on the various histological structures of all the skin regions. The thickness of total skin, epidermis, papillary layer and reticular layer of dermis varied among all the regions and was affected significantly by age and sex. The sweat glands, sebaceous glands and arrector pili muscles were found around all the hair follicles. Secretory caps were observed only in the skin of 1-2 years and 3 and more years sheep. The maximum numbers of compound hair follicles of skin in all the age groups were found to be on the shoulder, rump, flank and neck skin. The number and size of secretory units of all the skin glands had increased as age advanced.

Keywords: age, histology, skin, sheep, *Lori-Bakhtiari*

INTRODUCTION

Skin is the interface between the organism and the environment and consists of an epidermis and a dermis (Dellmann, 1993). Epidermis which consists mainly of a multilayer of keratinocytes, is ectodermal in origin and forms most of the appendages such as nail, sweat and sebaceous glands, hair and wool follicles (Junqueira & Camerio, 2003). Beneath of the epidermis is dermis, a thick and tough layer of connective tissue which extends to the hypodermis, can be divided into a superficial papillary layer and a deep reticular layer (Dellmann, 1993; Mobini, 2012c). The sheep population in Iran is 50 million, comprising 26 genetic groups. Sheep are raised for meat, wool, milk and pelt (FAO, 1998; Osfoori & Fesus, 1996). Iran possesses 20 breeds of sheep. Approximately 65% of the total sheep population is considered pure and 35% crossbred. Almost all sheep breeds of Iran are indigenous and have not yet been registered in formal breeding programs. More than 96% of Iranian sheep are fat-tailed (Kiyanzad *et al.*, 2003). *Lori-Bakhtiari* is an Iranian fat-tailed sheep which is raised in large numbers in Charmahal va Bakhtiari province in Iran where sheep production contributes

significantly to the agricultural economy (Mobini, 2012a; Mobini & Shirani Faradonbeh, 2012). The purpose of this study was to evaluate the histologic changes in different areas of the skin and its relationship with age in *Lori-Bakhtiari* sheep.

MATERIALS AND METHODS

A total of 24 clinically healthy *Lori-Bakhtiari* sheep were obtained from the research farm of the Veterinary College, Islamic Azad University of Shahrekord. The tissues used in this study were obtained from sheep slaughtered for human consumption. All experimental procedures were approved by the local ethics committee of the veterinary medicine of Shahrekord Azad University. The sheep were divided into four age groups: 1-10 days (neonate), 5-8 months (young), 1-2 years (young adult) and 3 years and more (old adult). In each age group, six animals (3 of each sex) were used. Immediately after slaughtering, skin samples each of 3 cm² were taken from eight regions namely belly, neck, leg, rump, flank, forearm, shoulder and hip. They were fixed in 10% neutral buffered formaldehyde for 24-48 hours and embedded in paraffin. Six-micron transverse sections were cut parallel to the surface of the skin at midsebaceous gland level. Tissues were stained with haematoxylin and eosin, Masson's trichrome, Ayoub-Shklar, Foot's method for reticulum, and Verhoeff's (Kiernan, 2008). Histologic studies on these sections were carried out using light microscope.

RESULTS

No gender effects in various structures of skin was observed between male and female in all the age groups. The skin of *Lori-Bakhtiari* sheep was composed of two layers, epidermis and dermis, in all the age groups and in both sexes. The epidermis in all the age groups of *Lori-Bakhtiari* sheep was lined with stratified squamous epithelium. Glands in the epidermis and lipid depositions on its surface were not found in all the various skin regions and the age groups (Fig. 1).

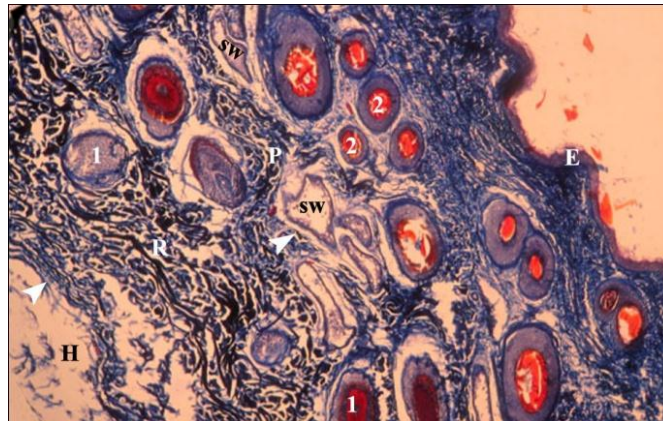


Figure 1. The leg skin of *Lori-Bakhtiari* sheep aged 5-8 months. Epidermis (E), papillary layer (P) and reticular layer (R) of the dermis, hypodermis (H), sweat glands (sw), primary follicle (1), secondary follicle (2) and collagen fibers (arrowheads). Ayoub-Shklar $\times 40$.

The skin dermis in all the age groups of *Lori-Bakhtiari* sheep was composed of collagen, elastic and reticular fibers, which the most of elastic and a large amount of reticular fibers were regular and parallel to the skin surface (Figs. 1-3), but most of the collagen fibers were irregular and disorganized (Fig. 1).

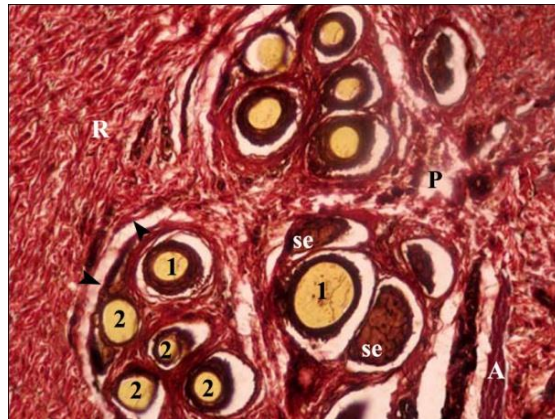


Figure 2. The papillary (P) and reticular layer (R) of the dermis of flank skin in *Lori-Bakhtiari* sheep aged 1-2 years. The primary (1) and secondary follicles (2) into the compound hair follicles surrounded by sebaceous glands (se), arrector pili muscle (A) and elastic fibers (arrowheads). Verhoeff's $\times 400$.

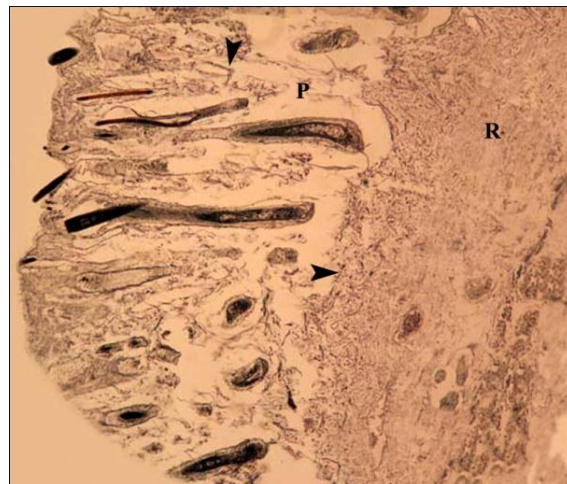


Figure 3. The papillary (P) and reticular layer (R) of the dermis of flank skin in *Lori-Bakhtiari* sheep aged 1-10 days. The arrowheads indicate reticular fibers. Foot's method for reticulum $\times 100$.

The dermis was divided into a thicker superficial papillary layer and a thinner deep reticular layer without a clear line of demarcation. The papillary layer consisted of loose connective tissue and all skin appendages structures such as hairs and follicles, sweat and sebaceous glands, *etc.*..., were located in this layer. The reticular layer which was extended to the hypodermis was a dense connective tissue (Fig. 1).

The primary follicles were located deeper than secondary follicles in all the various regions and age groups (Fig. 1). The sweat glands, sebaceous glands and arrector pili muscles were found around all hair follicles. Each compound hair follicle consisted of one primary follicle and four to six secondary follicles where cluster of 4 were most common (Fig. 2). The maximum numbers of compound hair follicles of skin in all age groups were found to be on the shoulder, rump, flank and neck skin. Arrector pili muscle, sweat and sebaceous glands were larger and well organized in young and old adult sheep. As the age increased, the size of all the hairs and follicles of various skin regions were also increased.

The sweat glands in all age groups were simple coiled saccular in all skin regions. They were smaller and more distributed in 1-10 days sheep. In some areas where there were no sebaceous glands, the glands were still associated with hairs (Fig. 1). The secretory cells of sweat glands were lined with a simple squamous to cuboidal epithelium. The secretory caps that indicated their secretory activity, were observed in the free apical cytoplasm of secretory cells protruded into the lumen (Fig. 4). Secretory caps were observed only in the skin of 1-2 years sheep and 3 years and more. The duct of sweat glands which was made up of a row of squamous to cuboidal cell penetrated into the epidermis of the hair follicle just before it opens onto the skin surface.

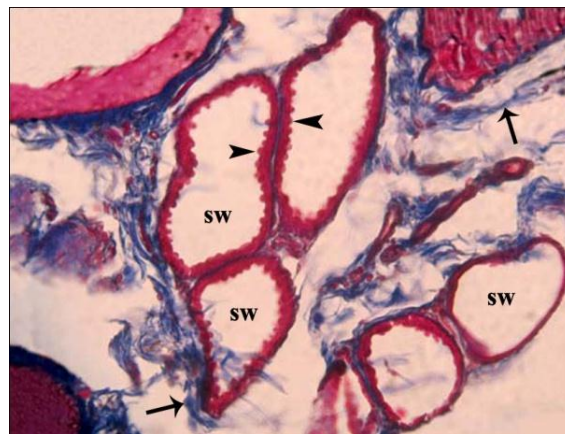


Figure 4. The secretory caps (arrowheads) into the sweat glands (sw) of rump skin in Lori-Bakhtiari sheep aged 1-2 years. The arrows indicate collagen fibers of dermis and around of hair follicles and sweat glands. Masson's trichrome $\times 400$.

In all the skin regions of all the ages of *Lori-Bakhtiari* sheep, the sebaceous glands were simple branched alveolar glands and were always associated with hair follicles (Fig. 2). The duct of the sebaceous gland was lined with a simple to stratified cuboidal, which opens

directly into the hair follicles. With increase in age, the size and the number of secretory units of the sebaceous glands and sweat glands of various skin regions were also increased. In all the age groups, the arrector pili muscle was inserted on the collagen and elastic fibers of the dermal sheet and attached to the papillary layer of dermis by very high collagen, moderately elastic and very less reticular fibers and composed of bundles of smooth muscle cells (Fig. 2).

DISCUSSION

In the present study, no significant difference in various structures of skin was observed between male and female in all age groups. Similar results were also reported by Mobini (2012c) in *Bakhtiari* and Yeruham *et al.* (1997) in *Merino*, *Assaf* and *Awassi* breeds. The skin of *Lori-Bakhtiari* sheep was composed of two principle layers, epidermis and dermis in all age groups, which was similar to other sheep breeds (Abbasi *et al.*, 2008; Aktas & Daglhoglu, 2009; Bhayani *et al.*, 2004; Genkovski & Gerchev, 2007; McManus *et al.*, 2011; Mir Shabir *et al.*, 2011; Mobini 2012c; Ozfiliz *et al.*, 2002; Purushothaman *et al.*, 2010; Shahrooz & Ahmadi, 2004; Warren *et al.*, 2008). The glands in the epidermis and lipid depositions on its surface were not found in all various skin regions and age groups, whereas they were reported in *Merino* sheep and their hybrids (Ozfiliz *et al.*, 2002).

In all age groups of *Lori-Bakhtiari* sheep, most of elastic and reticular fibers of dermis were regular and parallel to the skin surface and all skin appendages structures such as hairs and follicles, sweat and sebaceous glands, etc, were located in superficial papillary layer of dermis, but Dellmann (1993) reported that only the collagen fibers are parallel to the skin surface and the skin structures are present only in the deep layer of dermis.

In the present study, the sweat glands, sebaceous glands and arrector pili muscles were found around all the hair follicles, but Dellmann (1993) has stated that the secondary hair follicles may have the sebaceous glands but lack the arrector pili muscles and the sweat glands. Each compound hair follicle in all age groups of *Lori-Bakhtiari* sheep, similar to *Bakhtiari* sheep (Mobini, 2012b), consisted of one primary follicle and four to six secondary follicles and such findings varied significantly from what has been reported earlier by Dellmann (1993).

The sweat glands in all age groups of *Lori-Bakhtiari* sheep were simple coiled saccular in all skin regions. In domestic animals, they may be simple saccular or tubular type (Banks, 1993). In *Lori-Bakhtiari* sheep, the secretory cells of sweat glands were lined with a simple squamous to cuboidal epithelium, while Dellmann (1993) has stated that they lined with flattened cuboidal to low columnar cells. Dellmann has also stated that duct of sweat glands was made up of two layers of flattened cuboidal cells, but in the present study, it was lined by simple squamous to cuboidal cells. Also, in the current study, the secretory caps observed only in the skin of adult age groups were similar to what was reported earlier by Dellmann (1993).

In all skin regions of all ages of *Lori-Bakhtiari* sheep, the sebaceous glands were simple branched alveolar glands and their duct was lined with a simple to stratified cuboidal, while they may be simple, branched, or compound alveolar in domestic animals with a duct lined with stratified squamous epithelium (Banks, 1993; Dellmann, 1993).

Dellmann (1993) has stated that only elastic fibers are present in the attachment point of the arrector pili muscle to the papillary layer of dermis, but in the present study, reticular and collagen fibers were also observed in all ages of *Lori-Bakhtiari* sheep.

In conclusion, unlike *Bakhtiari* sheep (Mobini, 2012d; Mobini, 2013a; 2013b; 2013c) sex showed no significant histological effect on the various structures of all the different skin regions of *Lori-Bakhtiari* sheep. The thickness of total skin, epidermis, papillary layer and reticular layer of dermis varied among all the regions. Glands in the epidermis and lipid depositions on its surface were absent. The most common number of secondary follicles into compound hair follicle was 4. Secretory caps were observed only in the skin of young and old adult sheep. The maximum numbers of compound hair follicles of skin in all age groups were found to be on the shoulder, rump, flank and neck skin. The size and the number of secretory units of all the skin glands increased significantly with age.

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