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Effects of Sex on Histological Characteristics of Various Area of Skin in an Iranian Native Breed of Sheep

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Abstract: Skin is a remarkable and versatile organ, which not only covers the whole body but also has a number of other important functions. In present study, we aimed to compare some characters of skin in the various parts of skin in male and female of Lori sheep. To fulfill this task we were provided 20 sheep skin and removed our samples as small pieces from their different regions. Observations, which were made here, showed that the mean density of wool fiber in this breed is 6 mm^{-2}. Moreover, although no significant difference was observed regarding the thickness of epidermis and dermis, some clear differences were showed in the case of follicles diameters between 2 sexes. In general, we demonstrated here that in lori sheep the sex influences on quantitative and qualitative characters of skin and its main epidermal appendages namely, wool follicles.

Key words: Breed, histology, sex, sheep, skin

INTRODUCTION

Skin is a remarkable and versatile organ which plays a number of important roles for the body (Dellman, 1998). This organ is composed of two principle layers, epidermis and dermis. Epidermis is ectodermal in origin and forms most of the cutaneous appendages including glands, nail, hair and wool follicles. It consists mainly of a multilayer of keratinocytes. Beneath of the epidermis is dermis, a thick and tough layer of connective tissue (Junqueira and Camerio, 2003). One of skin appendages in mammals is wool that covers the body of sheep and some others in this class. The wool fiber produces from wool follicle, an epidermal appendage which penetrates deep into the underling dermis (Carter and Clarke, 1957). Histologically, there are two types of wool follicles viz. primary follicles, which produce thicker fibers than their secondary counterparts (Brown *et al*., 1968). One of the main characters that determine quality and quantity of wool produced by sheep are density of follicles and the ratio of secondary to primary follicles (the so-called S/P ratio).

One of main area in Iran with respect to sheep production is Lorestan province in southwest of the our country. The predominant sheep ecotype is called as lori sheep. This study was undertaken to investigate the impact of sex and distinct area of skin on some characteristics concerning the wool follicles in Lori sheep.

MATERIALS AND METHODS

Twenty reproductively mature Lori sheep (10 ewes and 10 rams) were identified according to their phenotypic features. The sheep were killed in a local slaughterhouse and their skins were dissected out. Samples of skins each of 2 cm^2 were removed from different regions of the skin using a punch equipment. The area to take samples were left and right flanks, left and right shoulders, left and right flanks and mid-back. The samples were immediately placed in formalin saline. The total number of wool follicles (P and S) in each piece was counted using a binocular microscope. The specimens were then processed through a serial steps for histological examinations. Hematoxylin and Eosin method were used for staining of histological sections. The sectioned samples were examined under a microscope which was equipped with a graded graticule by which the diameter of

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follicles (P and S) and the thickness of epidermis and dermis layers were measured. In general, eight parameters, including density of wool fibers per mm^2 (FD), number of primary follicles (PFN) and secondary follicles (SFN)/ mm^2, diameter of primary follicles (PFD) and secondary follicles (SFD), thickness of epidermis (ET) and dermis (DT) as well as the S/P ratio in both sexes in above-mentioned regions were measured (Humason, 1979).

The general linear models procedure of SAS/STAT software program was used to analyze the data. Two-way classification analysis was adopted for the fixed effects of sex and skin area. Means were separated by Duncan's Multiple Range and significance was accepted at $p<0.05$.

RESULTS AND DISCUSSION

By examining, the punched pieces with a total area of 6 cm^2/sample, the mean follicle density found to be 6.063 mm^{-2} (with a standard error of 0/166). There was no significant differences for fiber density by either sex or skin region factors ($p> 0.05$) (Table 1). Epidermis in both male and female and also in different regions showed a thickness between minimum 8 and maximum 45 μm with an average of 17.54 μm (Table 2). The highest thickness of epidermis observed in female (18.69 μm) and the thinnest epidermis exists on the flank region (16.63 μm). The epidermis is made of 3-8 cell layers and regarding its thickness a significant difference was observed between 2 sexes ($p<0.0082$). In general, the epidermis in female is thicker than its counterpart in male (Table 2). Dermis is a tough and thick (1- 4.9 mm) connective tissue that forms projections termed papillae which interdigitate with downward projections of epidermis. Within the dermis wool follicles, sweet and sebaceous glands and arrector pilli muscle are clearly observed. The males showed a thicker dermis compared to females (Table 2). The wool follicles are seen in groups and each group consists of a large primary follicle and several smaller secondary follicles. The Table 1-3 presents the data obtained from counting the primary and secondary follicles within the dermis as well as their diameter and the S/P ratio. There was a significant influence of sex on the number of secondary follicles ($p<0.05$) and S/P ratio ($p<0.01$) but the primary follicles number was affected by sex ($p>0.05$). The mean value of both factors was higher in female compared to male (Table 1). Moreover, sex showed a clear impact on the diameter of primary ($p<0.01$) and secondary ($p<0.05$) follicles. With regard to the diameter of primary follicles, a significant discrepancy was observed at various regions of skin ($p<0.01$) as in back region the follicles were thicker (Table 3). However, such correlation was not seen in case of secondary follicles ($p>0.05$).

It has been shown that the structure and the thickness of skin vary in different breeds of sheep. For example, in Bulgarian breeds, Native Karnoboat and Karakachen, skin has a 3.3 and 2.5 mm thick, which the epidermal layer forms on average 18 μm (Stankov *et al*., 2004). While in Merino sheep, the epidermis constitutes 24.9 μm of whole skin (Britt *et al*., 1985). The results of the current study shows that average skin thickness in Lori sheep is 2.4 mm consisting of 18 μm epidermis and the reminder for dermis. Also, in relation to epidermis thickness, a significant difference was found between 2 sexes as in females this layer is thicker than its counterpart in male. Moreover, in female, dermis was also thicker than male. However, regarding the thickness of the dermis in various portions of the skin, no significant differences were found.

It has been documented that the quality of wool depends up on SF/PF ratio as higher ratio refers to better quality for the wool (Hynd, 1995). The highest SF/PF ratio is found in Merino sheep which mounts to 16.5. In other breeds, this ratio is lower as a 6 months old Awassi fat-tailed sheep displays a ratio of 4.2 with greater ratios for males (Fayez *et al*., 1976). There are some indications that this ratio is hereditary but it is influenced by diet considerable (Gifford *et al*., 1995). The present study shows that in Lori sheep the mean SF/PF ratio is 2.26 (Table 1), which is comparable to other breeds, such as Barki, Sannen and Togenburg with 2.4, 3.9 and 2.4 ratios, respectively. These results reveal that the wool quality in Lori sheep is nearly satisfactory but not ideal,

Table 1: Effect (Mean±SE) of sex and body region (B.R.) on wool fiber density (FD), number of primary follicles (PFN), number of secondary follicles (SFN) and follicle ratio (SF/PF)

Factor	Level	FD	PFN	SFN	SF/PF
Sex	Female	5.924±0.238^{a}	3.168±0.215^{a}	8.584±0.655^{a}	2.873±0.203^{a}
	Male	6.202±0.172^{a}	3.274±0.189^{a}	6.681±0.546^{b}	2.060±0.134^{b}
B.R.	Shoulder	5.663±0.256^{b}	3.219±0.218^{a}	7.423±0.632^{a}	2.416±0.184^{a}
	Flank	6.191±0.235^{ab}	3.131±0.215^{a}	7.301±0.698^{a}	2.365±0.196^{a}
	Back	6.607±0.430^{a}	3.407±0.377^{a}	8.717±1.908^{a}	2.772±0.351^{a}
Mean±S.E.		6.603±0.166	3.221±0.142	7.633±0.435	2.467±0.128
			(p>F)		
Sex		0.6074	0.8855	0.0298	0.0038
B.R.		0.0963	0.7861	0.4534	0.4575
Sex×B.R.		0.6613	0.8082	0.9214	0.8693

[1]Sum of left and right shoulder, [2]sum of left and right flank

Table 2: Effect of sex and body region on primary and secondary follicles diameter (PFD, SFD)

Factor	Level	SFD	PFD
Sex	Female	59.76±0.81[b]	150.06±1.55[b]
	Male	62.48±0.80[a]	158.19±1.80[a]
B.R.	Shoulder	62.26±0.93[a]	155.57±1.99[a]
	Flank	60.34±0.88[a]	156.61±1.86[a]
	Back	60.04±1.28[a]	146.56±2.45[b]
Mean±S.E.		61.07±0.58	154.17±1.21
		(p>f)	
Sex		0.0187	0.0006
B.R.		0.0664	0.0002
Sex×B.R.		0.8468	0.1171

Table 3: Effect of sex and body region on epidermis (ET) and dermis (DT) thikness

Factor	Level	ET	DT
Sex	Female	18.69±0.54[a]	2036.80±101.03[b]
	Male	16.39±0.50[b]	2633.90±109.89[a]
B.R.	Shoulder	17.86±0.69[ab]	2479.38±143.26[a]
	Flank	16.63±0.51[b]	2164.50±115.17[a]
	Back	18.73±1.71[a]	2329.00±155.36[a]
Mean±S.E.		17.54±0.37	2335.35±80.09
		(p>f)	
Sex		0.0187	0.0006
B.R.		0.0664	0.0002
Sex×B.R.		0.8468	0.1171

[1]Sum of left and right shoulder, [2]sum of left and right flank

if compared to Merino sheep. Moreover, in female this ratio was higher than male, whit no discrepancy in different parts of skin. The undesired quality of the wool in lori sheep is also reflected in a low density of wool fiber per mm^2 ($6\ mm^{-2}$) since this density is much greater in fine wool breeds.

Considering the diameter of wool follicles, the current study showes a significant impact of sex on follicle diameter as in male's follicles are thicker. There is a straight relationship between follicle diameter and fiber thickness, so it can be concluded that in Lori sheep the females grow and produce finer wool. Various parts of skin in either sex are closely similar with respect to follicle diameter.

From the results obtained it could be concluded that the quality of the wool produced in this specific breed is not very satisfactory and is comparable with many endemic Uri Asian breeding. As far as sheep rearing for wool production is considered in Lori sheep, most emphasis most be focused on follicle density and follicle ratios in breeding programs as the fine-wool breeds show greater superiority for these variables.

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