HISTOLOGICAL STUDY OF WOOL FOLLICLE IN LOHI SHEEP FROM ONE TO FOUR YEARS AGE

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The influence of age on follicle population, types of follicles and follicle diameter in *Lohi* sheep was investigated. The primary and secondary follicle population of the 12 and 23-month animals was less than that of 36 and 48-month old groups. The difference was highly significant. However, it was non-significant between 36 and 48-month old animals. The number of primary and secondary follicles ranged from 500 to 587 per sq. cm. in various age groups. The maximum number of primary and secondary follicles which was observed at 36 months was 435 and 152 per sq. cm. The diameter of primary and secondary follicles ranged from 117 to 148 and 56 to 65 microns respectively and the data indicated that the diameter of primary and secondary follicles increased with advancing age. The difference in the diameter of primary and secondary follicle in the 12, 24 and 48-month age groups was highly significant but was non-significant between 12, 24 and 36-month groups. It is concluded that the animals after the age of 30 months may be recommended for carpet wool production.

INTRODUCTION

Sheep raising for wool and mutton production at present is one of the most profitable enterprises in West Pakistan. The country has about 13 million sheep with 16 well defined breeds. These animals are heterogenous in type with wide variation in physical characteristics including body form and wool production (Haq and Masud, 1966). The *Lohi* is one of the largest in numbers of the sheep breeds of West Pakistan, constituting about 16 per cent of the total sheep population and it is economically important due to wool and mutton qualities.

There is a great variation among the different breeds of sheep in the number of fibres per square inch of skin (Pearse, 1951). To increase the production of wool both qualitatively and quantitatively it is obligatory to study the wool bearing capacity of different breeds of sheep in West Pakistan. The correct appraisal of the performance of different breeds of sheep for wool production can be made by undertaking a study of the follicles responsible for the production of hair and coarse fibres. There are several factors affecting follicle

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population, density and fibre diameter. Age is one of the important factors. The present investigation was undertaken to study the sequence of changes in follicle number of different stages of growth, to determine the follicle population per sq. cm. of skin and to study the type and mean diameter of follicles from one to four years of age in *Lohi* sheep.

REVIEW OF LITERATURE

The studies on follicles indicate that the primary units in the skin from which the wool fibres are formed consists of two types of follicles, primary and secondary and these are arranged in a characteristic fashion in the skin (Wildman and Carter, 1939). According to Carter (1943) the primary follicles develop during the 35th to 85th day of prenatal life, while the secondary follicles develop thereafter. At birth all the primary follicles and a small proportion of secondary follicles have reached maturity.

Lans (1950) reported that the follicles from which the fibres originated from the embyronic age were of primary and secondary types. The primary follicles possessed both the sebaceous and sudorific glands together with an arrector pilli muscle. The secondary follicles appeared later than the primaries and were typically associated with a single sebaceous gland. The primary follicles tended to produce kemp, medullated and non-medullated fibre types, whereas the secondaries produced the bulk of the fleece. There was no fundamental difference between the follicles which produced modullated and those producing medullated fibres.

Auber (1954) and Margolena (1954) observed that the follicle population completed its development early and only a few secondary follicles were added after birth. Carter (1955) concluded that the primary follicles were laid down in the skin between the 65th and 85th days after conception. From the 85th day until birth secondary follicles were laid down in a somewhat irregular pattern around the group of three primaries. The number of secondary follicles surrounding the group of three primary follicles was expressed as the secondary to primary ratio and varied greatly between breeds. Carter and Clarke (1957) stated that the total number of follicles per unit urea tended to be a function of follicle group size rather than number of groups per unit area.

MATERIAL AND METHOD

Sixteen experimental animals from one to four years of age were randomly selected from the *Lohi* Experimental flock at West Pakistan Agricultural University, Lyallpur. These animals were divided into four groups of 12, 24, 36 and 48 months' age. The skin samples were taken from the shoulder and

breach region by means of biopsy punch at the beginning of the experiment and thereafter at six months' interval. The processing and staining procedure for skin samples was followed as described Carter and Clarke (1957). Data on follicle population, types of follicles and their mean diameter were recorded. Analysis was performed by the standard statistical method of variance.

RESULTS AND DISCUSSION

The average number of primary and secondary follicles and the age at which the samples were taken are given in Table 1.

TABLE 1. *Average Population of Primary and Secondary Follicles.*

Age (months)	Primary Follicle population (per sq. cm.) $(cm.)^2$	Secondary Follicle population (per sq. cm.) $(cm.)^2$	Total Follicle population (per sq. cm.) $(cm.)]^2$
12	363	137	500
18	370	133	503
24	373	136	509
30	410	132	542
36	435	152	587
42	433	142	575
48	429	146	575

The results of primary follicle enumeration in four age groups (12, 24, 36 and 48 months) showed a highly significant ($P < 0.01$) difference between the age groups. The average number of follicles of the three and four-year age groups differed significantly ($P < 0.01$) when compared to the 12 and 24 months age groups. The difference between the 36 and 48 months age groups was statistically non-significant. The results of the study of secondary follicles in four age groups (12, 24, 36 and 48 months) showed variations in number but this difference was non-significant.

The data for primary follicles (18, 30 and 42 months age groups) when subjected to analysis of variance showed a highly significant difference between the age groups. The follicle population of the 30-month group was significantly greater than for the 18-month animals. Similarly, the results of 42-month age group was significantly higher than 18-month, animals. The difference between 42 and 30-month age groups was non-significant. There

was a non-significant difference in secondary follicle population between the 18, 30 and 42-month age groups.

The results obtained for the primary follicles in the present study were similar to those reported by Carter (1943) and Auber (1954). They reported that the follicle population completed its development during prenatal life and only a few secondary follicles were added after birth. Margolena (1954) reported that the development of the follicles was initiated prenatally and completed within the first month of postnatal life. The observations reported in this study regarding the differentiation of primary and secondary follicles were similar to the observations made by Wildman and Carter (1939) and Carter (1955). It was observed that not every depression on the skin surface was a follicle funnel and that the primary follicles were conspicuously larger than the secondary follicles. The observation that the arrangement of primary follicles was in two groups of three (a trio) was similar to that reported by Carter (1955).

Follicle Diameter

The diameters of primary and secondary follicles for the various age groups are given in Table 2.

TABLE 2. *Average Diameter of Primary and Secondary Follicles*

Age (months)	Diameter of primary follicles (microns)	Diameter of secondary follicles (microns)
12	120	57
18	118	56
24	117	56
30	125	58
36	139	59
42	146	60
48	148	65

The follicle diameters at 48 months were significantly greater than those at 12 and 24 months. There was a non--significant difference between the 12, 24, 36 and 48 month groups. Secondary follicle diameter (12, 24, 36 and 48 months) differed highly significantly. The differences between the 12, 24 and 36 month groups was statistically non-significant. The diameter of secondary

follicles in the 48 month group was significantly greater than that of the 12, 24 and 36 month sheep. The data indicated that the diameter of primary and secondary follicles increased with advancing age. Primary follicle diameter showed a highly significant difference between the 18, 30 and 42 months age groups. The diameter of the 30 month group had a highly significant greater number of follicles than the 18 and 30-month animals. There was a non-significant difference between the animals of 18, 30 and 42 months of age.

These results are similar to those reported by Burns and Clarkson (1959) who indicated that the size of the follicles or its various parts might vary throughout the animal's life and that variation may be related to its productivity. Vigorous fibre growth tended to produce medulla which caused an increase in follicle diameter.

LITERATURE CITED

Auber, L. 1954. Observations on the development of fleece and follicle population in Suffolk sheep. *Ani. Breed. Abst.* **22** : 591.

Burns, M., and H. Clarkson. 1949. Some observations on the dimensions of follicles and of other structures in the skin of sheep. *Jour. Agri. Sci.* **40** : 126.

Carter, H. B., 1943. Studies in the biology of the skin and fleece of sheep. *Coun. Sci. Industr. Res. Aust. Bull.* 164 (*Jour. Agri. Sci. Res.* **6** : 68-75).

Carter, H. B. 1955. The hair follicle group in sheep. *Ani. Breed. Abst.* **23** : 101-116.

Carter, H. B., and W. H. Clarke. 1957. The hair follicle group and skin follicle population of some non-Merine breeds of sheep. *Aust. Jour. Agri. Res.* **8**: 109-119.

Haq, I., and M. Masud. 1966. Livestock Poultry and their Products. West Pak. Agri. University, Lyallpur.

Lang, W. R. 1950. Non-kempy, medullated fibre in Australian wool. *Jour. Text. Industr. Trans.* **28** : 309-320.

Margolena, L. A. 1954. Sequence of growth of primary and secondary fiber follicles in Karakul sheep. *Jour. Ani. Sci.* **13** : 765-780.

Pearse, E. H. 1951. Sheep and property management. Seventh Edi., p. 217 The pastoral review PTY Ltd., London.

Wildman, A. B., and H. B. Carter. 1939. Fiber follicle terminology in the Mammalia. *Nature* (London). **144** : 783.