Full Length Research Paper

Fibrocartilage embedding hair follicles on the skin of the knee of the camel (Camelus dromedarius): an ideal structure for its comfort

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The habitual pronation of the camel (Camelus dromedarius) aroused the curiosity to specially study the histological structure of the padded knee-cap area on which the animal rests its massive body. Previous studies of other body areas revealed hair follicles grouped into distinct clusters which were embedded in delicate collagenic fibers in groups with the hairs growing in tufts. Histological investigation of the skin of the knee region of the Nigerian one-humped camel in this study showed that the hair follicles there were surrounded by fibrocartilage, varying from the structure in previous studies from other body areas. This is a new finding and has never been reported. It provided plausible explanation for believing that the structure serves as a comfort zone for the camel when resting in that hot, stressful environment.

Key words: Histology, collagenic fibers, dense white fibrous connective tissue (DWFCT), perichondrium, pronation, environment, adaptation.

INTRODUCTION

Animals have evolved methods for easing the severity of, or raising their resistance to environmental stresses. The adaptations are anatomical, physiological, and behavioural in nature. Dromedary poses many problems of adaptation to environment for investigation and handling. Its bulky frame, physognomy, height and gaunt extremities, remarkable hump, pads on joints, (Mcknight, 1969), type and distribution of hair (soft and fine) are pointers. The various anatomical and behavioural aspects of the camel have received little attention; rather, other domestic animals have been more researched into, especially concerning diseases (Gbolagunte, 1997; Gbolagunte et al., 2009). The size of the camel, the financial implications and availability of the material has been constant constraints. Among the paucity of studies which have been made on the histology of the camel skin involved those of the normal pattern (Jararr and Faye, 2015); and those from the midside region only, observing histological changes in the hair follicles at different ages (Abdou et al., 2006), and studies identifying hair follicle characteristics and activity (Ansari-Renani et al., 2010). Studies embracing skin measurements such as density of hair follicles and density of sweat glands (Lee and Schmidt-Nielson, 1962), as well as those from different body regions, with measurements of hair follicles being length, diameter, depth and density (Gbolagunte, 1983; Gbolagunte and Jamdar, 1984; Dowling and Nay, 1962); investigating the trend and relation in adaption to the environment (Lee and Schmidt-Nelson, 1962), and its suitability for leather manufacture (Gbolagunte and Jamdar, 1984; Hekal, 2014) were carried out.

Extensive observation of the camel's behavior with regards to its pronation- a habitual position when resting; often on the knees, aroused this curiosity to specially investigate the histological structure of the skin of the knee. The structure of the skin of the other body areas of the camel showed that the hair follicles were grouped into distinct clusters (Dowling and Nay, 1962; Gbolagunte, 1983; Lee and Schmidt-Nielsen, 1962; Gbolagunte and Jamdar, 1984). These clusters were embedded in delicate collagenic fibres in groups so that the hairs grew...
in tufts. The groups were roughly oval in shape and varied in size. The small hairs emerged from a common hair follicle neck (Lee and Schmidt-Nielsen, 1962; Gbolagunte, 1983). There appeared to be a patterned trio group of primary and secondary hair follicles, each unit of the trio being covered and separated by invading septa from a larger defined covering of connective tissue (collagen) capsule (Gbolagunte and Jamdar, 1984).

The present study examines the hair follicle structure of the skin of the padded knee area, with which the camel pronates when resting in the hot stressful desert environment, in order to justify the curiosity attending to its presumed comfort.

MATERIALS AND METHODS

Materials

Skin samples were obtained from the pad of the knee region of adult camels from the abattoir in Kano, Nigeria, immediately after slaughter. More samples were also obtained from the midside as control. They were spread out on corks and impaled in order to retain as far as possible, the original size and shape of the samples.

Methods

All the samples were fixed in 10% formol saline immediately after collection for 72 h, and were later transferred to a 4% aqueous solution of phenol for three days to soften, then dehydrated in various grades of alcohol, cleared in benzene, and wax impregnated using a Histokinnette Tissue Processor.

The tissues were embedded in paraffin. Vertical and horizontal sections were cut serially at eight microns with a rotary microtome. Sections from half of this group were stained using a simple triple stain-Routine-Haematoxyline-Phloxine-Safran stain (Luna, 1968). The sections from the remainder of the group were routinely stained with haematoxyline and eosin (H&E).

RESULTS AND DISCUSSION

The follicle group on the camel's skin in the knee cap region was surrounded by fibrocartilage with its excessive amount of collagen in its intercellular substance (Figure 1). These collagen fibers appeared to be disposed in a plane parallel with the structure. Each unit of the hair follicle trio was covered and separated by invading septa from a larger defined covering of this fibrocartilage capsule. The midside hair follicles were embedded by delicate collagenic fibres (Figure 2), as observed in the literature (Lee and Schmidt-Nielsen, 1962; Dowling and Nay, 1962; Gbolagunte, 1983; Gbolagunte and Jamdar, 1984).

Fibrocartilage closely resembles dense regular connective tissue (Dellmann, 1971). It is found in intervertebral discs, tendon insertions and other areas requiring a connective tissue of great tensile strength. It is
very similar to hyaline cartilage except that fibrocartilage contains an excessive amount of collagen in its, intercellular substance. Moreover, the collagen fibers tend to be disposed in a plane parallel with the pull made on the structure. Fibrocartilage is considered to be intermediate between dense white fibrous connective tissue (DWFCT) and true cartilage. It tends to form a point of stress to give added strength. Thus it lacks a definite perichondrium since the perichondrium is a source of chondroblasts which aid information of new cartilage. The presence of fibrocartilage surrounding the hair follicle cluster in the skin of the knee of the camel, in lieu of delicate collagenic fibers in this study, has not been reported elsewhere.

The observed fibrocartilage in the skin of the padded knee region of the camel; existing at the location of stress, is expected to give it added strength in its regular resting pronation posture. It should provide the needed comfort to the animal; an inhabitant of a very stressful hot desert environment, thereby evolving a naturally endowed anatomical structure to give succor and adaption.

**Conclusion**

The curiosity aroused by extensive observation of the one-humped camel (*Camelus dromedarius*) in its habitual pronation when resting its massive body, prompted this particular histological study of the knees’ skin structure, which ultimately revealed that the hair follicles there, were surrounded by fibrocartilage, unlike delicate collagenic fibers surrounding the follicles in other body areas, especially the midside region (which is the popularly sampled area). Histologically, fibrocartilage closely resembles dense regular connective tissue; often found in areas requiring a connective tissue of great tensile strength and it fulfilled this curiosity by confirming with this study, that it must be giving a measure of comfort to the animal.

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**REFERENCES**


