# A STUDY OF SOME PHYSICAL COAT TRAITS OF DROMEDARY CAMELS IN THE NORTH COASTAL BELT OF THE WESTERN DESERT OF EGYPT

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*Received on: 8/6/2006* *Accepted on: 7/8/2006*


## ABSTRACT

*Fifty three camels were shorn and their fleeces were weighed and divided into three parts according to body position (neck, hump and sides). Traits studied were fleece weight, fiber diameter, staple length, fiber length, crimp frequency of the fine fibers, fiber type ratio and medullation index. The effect of body position on fleece weight and fiber diameter was also studied.*

*The coat consisted of two layers; outer long coarse fibers (90.8%) with an average fiber length of 7.8 ± 0.56 cm and inner short fine crimpy fibers (9.2%) with an average fiber length of 3.8 ± 0.24 cm with 1.6 ± 0.18 crimps/cm The average fleece weight was 1130.7 ± 121.96 gm. The mean fiber diameter was 63.9 ± 0.21 μm. The medullation index was relatively high (31.31 ± 1.405).*

*The major fleece component was that of the sides (797.4 ± 93.48 gm) while the lowest fleece part was that of the neck (75.4 ± 15.19 gm). The coarser fiber diameter was observed on the hump samples (80.9 ± 0.32μm) followed by the neck samples (56.9 ± 0.32μm) and the lowest was that of the sides (52.2 ± 0.38μm). The sampling position affected both traits (P<0.05).*


*Key words: Dromedary camels, Hair, Fleece weight, Fiber diameter, Staple length and Medullation Index.*

## INTRODUCTION

Camel hair consists of two coat layers, relatively coarse outer hair and inner down fibers. The under-coat produced by animals living in the hot desert climates tends to be coarser and sparser than those from the more temperate climate (Petrie, 1995). The coat of camel protects it against the intensive solar radiation and the hot climate; it acts as a barrier against the environmental heat (El-Hassanein, 1989). Guirgis *et al.* (1992) observed seasonal changes in most of the camel coat traits to accommodate the seasonal changes in the environmental climate.

The fine inner fibers of camel coat might be used in yarn production. They are woven or blended with fine wool for cloth manufacture. The outer coat fibers are used to make felts, tents, waterproof textures and for carpets backing (Petrie, 1995).

In Egypt, the total population of camels is 136,312 heads. About 18,129 (13%) of the population is in the north western coast of Egypt (Statistics of the Animal Production Sector, Egyptian Ministry of Agriculture and Land Reclamation, 2003).

This work aimed at studying some physical coat traits of the dromedary camels in this region in order to promote the use of camel hair in small scale industries, hence sustainable development of desert areas.

## MATERIALS AND METHODS

This study was carried out on 53 adult dromedary camels. At shearing, fleeces (growth of one year) were divided into three parts according to the body position (neck, hump and sides). Each part was weighed, and then sub-samples were collected to study the effect of body position on fleece weight and fiber diameter. Some coat characteristics studied were fleece weight, fiber diameter, fiber length, staple length, fiber type ratio, crimps/cm and medullation index (Pilkington and Purser, 1958 and Guirgis, 1973). Measurements were taken on a compound sample.

**Fiber diameter:** A section of 1 mm of each sample at a level of 2 cm from the base of staples was cut and snippets were mounted in liquid paraffin oil and spread on a slide and covered. Relative humidity (RH %) and temperature (°C) were recorded and corrections were made (Anderson, 1955) to get the figures at the standard conditions (65 % RH. and 20 °C). Not less than 300 snippets were measured using computerized image analyzer (LEICA Q500).

To study fiber diameter distribution of the whole fleece at different body positions, the fiber diameters were classified into five classes: class 1 (≤ 40μm), class 2 (from 41 to 80μm), class 3 (from 81 to 120μm), class 4 (from 121 to 160μm) and class 5 from (161 to ≤200μm). The percentage of each class was calculated and illustrated in Fig (1).

**Staple length:** Average length of ten staples from each sample was measured using millimeter ruler according to Booth (1964). The length was obtained without stretching and from the base of the staple to the base of the formed triangle at the tip of the staple.

**Fiber type ratio:** Sub samples "not less than 300 fibers" were classified into several types according to its coarseness and the percentage of medulla to type A; very coarse fibers with medulla occupying more than 90% of the fiber, type B; coarse fibers with about 70% medulla, type C; with about 50% medulla, type D; with about 30% medulla and Fine: non medullated fibers. Fiber type percentages were also counted (Guirgis, 1967).

**Crimps:** The crimp frequency/cm was counted along the fiber using a millimeter ruler.

**Medullation index (MI):** It was calculated for each sample, according to the following equation of

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Pilkington and Purser (1958) and adopted by Guirgis (1973) *Where* : $MI = \frac{1}{10}\sum_{i=1}^{4} Pi$

Where, i = 1, 2 ,3 and 4 are scores for fine, coarse, hetrotype and kemp, respectively. $P_i$ is the percentage of the $i^{th}$ class.

**Statistical analysis:** data were analyzed using general linear model (GLM). The model included the fixed effect of body position on fleece weight and fiber diameter (SAS 2000). Differences between means were tested by Duncan Multiple Range test (Steal and Torrie, 1980). The mean value and the standard error for each trait were also estimated.

## RESULTS AND DISCUSSION

Average fleece weight encountered was 1130.7 ± 121.96 gm (Table 1). The major fleece component was that of the sides 797.4 ± 93.48 gm followed by hump 254.4 ± 32.04 while the lowest fleece part was that of the neck 75.4 ± 15.19 gm where the differences between the three positions were significant ($P<0.05$) (Table 2). Yagil (1982) reported that adult camels fleece weights ranged from 1 to 5 kg. The relatively light fleece weight might facilitate the heat loss under the hot climate conditions of desert (Taha *et al.*, 2006).

Mean fiber diameter was 63.9 ± 0.20 µm (Table 1). Petrie (1995) stated that outer coat fibers of camel's fleece are coarse with a diameter of 20-120µm, while the fine down fibers varied from 19-24 µm. Sampling position affected ($P<0.05$) the mean fiber diameter where the coarser mean fiber diameter was observed on the hump samples (80.9 ± 0.32µm) followed by neck samples (56.90 ± 0.32µm) and the lowest was that of the sides (52.2 ± 0.38µm) (Table 2). Similar results were reported by Guirgis *et al.*, (1992). They showed that hump and other dorsal positions (withers and hip) grew coarser fibers than the lateral positions (shoulder, mid-side and britch) in dromedary camels at the extreme south of Egypt.

The fiber diameter distribution (Fig. 1) on the neck had the lowest percentage of the fine fibers and the highest percentage of the coarse ones where only 3.8% of the fiber diameters were less than 40µm (Class 1). Classes (2) and (3) comprised 30.1% and 45.4%, respectively. Class (4) fibers comprised 19.6% while class (5) fibers comprised the lowest percentage (1.2 %).

On the hump, fiber diameter tended to be lower than that of the neck where the percentages of class (1) and class (2) increased obviously to 17.6% and 59.6%, respectively. While class (3) percentage was obviously lower than those on the neck (19.2 vs. 45.4%). Percentages of classes (4) and (5) fibers declined to 3.6% compared with 20.8 % on neck.

Side samples had the highest percentage of the finer fibers (36.4% and 47.1% for class 1 and class 2, respectively) and the lowest percentage of the coarse fibers (13.6% and 2.8 % for classes 3 and 4, respectively). It was closer to the fiber diameter distribution on the whole fleece where the trend line was similar in both of them. However, the whole fleece had lower percentages of classes (1) and (2) and higher percentages of classes (3, 4 and 5) than that of the sides.

Staple length was 7.7 ± 0.48cm (Table 1). Guirgis *et al.* (1992) reported lower staple length of the dromedaries at the extreme south of Egypt (2.1 ± 0.24 to 3.1 ± 0.42 cm). Differences between the two results might be attributed to environmental variations between the two regions.

Medullation index (Table 1) was relatively high (31.3 ± 1.41). Guirgis *et al.* (1992) reported that the medullation index of dromedary camel's coat ranged from 31.4 to 32.5. The main function of medulla is to increase the protective properties of the fleece by adding internal air space (Berger and Mauersberger, 1984). The thicker medullated fibers might enhance air movement at skin surface resulting in good opportunity for moisture evaporation and consequent transmission of heat from the skin (Govindiah and Nagarcenker, 1983).

Results showed that the camel's coat consisted of two layers; outer coat with long coarse fibers and inner coat with short fine crimpy fibers. Outer coat fibers comprised 90.8 ± 4.32 % of the fleece with an average fiber length of 7.8 ± 0.56 cm. Percentages of different fiber types of the outer coat were 17.5 ± 2.93%, 21.6 ± 3.87%, 26.5 ± 4.63% and 25.2 ± 5.66% for A, B, C and D fibers, respectively. The corresponding average fiber lengths of these types were 9.1 ± 0.55 cm, 9.5 ± 0.68 cm, 8.4 ± 0.66 cm and 4.4 ± 0.93 cm, respectively. Under coat fibers comprised 9.2 ± 4.07 % of the fleece. Average fiber length and crimp frequency of under coat fibers were 3.8 ± 0.24 cm and 1.6 ± 0.18 crimps/cm, respectively (Table 3). The presence of these two coat types might indicate different roles of each type in animal protection against the surrounding environmental conditions. Schmidit-Nielsen *et al.* (1957) reported the existence of double coat in camels. They revealed that the coarse outer-coat fibers provides an efficient barrier against heat gain from the surrounding environment and facilitates heat dissipation during summer. Guirgis *et al.* (1992) reported that the abundant undercoat crimpy hair fibers might increase the insulating role of the under coat and would provide an efficient system of heat conservation during the cold season. The effect of the environmental temperature on the under coat fibers was mentioned by Petrie (1995). He reported that the under-coat fibers produced by animals living in the hottest desert climates tended to be coarser and sparser than those from the more temperate climate.

Differences in some physical coat traits might invite for a system of grading of camel hair to encourage processing into house crafts, hence sustainable development of desert areas.

**Table (1): Some fleece characteristics of camel hair.**

| Trait | Mean ± SE |
|---|---|
| Fleece weight (gm) | 1130.7 ± 121.96 |
| Fiber diameter (μm) | 63.9 ± 0.21 |
| Staple length (cm) | 7.7 ± 0.48 |
| Medullation index | 31.3 ± 1.41 |

*SE: Standard error.*

**Table (2): Effect of body position on fleece weight and fiber diameter (Mean ± SE)**

| Position | Fleece weight (gm) | Fiber diameter (μm) |
|---|---|---|
| Neck | 75.4 ± 15.19$^{c}$ | 56.9 ± 0.32$^{b}$ |
| Hump | 254.4 ± 32.04$^{b}$ | 80.9 ± 0.32$^{a}$ |
| Side | 797.4 ± 93.48$^{a}$ | 52.2 ± 0.34$^{c}$ |

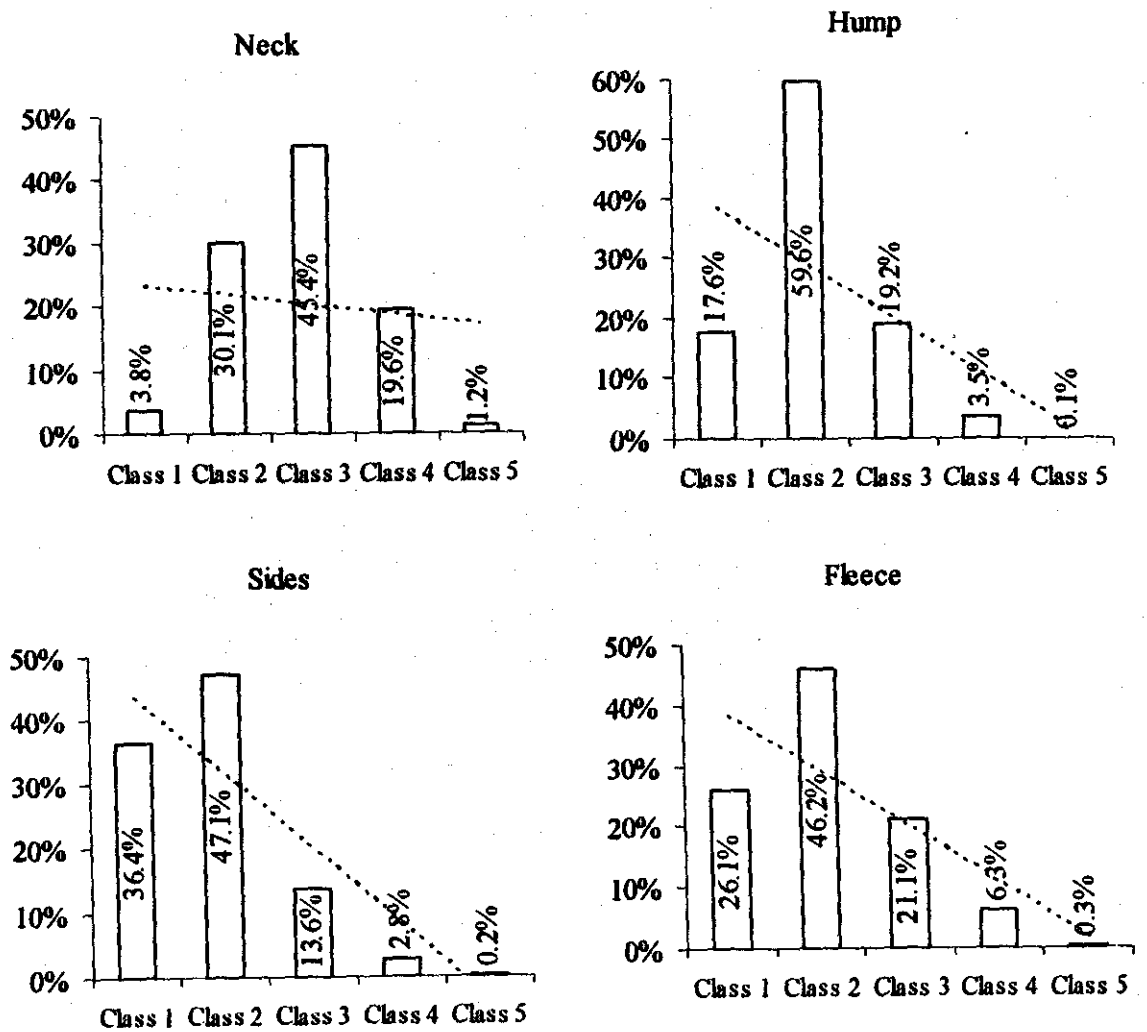
*Values with different superscripts within the same column are significantly different ($p<0.05$).*
*SE: Standard error.*

**Table (3): Fiber type ratio, fiber length, crimp frequency of fine fibers (Mean ± SE)**

| Trait | Fiber type ratio (%) | fiber length (cm) |
|---|---|---|
| *Outer coat* | | |
| A fibers | 17.5 ± 2.93 | 9.1 ± 0.55 |
| B fibers | 21.6 ± 3.87 | 9.5 ± 0.68 |
| C fibers | 26.5 ± 4.63 | 8.4 ± 0.66 |
| D fibers | 25.2 ± 5.66 | 4.4 ± 0.93 |
| Total coarse fibers | 90.8 ± 4.32 | 7.8 ± 0.56 |
| *Under coat* | | |
| Fine fibers | 9.2 ± 4.07 | 3.8 ± 0.24 |
| Crimps/cm | 1.6 ± 0.18 | |

*SE: Standard error.*

**Figure (1): Histograms of the fiber diameter distribution on the neck, hump and side samples and the whole fleece.**




*Where: Class 1 (≤ 40μm), Class 2 (from 41 to 80μm), Class 3 (from 81 to 120μm), Class 4 (from 121 to 160μm) and Class 5 (from 161 to ≤200μm)*

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## الملخص العربي

### دراسة لبعض الصفات الطبيعية لوبر الجمال وحيدة السنام في الساحل الشمالي الغربي لمصر


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أجريت هذه الدراسة على جزات ٥٣ من الجمال وحيدة السنام الموجودة في الساحل الشمالي الغربي لمصر بهدف تقييم بعض صفات وبر الجمال في هذه المنطقة حيث تم عند الجز تقسيم الجزات الى ثلاثة اجزاء: غطاء الرقبة – غطاء السنام – غطاء الجانبين و تسجيل وزن الوبر على كل جزء كما تم قياس متوسط قطر الألياف في عينة من كل جزء و في عينة مجمعة من الأجزاء الثلاثة لدراسة توزيع أقطار الألياف فيها. كما تم دراسة تركيب الغطاء و طول الخصلة و النسب المئوية للأنواع المختلفة من الألياف و دليل النخاع. و أوضحت الدراسة تكون غطاء جسم الجمال من طبقتين من الألياف الأولى تكون الغطاء الخارجي بنسبة ٩٠,٨١ ± ٤,٣١٧ وهي من ألياف طويلة خشنة و الثانية تكون الغطاء الداخلي بنسبة ٩,١٩ ± ٤,٠٧١ % و مكونة من ألياف قصيرة ناعمة نسبياً.

كان متوسط وزن الجزة ١١٣٠,٧٢ ± ١٢١,٩٦٤ جم و متوسط قطر الألياف ٦٣,٨٧ ± ٠,٢٠٥ ميكرون و متوسط طول الخصلة ٧,٧١ ± ٠,٤٨١ سم و دليل النخاع ٣١,٣١ ± ١,٤٠٥. كان تأثير منطقة الجسم على وزن الجزة و متوسط قطر الليف معنوياً حيث كان الجزء الأكبر من وزن الجزة على منطقة الجانب يليها السنام ثم الرقبة (٧٩٧,٣٩ ± ٣٩,٤٨١ جم ، ٢٥٤,٣٥ ± ٣٢,٠٤٢ جم، ٧٥,٤١ ± ١٥,١٨٦ جم على التوالي) و كان قطر ألياف الوبر (٨٠,٩٦ ± ٠,٣١٨ و ٥٦,٩٠ ± ٠,٣٢٤ و ٥٢,٢٤ ± ٠,٣٣٧ ميكرون) على السنام و الرقبة و الجوانب على التوالي.