SOME HAIR CHARACTERISTICS OF THE ONE-HUMPED CAMEL FOR THE USE IN SMALL SCALE INDUSTRIES

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ABSTRACT

A herd of one-humped camels belongs to the Maryout Research Station, Desert Research Center, Egypt was used in this study. At shearing time, clips of camel hair (one year growth) were classified subjectively into three main grades; the first is the control grade (G1) the raw camel hair, the second is the harsh grade (G2); coarser, longer, and thicker and the third group (G3) is the fine grade; soft, shorter and thinner. Fine category has the lowest fiber diameter, followed by the control group and then the harsh category (30, 42 and 53µ, respectively). Friction test for yarns made from the previous categories indicated no significant differences between both harsh and fine categories (246.4 and 225.4 Revs, respectively), while the control group was significantly higher 15 and 25% compared with the same previous category, respectively. Metric yarn count was higher in the fine grade (G3 1.82), while the harsh grade (G2) was the lowest one 1.16 and the control grade (G1) has a moderate value between G2 and G3 (1.31). The previous results might explain the potentiality of fine category to produce more fine yarns with the increase in yarn count. Furthermore, harsh category was ten and fifteen times higher for thin and thick places.

Key words: Camel, Hair, Yarn, Elongation.

INTRODUCTION

Egyptian one-humped camels belong to the sub-species of one-humped dromedary or Arabian camel. Total population of camels in Egypt is about 136,312 heads, about 14% of them are found in the North Western coastal zone (Egyptian Ministry of Agriculture and Land Reclamation, 2003). Camel fleece comprises two types of coats; outer and inner coats. The outer coat fibers are coarse, long, harsh and coloured (varying from reddish to light brown), while the inner down fibers are fine, short, crimpy with pastle colour.

Both outer and inner coat fibers play an important role in the animal's thermoregulation. The outer coat is responsible for protecting animals from direct sunlight, heat and radiations surrounding the animals, whereas the inner coat is concerned with saving metabolic heat production or body heat loss in the cold weather.

The fine fibers of camel coat might be woven alone or after blending with wool to produce yarns for cloth manufacture, while the outer coat fibers are used (after felting) to produce men's winter wear, which are usually warm and completely waterproof. Furthermore, it might be used to produce tents and for carpet backing (Petrie, 1995).

Because of the rare of researches in the industrial characteristics of the one-humped camels hair, this study aimed to investigate some physical and textile characteristics of camel hair after being subjectively categorized into fine and coarse types.

MATERIALS AND METHODS

In this study, sixty five camel hair clips were collected from a herd of the one-humped camels at Maryout Research Station at sheering time. Twenty clips were chosen randomly to represent the camel hair as used without any classification (control grade, about 50 kg), the rest of the clips were put together as a big amount of camel hair, then it were subjectively classified into two categories; fine category (soft, short and thin, about 40 kg) and harsh category (coarse, long, and thick, about 45 kg). The amount of camel hair which had unclear definition as mentioned above was excluded. Three representative samples from each category were kept in plastic bags for analysis. From each representative sample, ten staples were used to measure staple length (STL); staples were measured against a ruler to the nearest 0.5 cm, where measurements were made from the base to the dense part of the tip without stretching staples. The average length of these staples was calculated and recorded for each sample. Fiber diameter (FD) was measured using Image analyzer (LEICA Q 500 MC) with lens 4/0.12. A section of 0.2 mm in length was cut by a Hand-Microtom at a level of 2 cm from the base of the staples of each sample. These cuttings were put on a microscope slide with 2-3 drops of paraffin oil, spread and covered with a slide cover. About five hundred fibers were taken at random and measured from each sample. The mean fiber diameter (FD) and the standard deviation of fiber diameter were calculated for each sample.

During measuring fiber diameter, numbers of medullated fibers (Med) were counted and their percentages were calculated and recorded for each sample. A number of fifteen staples were taken at random from each greasy sample to measure staple strength (SS). Each staple was trimmed by cutting its tip. Each staple was subjected to the Agritest staple breaker (Agritest Pty. Ltd). The staple was broken into two parts; top and base. The measurement of the staple strength (SS) was calculated for each sample in

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terms of Newton/Kilotex (Heuer, 1979 and Caffin, 1980). The point of break (POB) was also calculated as a percentage of the length of the tip portion from the original length of the staple.

Each scoured sample was hand carded using a hand-carding board. A 10-gm scoured and carded sample was placed into the cylinder of the WRONZ loose wool Bulkometer (Dunlop et al., 1974) to attain the measurements of loose wool bulk (BUL) and resilience (RES) for each sample. Random samples of yarns coming from each category were tested as follows:

- Yarn count (metric) = yarns length (m) / yarns weight (g), 15 samples were used in this test.
- Yarn twisting (yarns from each grade was played at nominal level of 170 turn per meter (TPM) on Z direction), 15 samples were used in this test.
- Yarn strength and elongation: Uster Tensorapid 3 (Zellweger Uster) was used to measure yarn strength (RKM = count-related force at break), tenacity and elongation, 15 samples were used in this test.
- Yarn evenness and hairiness, 15 samples from each grade were used in this test to measure the regularity of the yarn by the following abbreviations:
  - Thin places (-50%): number of mass reduction of 50% or more in a yarn with respect to the mean value.
  - Thick places (+50%): number of mass increase of 50% or more in a yarn with respect to the mean value.
  - Neps (+200%): number of mass increase of 200% or more in a yarn with respect to the mean value and reference length of 1cm, these short thick places in a yarn may be the result of vegetable matter or fiber collections pushed together.
- Yarn friction: fifteen samples were used in this test to examine the friction for standard length of yarns (Revs).

Data were analyzed using the general linear model procedure (Proc GLM) of SAS (1995). Source of variation for dependent variable (grades) was tested. Comparisons among means within grades were tested using Duncan's New Multiple Range Test and its significance was tested (Steel and Torrie, 1980). Simple correlation coefficients among various traits were also calculated and tested.

RESULTS AND DISCUSSION

All processing characteristics under study were significantly different among camel hair grades reflecting the important role of camel hair characteristics as a raw material in its yarn characteristics and consequently those of the end product.

Metric yarn count was higher in the fine grade (G3) 1.82, while the harsh grade had the lowest value (G2) 1.16 and the control grade (G1) had a medium value of 1.31 between G2 and G3. The significant negative correlation between metric yarn count and each of fiber diameter (r = - 0.87) and staple length (r = - 0.66) might explain the previous result; in fine fibers the percentage of length to weight increased and vice versa in the harsh fiber grade. Similar results were obtained by Hunter *et al*, (1985 and 1987) who reported that fiber diameter and length played a vital role in the yarn characteristics. Furthermore, the end uses of wool are determined by its own characteristics; diameter, bulk, length (Petrie, 1995).

Yarn twisting was higher in G2 (332.0 TPM) as compared with both G1 (229.5 TPM) and G3 (224.4 TPM) as shown in Table (1). The highly significant and positive correlation found between yarn twisting and both fiber diameter (r = 0.65) and its standard deviation (r = 0.62) could explain the previous result that with increasing fiber diameter the twisting count tended to increase (Table 5). The same result was reported by Hunter and Gee (1980) who found that the average fiber diameter and its variation might play a vital role in wool processing. Moreover, Von Bergen (1963) found that fiber diameter controlled about 80 % of the spinning process, while fiber length controlled about 15% of the product value.

Friction test of yarns made from the previous categories illustrated no significant differences between both harsh and fine categories (242.6 and 223.7 Revs, respectively), while the control group was significantly higher (18 and 28% compared with the same previous categories, respectively).

Table (1) showed that yarn tenacity significantly increased in G3 (3.34 Rkm) as compared with both G1 and G2 (2.22 Rkm and 2.10 Rkm, respectively). In Table (5) the negative correlation found between yarn tenacity and both fiber diameter (r = - 0.62) and staple length (r = -0.58) substantiated with the present results. It is of interest to know that medulla might have an unfavorable effect on fiber strength which would vary between camel hair and wool. Meanwhile, Ryder and Stephenson (1968) reported that yarn strength was higher with increasing true wool fiber length. Moreover, Ince (1979) concluded that longer true wool fibers produced stronger yarn.

Results in Table (1) showed that yarn elongation differed significantly among different grades of camel hair, where it was higher in G3 followed by G1 and G2, where a negative correlation was found, as shown in Table (5), between elongation and both fiber diameter (r = - 0.36) and staple length (r = - 0.48). These results are in agreement with those of Ince (1979) who concluded that longer fibers produced yarns of low elasticity.

Some of yarn characteristics differed in staple and fiber characteristics such as strength and elongation. This might be because of the earlier processes of carding, twisting and spinning to form the yarn. Table (3) showed a highly positive correlation between yarn tenacity and yarn elongation (r = 0.74), while Helal (2004) found a very weak correlation (0.01) between some local coarse wool staple strength and elongation. Furthermore, wool fiber types might be different (to some extent) as compared with camel hair. Also fiber distributions in both wool and camel hair might be different compared with fiber distribution in yarns. Twisting of fibers to produce yarns involved many factors when comparing between strength in both yarns and staples.

Along these processing stages, weak fibers were broken and lost. Ainsworth (1988) reported that weak wool gave higher card loss as compared with the stronger one.

Bulk and resilience play an important role in the characteristics of yarn and consequently the end product. Grades of camel hair affected significantly the loose bulk which was increased in both G2 and G3 as compared with G1 (Fig., 1 and Table, 2). Ross (1978) and Ross *et al.* (1979) reported that medullated yarns were found to be more bulky. Also, Carnaby and Elliott (1980) indicated that bulky wool produced bulky yarns.

Harsh grade was ten and fifteen times higher in thin and thick places/km, respectively as compared with the fine one (Fig 2), which might reflect the regularity in the yarns of inner category compared with those of the other grades. The high correlation found between both thin and thick places and fiber diameter (r = 0.95 and 0.85, respectively) might illustrate that with increasing fiber diameter, very thick fibers might contribute to the irregularity in the formation of the yarn in many places which tended to increase the thin and thick places compared with the mean value.

It might be concluded that camel hair has different characteristics as compared with sheep wool and goat hair. The characteristics of raw camel hair might have an influence on most yarn characteristics, while some characteristics could take a different trend during the processing stages. The potentiality of camel hair could be improved by planned breeding programs.

Figure (1): Bulk and resilience of different grades of camel hair.

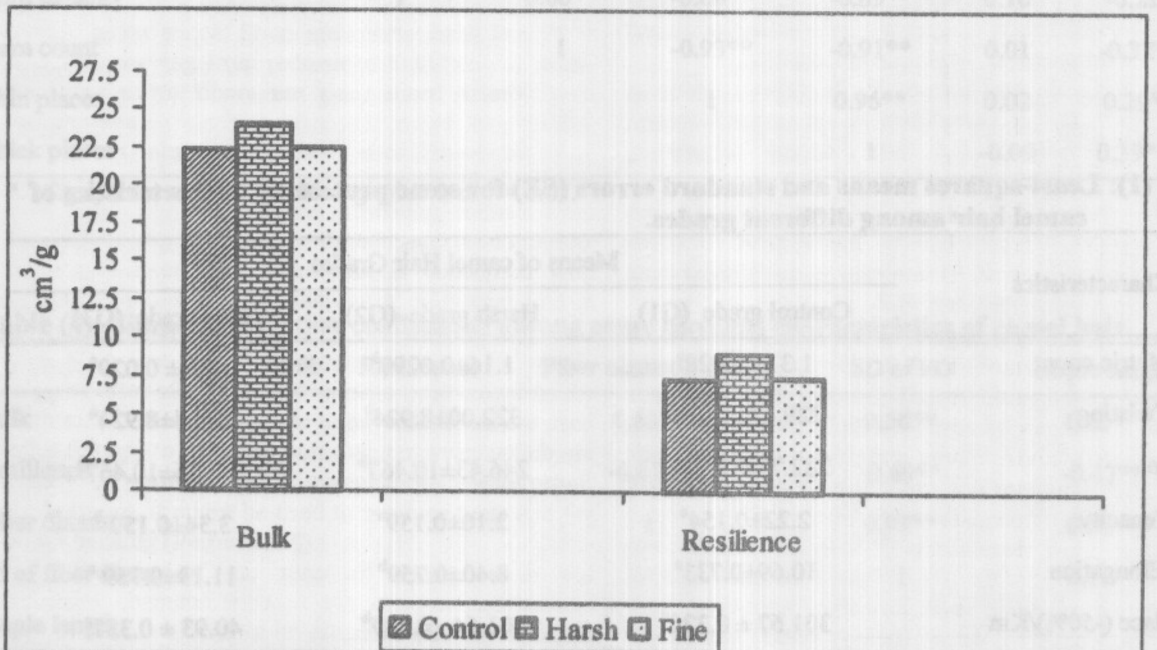

Table (5): Simple correlation coefficients among some yarn and physical characteristics of camel hair.

	Bulk	Resilience	Fiber diameter (FD)	SD of FD	Staple length
Yarn Twisting	0.74**	-0.30*	0.65**	0.62**	0.54**
Elongation	-0.33*	0.11	-0.36**	-0.36**	-0.48**
Yarn Friction	-0.25	-0.51**	0.16	0.25	0.03
Yarn tenacity	-0.19	0.44**	-0.62**	-0.67**	-0.58**
Yarn count	-0.41**	0.67**	-0.87**	-0.91**	-0.66**
Thin places	0.48**	-0.71**	0.96**	0.99**	0.76**
Thick places	0.23	-0.75**	0.86**	0.93**	0.64**
No of Neps	0.37**	0.09	0.11	0.06	0.08

SD = Standard deviation
* *Significant at P< 0.05.* ** *Significant at P< 0.01.*

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الملخص العربي

بعض صفات وبر الجمال وحيدة السنام المستخدمة في الصناعات الصغيرة

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إستخدم فى هذة التجربة قطيع من الجمال وحيدة السنام التابع لمحطة بحوث مريوط – مركز بحوث الصحراء– مصر. فى وقت الجز تم فصل الجزات (عام من النمو) إلى ثلاث درجات : مجموعة بدون تدريج (المجموعة الكونترول) و المجموعة الخشنة وتضم الألياف الخشنة والطويلة والسميكة والمجموعة الثالثة هى المجموعة الناعمة و التى تضم الياف ناعمة و قصيرة وأرفع فى قطرها مقارنة بالمجموعة الثانية. المجموعة الناعمة كانت أقل المجاميع فى القطرتلاها المجموعة المقارنة ثم المجموعة الخشنة (٣٠، ٤٢، ٥٣ ميكرون على التوالى). أوضح إختبار الإحتكاك للغزول المصنعة من المجاميع السابقة عدم وجود إختلافات معنوية بين المجموعة الناعمة والخشنة (٢٤٦,٤ ، ٢٢٥,٤ Revs) على التوالى بينما كانت مجموعة المقارنة أعلى بنسبة ١٥ و٢٥ % مقارنة بالمجموعتين السابقتين على التوالى. الرقم المترى للمجموعة الناعمة كان أعلى (١,٨٢) بينما كا نت المجموعة الخشنة هى الأقل بين المجاميع (١,١٦) و إحتلت المجموعة المقارنة مكانة معتدلة بين المجموعتين السابقتين (١,٣١). النتيجة السابقة قد تفسر القدرة الكامنة للألياف الناعمة على إنتاج غزول أنعم وأطول. الأكثر من ذلك ان المجموعة الخشنة كانت أكثر ١٠ و ١٥ مرة فى عدد النقط الرفيعة و السميكة على طول واحد كيلو متر من الغزل على التوالى مقارنة بالمجموعة الناعمة مما يعكس القدرة الإنتظامية العالية للمجموعة الناعمة. ارتبطت متانة الغزول إرتباطا عالى المعنوية بالإستطالة (معامل الإرتباط = ٠,٦٦). ولهذا كانت المجموعة الناعمة أعلى مقارنة بالمجموعة الخشنة فى كل من الإستطالة (١١,٢ و ٨,٤ %) و المتانة (٣,٣ و ٢,١ Rkm) على التوالى.