Egyptian J. Anim. Prod. 35, Suppl. Issue, Dec. (1998):417-428.

SOME OBSERVATIONS ON THE COAT OF SMALL RUMINANTS IN THE EXTREME SOUTH OF EGYPT

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SUMMARY

Sheep and goats form an important segment of animal resources in the triangle of Halaieb, Shalateen and Abouramad area at the extreme south east of Egypt. Representative samples of wool and hair were obtained to study their characteristics and their role in adaptation to the dominating hot environment. Some recommendations to the use of wool in local handicrafts were suggested for sustainable development of the area under study.

Results showed that about half of the sheep population had a hair cover and that hair sheep showed a lower response in all physiological parameters studied, as compared to those with woolled coats. This might indicate better heat tolerance of hair sheep.

Mean fiber diameter ranged from 66.47 to 74.53 μm for woolled and hair sheep fleeces, respectively. High values encountered were ascribed to the high frequency of medullated fibers, suitable for heat regulation.

A relatively short mean staple length (3.31 cm) in sheep might support a protective barrier against heat load.

Fleece structure of sheep showed an outer-coat, of kemp and coarse fibers, that composed 62.5 and 50.3% of fiber population, and an under-coat of 37.5 and 49.7% fine crimpy fibers, in hair and woolled sheep fleeces, respectively.

Medullation index showed a higher value, 29.08, in samples of hair sheep than that, 23.31, of woolled sheep.

For better utilization of wool shorn from sheep, clip preparation was recommended with a grading system composed of 2 grades, based on kemp content. Grade 1 with no to low content of kemp, could be used in knitting and blankets. Grade 2 with a moderate to high level of kemp, could be used in floor coverings. Percentages of grades 1 and 2 represented 59 and 41%, respectively.

Out of 55 hair samples from goats, only 2 samples showed an under-coat, the rest had only coarse outer-coat. The absence of under-coat is required for

heat dissipation, in the great majority of samples might be advantageous to heat dissipation, which would be considered in favour to goat heat tolerance.

Keywords: Hair and woolled sheep, goats, outer-coat, under-coat, thermoregulation, handicrafts.

INTRODUCTION

Small ruminants and camels form the main animal resources in the triangle of Halaieb, Shalateen and Abou Ramad at 22 No latitude. Inhabitants shepherd their flocks, as their main occupation, where they graze natural range plants.

This work was carried out to throw some light on the coat of small ruminants and the best way of utilization of this product. Some physical characteristics of the coat as well as some recommendations for their use in local handicrafts would be suggested for improving the income of the inhabitants.

MATERIALS AND METHODS

During three visits to the triangle of Halaieb, Shalateen and Abou Ramad, samples were collected from sheep and goats, (20 sheep and 13 goats) at December 1996, (30 sheep and 13 goats) at February and (45 sheep and 29 goats) April 1997, a total number of 150 wool and hair samples were obtained from 95 sheep and 55 goats. Six positions were sampled from each animal (3 dorsals, Withers, Back and Hip & 3 laterals, Shoulder, Midside and Britch) and a representative composite sample was tested. The experimental animals were adult (2-4 years) females. In goats, 92% of the population were black and 8% had black and white patches. In sheep, only quarter of the population had a white fleece, 30% were brown and the rest had brown and white patches in their fleeces. Sheep samples were classified visually before testing into (47 hairly, apparently looks hairy, 48 woolly where wool fibers are apparent). All samples were tested for the following parameters:

1. Staple length/cm. according to Guirgis (1973).
2. Fiber diameter (μm). according to Guirgis (1973).
3. Fiber type ratio (Guirgis, 1973): sub-samples were sorted into outer-and under-coat.Outer-coat fibers were classified into 5 types, kemp, heterotype (partly kemp followed by wool part), A, B and C fiber types (El-Ganaieny, 1996), in which, A, B and C fibers contained 70, 50 and 30% medulla, respectively. Outer-coat hairy samples of goats were divided into 4 grades according to medulla percentages A, B, C and D fiber types with 90, 70, 50 and 30% medulla, respectively.

4. Number of crimps per/cm (under-coat).
5. Medullation index: according to Pilkington and Purser (1958) and adopted by Guirgis (1973).
6. Physiological parameters: coat temperature, skin temperature and rectal temperature, were obtained during the second visit in February 97 from 43 animals (30 sheep and 13 goats).
7. Coat depth/cm using a ruler on the animal (vertical distance between skin level and top of coat cover) were measured and the average taken on 6 positions mentioned.
8. Data were tabulated as means±SE.

RESULTS AND DISCUSSION

Sheep Coat:

50.5% of sheep were covered with wool, whereas 49.5% had a hairy coat. The results of sheep thermal responses (Table 1) indicated that hair sheep showed lower values in all physiological parameters studied, compared to those with woolly coats. Although all animals were raised at the same environment, mean coat temperature of hair sheep was 1.31oC less than that of the woolled sheep. The same trend was observed, where reductions were 0.03oC and 0.49oC in skin temperature and rectal temperature, respectively. Results encountered might indicate better heat tolerance of hair sheep than those woolled, hence, the high percentage of hair sheep to suit the tropical environment.

Table 1. Some fleece traits, and thermal response, of sheep raised under the triangle environment and some thermal responses

Sheep	Fiber diameter (µm)	Staple length (cm)	Coat depth (cm)			Medu-llation index	Thermal response (oC)		
			Dorsal	Lateral	Total		Coat temp.	Skin temp.	Rectal temp.
Overall	70.46± 2.367	3.21± 0.147	2.83± 0.143	3.15± 0.212	2.98± 0.173	26.17± 1.006	-	-	-
Hair	74.53± 3.390	3.05± 0.183	2.67± 0.191	3.05± 0.283	2.87± 0.233	29.08± 1.529	32.37± 1.044	39.11± 0.282	39.02± 0.149
Woolled	66.47± 3.237	3.37± 0.230	2.97±	3.24±	3.12±	23.31± 1.190	33.68± 0.428	39.14± 0.476	39.51± 0.124

Fiber diameter:

The overall mean fiber diameter was 70.46±2.367 µm (Table 1), which ranged from 66.47 ± 3.237 to 74.53±3.390 µm in woolled and hair fleeces, respectively. Values were generally greater than those reported in other Egyptian sheep breeds (Girgis, 1980).

Highly medullated fibers, kemp, A and B of medullated outer-coat fibers with (70, 50%) medulla, respectively, might have contributed towards the high value of mean fiber diameter. Hair sheep were more kempy than the woolled ones. The first had a higher value of mean fiber diameter than that of the latter.

Staple length:

The overall average staple length was 3.21±0.147 cm (Table 1), where values were 3.05±0.183 cm in hair sheep samples that tended to increase in woolled sheep (3.37±0.280 cm). Values encountered were lower than those reported in other Egyptian sheep breeds (Guirgis, 1980). Earlier work showed that staple length between 2-4 cm might be sufficient to give a good protective barrier against heat load (Macfarlane et al., 1958; Schimdt-Nilson, 1979). Sheep covered with a fleece would survive under very wide thermoneutral zones, and heat production of sheep with a fleece that varied from 2.5 to 12.0 cm in length remained constant over an environmental temperature that ranged from 15 to 35oC (Blaxter et al., 1959).

Coat type:

Fleeces of tested sheep were of bimodal structure, as those of wild sheep breeds, where coat would easily be classified into two main types that differed in physical and morphological characteristics. The outer-coat (guard), hairy fibers, and the under-coat fibers which tended to be finer and crimpy.

a) Outer-coat fibers:

The average outer-coat fiber percentage was 56.3±2.93%, which contained 15.21, 15.97, 15.17 and 9.95% as kemp and heterotype, A, B and C fibers, respectively. The majority of outer-coat fibers were made of medullated types, which would support the role of the outer-coat as a guard integumental barrier, that would protect animals from the environmental hazards. The distribution of outer-coat fibers, varied between hair and woolled fleeces, in which hair coats contained higher values of kemp, heterotype and type A fibers (very coarse and medullated) in comparison to the woolled coats.

Table 2. Percentage of different fibre types in the fleeces of sheep

Sheep	Outer-coat fiber types							Under-coat			
	Kemp %	%	A %	B %	C %	Σ %	Fiber length (cm)	Σ %	Fiber length (cm)	Crimps /cm	Fiber diameter (µm)
Overall	12.35± 1.729	2.86± 1.192	15.97± 1.361	15.17± 1.357	9.95± 1.397	56.34± 2.931	3.33± 0.155	43.66± 2.931	2.66± 0.160	3.08± 0.098	20.36± 0.562
Hair	17.35± 2.670	3.72± 2.111	16.03± 1.784	14.93± 1.701	10.51± 2.276	62.49± 4.131	3.28± 0.214	37.51± 4.131	2.35± 0.184	3.26± 0.168	20.18± 0.771
Woolled	7.46± 1.873	2.01± 1.150	15.93± 2.067	16.54± 4.232	9.40± 1.657	50.32± 4.011	3.38± 0.227	49.68± 4.010	2.93± 0.248	2.92± 0.106	20.57± 0.825

The outer-coat fiber length averaged 3.33±0.155 cm, which ranged between 3.28±0.214 and 3.38±0.248 cm for both hair and woolled coats, respectively.

Outer-coat (mostly highly medullated) fibers % were highest in hair sheep during winter (December) indicattheir role as a protective integument. The under-coat% was highest during February-April in the woolled section referring to their insulation properties during low ambient temperature. The length of under-coat of woolled sheep was usually longer than that in hair sheep which might maximize its role as an insulator. However, number of crimps/cm was higher in the under-coat of hair sheep than that of the woolled which might compensate and increase the still layer of air that would add to the insulating capacity.

Hair sheep had the highest % of medullated outer-coat fibers whereas woolled sheep had the highest % and the longest of under-coat fine fibers.

b) Under-coat fibers:

The average under-coat fiber percentage was 43.66±2.931%, where values were 37.5±4.13 and 49.7±4.01% in hair and woolled fleeces, respectively. These results might indicate that the under-coat, besides its biological function, could be processed, when clipped, in local woollen products. However, the average under-coat fiber length was 2.66±0.160 cm, where values were 2.35±0.184 cm and 2.93±0.248 cm for hair and woolled fleeces, respectively. Furthermore, the under-coat fibers had important characteristics suitable in the textile industry; the number of crimps/cm were 3.08±0.098 on the average, where values were 3.26±0.168 in the hair fleeces and 2.92±0.106 for the woolled fleeces. The average under-coat fiber diameter was 20.36±0.562 µm, where values were 20.18±0.825 µm for hair and 20.57±0.771 µm for woolled fleeces. These results might recruit the under-coat for handicrafts, and would be considered as a non-agricultural activity for the development of the area.

Medullation:

Medulla is an important element, as spinning properties of medullated fibers are lower and in dyeing they dye in a lighter shade. Biologically, the main function of medulla is to increase the protective properties of the fiber by adding internal air spaces (Berger and Mauersberger, 1948). Medullation index might be considered an easy method to express medullation in the whole fleece. The method was adopted and modified by Guirgis (1973) from Pilkington and Purser (1958). In the present work, medullation index averaged 26.17 for the total fleeces, where values were 29.08 and 23.31 in hair and woolled sheep, respectively (Table 1).

The incidence of medullation and animals ability to regulate their rectal temperature was reported to be correlated (r= 0.95) in Shorthorn and Zebu x

Shorthorn cattle (Dowling, 1959 a). In his study of the medullation of the hair coat as a factor in heat tolerance, he reported a difference between groups and between seasons for the same group in rectal temperature (low rectal temperature taken as indicating heat tolerance) and in degree of medullation.

It was suggested that a higher degree of medullated fibers in the summer coat of Bos indicus would help animals to be more heat tolerant than other European breeds (Dowling, 1959 b; Schleger and Turner; 1960; Hayman, 1965).

Dowling (1959 a & b) working on different breeds of cattle, reported that the major change in heat tolerance appeared to be associated with changes in medullation.

Dowling (1956); Ibrahim (1979) and Finch (1983) showed that the calf with long woolly coat would not be able to dissipate heat, thus depressing the physiological function, whereas a sleek shallow coat in cattle would be in favour of thermal balance and maintenance of productivity. Heat exchange through coat depends on the physical characteristics of hair fibers (density, depth, medulla, diameter, colour, solar absorptivity and reflectivity). Other factors such as skin temperature, air temperature, wind speed and thermal radiation were involved (Gebremedhin et al., 1987).

Benjamin (1985), studying Jersey, Hereford and Charolais cattle, in India, reported that during winter months, there was a reduction in the number of hairs having continuous medulla. This might possibly assist in a decrease of an outward flow of heat through the hair coat during winter months.

Govindiah and Nagarcenkar (1983), studying Brown Swiss, Jersey and Sahiwal cattle in India, reported that the thicker shorter medullated hairs in summer months would enhance air movement at skin surface resulting in a good opportunity for moisture evaporation and consequent transmission of heat from the skin.

In the present work correlation between % of outer-coat (medullated fibers) and rectal temperature at 2.00 pm in woolled sheep was 0.69. This might mean that about 48% of variability in rectal temperature could be explained by medullation in the outer-coat. This might reflect the role of medullation in regulating rectal temperature, hence, its contribution to heat tolerance.

Thermal responses:

Some physiological parameters were measured on a group of sheep and goats, (30 sheep and 13 goats) during the second visit of February 1996, and it was found that hair sheep seemed to give better response when exposed to the weather conditions, where the hair group had lower coat, skin and rectal temperatures, than those with woolled fleeces. Results might indicate that hair coated sheep might be more suitable under the existing hot arid environment, hence the high frequency of hair sheep.

The use of wool in handicrafts:

Clip preparation of fleeces and classing into grades, suitable for different products, are required for processing of animal fibers. This would be suitable to make the best use of the available meagre resources to maximize returns, hence sustainable development of the area. Woolled fleeces were sorted into two grades, according to the kemp content:

1. Grade 1 had a content that ranged from no kemp to low, which corresponded to 0-1 kemp scale. The staple length ranged between 1.6 and 6.0 cm with an average of 3.8 cm and that fiber diameter ranged from 24 to 112 μm with an average of 34.2 μm.

This grade could be used in knitteds and blankets.

2. Grade 2 had a medium to high kemp content, which corresponded to 2-3 kemp scale. Staple length averaged 4.05 cm (that ranged from 1.6 to 9 cm) with a mean fiber diameter of 79 μm, the range of which was 44-130 μm.

This grade would be directed towards floor coverings.

It was suggested that introducing simple technology would upgrade products, hence higher prices would be obtained. The use of a spinning wheel would help in producing spun yarns that are more uniform than those hand-spun. It is worth noting that grades of woolled fleeces represented 59 and 41% for grades 1 and 2, respectively.

It was shown that the percentage of kemp fibres that carpet wool buyers found acceptable was 3-5% (Nash, 1964). Earlier studies (Guirgis et al., 1982) reported a high heritability estimate of 0.43 of kemp. Hence, selection against kemp would be recommended, and that would be coupled with fleece opening and less dense wool which would not contradict with heat tolerance of animals to the surrounding hot environment.

However, selection against kemp could be done at an early age of lambs at 4 weeks of age. Selection would be recommended too for a longer staple, at least 7 cm to be more suitable for carpet wool yarns. However, it was reported that selection against kemp would be accompanied by an increase in staple length and fleece weight (Guirgis et al., 1982).

Goat's coat:

From a total number of 55 samples only 2 (3.63%) showed an under-coat during winter whereas during spring all samples possessed only an outer-coat and that 99.82% of the total fibers were those of the outer-coat. Similar results previously reported by El-Ganaieny (1996) showed that goats raised at Maryout experimental flock had 99.37% of their fleeces as an outer-coat whereas at Kostal, at the extreme south of Egypt at Naser lake shores, goats had an outer-coat that composed 95.44% of the fleece fibers. This might be attributed to the nature of outer-coat as being highly medullated and sparse, thus assisting heat dissipation from the body in the prevailing hot conditions.

The relatively high average fiber diameter (73.51 µm) (Table 3), might be due to the contribution of relatively highly medullated outer-coat fibers, where percentages were, 33.12, 25.19, 29.49 and 11.62 of A, B, C and D fiber types, respectively. This might confirm the role of medullated fibers required for protection of animals. Medullation index and coat depth were highest during spring than those during winter.

Table 3. Some traits of goat fleeces, raised under the triangle environment and some thermal responses.

Group	Fiber di(µm)	Staple length (cm)	Coat depth (cm) Dorsal	Lateral	Total	Medu-llation index	Thermal response (oC) Coat temp.	Skin temp.	Rectal temp.
1	75.53± 5.052	5.11± 0.292	1.80± 0.103	1.58± 0.120	1.70± 0.093	33.65± 1.766	-	-	-
2	69.56± 2.499	5.24± 0.400	1.98± 0.117	2.20± 0.094	2.11± 0.088	31.79± 1.889	28.81± 1.002	37.51± 0.397	38.88± 0.177
3	74.50± 1.706	5.72± 0.344	5.97± 0.375	5.63± 0.412	5.80± 0.337	41.99± 1.058	-	-	-
Overall	73.57± 1.599	5.44± 0.211	3.97± 0.342	3.78± 0.337	3.89± 0.321	37.61± 1.030	-	-	-

Table 4. The outer and under coat fiber percentages in the fleeces of goats

Group	Outer-coat fiber types A %	B %	C %	D %	Σ %	Fiber length (cm)	Under-coat Σ %	Fiber length (cm)	Crimps /cm
1	16.58± 3.774	28.95± 4.067	31.45± 4.579	22.68± 7.073	99.67± 0.331	4.54± 0.175	0.33	2.70± 0.115	2.9± 0
2	17.61± 3.368	21.11± 3.383	32.74± 4.442	26.48± 7.005	99.55± 0.446	5.68± 0.368	0.43	4.80± 0.123	2.9± 0.313
3	47.47± 5.299	25.33± 3.9397	27.16± 5.881	0	100.0± 0	7.47± 0.453	0	-	-
Overall	33.12± 3.645	25.19± 2.441	29.49± 3.427	11.62± 2.833	99.82± 0.130	6.35± 0.306	0.18± 0.127	4.55± 0.250	2.9±

Thermal response of goats was much better, where physiological parameters were lower than those of sheep in general and those with hair coat in particular. This might be due to the absence of the insulating layer of the under coat in goats, hence the easy transfer of metabolic heat through dissipation in goats. The physiological responses, showed a thermal temperature gradients of 10.07oC (rectal-coat) and of 8.70oC (skin-coat), where the average ambient temperature was 31.25oC with 40.50% relative humidity, hence the difference in gradient between rectal and skin temperatures would be 1.37oC. The high gradient (Rectal-coat) might confirm the role of coat as a bad conductor of heat.

ACKNOWLEDGEMENTS

The authors would like to thank the Academy of Science and Technology for financing the project, from which this work was carried out and the Principal Investigator, Professor H.M. El-Shaer, for providing facilities that made this work possible.

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بعض ملاحظات على غطاء جسم المجترات الصغيرة بأقصى جنوب مصر

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شعبة الإنتاج الحيواني والدواجن – مركز بحوث الصحراء بالمطرية – القاهرة

تمثل الأغنام والماعز جانبا مهما من مصادر الثروة الحيوانية بمنطقة مثلث حلايب وشلاتين وابورماد التى تقع بأقصى جنوب مصر حيث تم إجراء هذا البحث للتعرف على صفات غطاء الجسم فى هذه الحيوانات ودوره فى أقلمتها لظروف الحرارة السائدة بالمنطقة وكذلك اقتراح بعض التوصيات لاستخدام الصوف المنتج فى الصناعات اليدوية المحلية لتدعيم عملية تطوير تلك المنطقة٠

أظهرت الدراسة:

١- أن حوالى نصف تعداد أغنام المنطقة مغطاه بالشعر والنصف الآخر مغطى بالصوف ، كما أثبتت الدراسة أن الأغنام ذات الشعر أظهرت استجابات فسيولوجية منخفضة بالمقارنة بالأغنام ذات غطاء الصوف وهذا يدل على قدرة الأغنام ذات غطاء الشعر على تحمل العبء الحرارى عنها فى الأغنام ذات غطاء الصوف٠

٢- كان قطر الألياف ٤٧ر٦٦ و ٥٣ر٧٤ ميكرون فى الأغنام ذات غطاء الصوف والشعر على الترتيب ، ويعزى كبر قطر الألياف الى زيادة ملحوظة فى الألياف الخشنة ذات النخاع بالجزات حيث تلعب هذه الألياف دورا ملموسا فى التنظيم الحرارى لجسم الأغنام تحت ظروف المنطقة٠

٣- متوسط طول الخصلات سجل ٢١ر٣ سم بانخفاض واضح عن السلالات المصرية الأخرى وان كان يعتبر مناسبا وكافيا لحماية الأغنام من الحرارة الجوية٠

٤- كانت الألياف بالجزات مكونة من طبقتين هما: الغطاء الخارجى والغطاء الداخلى كما هو الحال فى الأغنام البرية٠ الغطاء الخارجى ويتكون من الكمب وألياف أخرى خشنة ذات نخاع كبير والغطاء الداخلى ذو الألياف الناعمة ذات التموجات وكانت نسبة الغطاء الخارجى ٥ر٦٢ و ٣ر٥٠٪ كما كانت نسبة الغطاء الداخلى ٥ر٣٧ و ٧ر٤٩٪ فى الأغنام ذات غطاء الصوف والشعر على الترتيب٠

٥- دليل النخاع كان كبيرا فى جزات الأغنام ذات الشعر ٠٨ر٢٩ وانخفض الى ٣١ر٢٣ فى جزات الأغنام ذات الصوف٠

٦- من خلال تحليل عينات شعر الماعز تبين أن عينتين فقط بها غطاء داخلي والباقي صنف كغطاء خارجي ذو الألياف الخشنة وقد فسر غياب ألياف الغطاء الداخلي الذي يعمل كعازل لحفظ حرارة الجسم بأن ذلك مرغوب لتسهيل فقد الحرارة من الجسم وقد يكون غياب الغطاء الداخلي إحدى مميزات غطاء الجسم في الماعز بالمنطقة حيث يزيد من قدرتها على التأقلم.

ولحسن استخدام الصوف الناتج أوصت الدراسة بتدريج الصوف الخام الى رتبتين رئيسيتين (طبقا لمحتوى الجزات من الكمب).

أ - الرتبة الأولى وتمثل ٥٩٪ من إجمالي الجزات وتحتوى على كمب من صفر الى قليل ويمكن استخدامها في التريكو البطاطين.

ب- الرتبة الثانية وتمثل ٤١٪ من إجمالي الجزات وتحتوى على كمب من متوسط الى عالي ويمكن استخدامها في المفروشات الأرضية ، كما ينصح بادخال المغازل نصف الآلية وذلك للحصول على غزول متجانسة بدلا من المغازل اليدوية.