19 *Egypt. J. Anim. Prod.*, Vol. 27, No. 2, pp. 227-240 (1990)

Effects of Wool Coat Length and Water Deprivation on Seasonal Changes in Some Physiological and Hematological Parameters

M.H. Khalil

Dept. of Animal Prod., Fac. of Agric., Al-Azhar Univ., Nasr City, Cairo, Egypt.

TWENTY NINE Barki ewes (Egyptian fat tailed breed) were used in this study. They were divided according to their wool length into 9 unshorn, 10 half-shorn and 10 shorn. Each of the three groups of sheep was devided into two subgroups : one was given water ad libitum and the other was deprived of water for a period of 72 hr in summer and 96 hr in winter. During the experimental period all ewes were kept under shade and the control group was separated from the water deprived animals. Physiological measurements were taken every 12 hr. Blood samples were collected every 24 hr for measurements of percent hematocrit.

Sheep were able to withstand dehydration up to 19.9% loss in body weight without ill effects. Also they rapidly rehydrated in winter and overhydrated in summer.

In both seasons the wool coat had significant ($P < 0.05$) effect on rectal and skin temperatures and respiration rate, where under shade they increased with increasing wool length.

Dehydration caused an increase in rectal and skin temperatures in summer while it has an inverse effect in winter. Respiration rate decreased by dehydration in summer. In winter, percent hematocrit increased gradually with gradual increase in the water deprivation period.

Key words : Sheep, wool length, water deprivation, Physiological and hematological parameters.

The fat-tailed sheep were reported by several workers (Hafez *et al.*, 1956; Juma *et al.*, 1971; Khalil, 1980 and Khalil, 1985 & 1989) to exhibit significant seasonal and diurnal variations in rectal and skin temperatures and respiratory frequency. Although the rectal temperature changes were statistically significant, their magnitude was small (about 1.0 C). This finding condradict the reported thermostability of fat tailled sheep, *i.e.*, Awassi (Degen, 1977) and the Australian Meruno (Macfarlane, 1964 and Johnson, 1971).

Water deprivation for three days in Barki sheep kept in Egypt's northwestern desert during the summer caused a decrease in body weight of up to 20 percent. The sheep continued to eat during dehydration period (Khalil, 1990-a). In another study at the same location, Khalil (1980) found that dehydration for 56 hr decreased body weight 11 to 16 percent. Dehydrated sheep had similar rectal temperatures, and lower respiration rate than hydrated sheep.

In sheep, the heavy wool fleece acts as a protector by lowering heat loss in cold environments and by decreasing heat gain in hot environments. Thermal insulation of the fleece has been studied under field conditions in Barki (Khalil, 1980 and Khalil *et al.*, 1985) When animals were exposed to sun, the unshorn animals were more tolerant as a result of the fleece's insultation from solation. On the other hand, shorn sheep under shade were more heat tolerant than unshorn ones.

Literature on the physiological and behavioral of sheep with various wool coat length during water deprivation period is scanty. The objective of this paper is examine some physiological and behavioral changes that may be used to modify common practices in sheep management to improve their productivity in the tropics.

Material and Methods

The present experiments were conducted on 29 Barki ewes (an Egyptian fat tailed breed), 3-3.5 years old with an average body weight of 29.64 ± 0.70 kg. The animals were maintained at an experimental station supervised by the Faculty of Agriculture, Al-Azhar University and located at El-Hammam, Matrouh Governorate, Egypt. Before and during conducting these experiments all animals were kept under semi-open sheds day and night. They were fed on hay and concentrates according to their body weight requirements (Morrison, 1959). Water was provided *ad libitum* twice daily during the pre-experimental periods. All animals were healthy and clinically free from diseases.

The experimental animals were divided according to their wool length into 9 unshorn, 10 half-shorn and 10 shorn. The unshorn group had a mean wool length of 14.67 ± 1.07 cm and 11.95 ± 0.52 cm in summer and winter respectively, and a mean fibre diameter of 27.77 ± 1.69 um and 31.53 ± 1.15 um in the same respective order. The half-shorn group had a mean wool length of 3.75 ± 0.19 cm and 2.70 ± 0.16 cm in summer and winter respectively and a mean fibre diameter of 32.51 ± 1.58 um and 27.56 ± 0.73 um in the same respective order. In this group shearing was performed about three months prior to the start of the experiments. In the shorn animals shearing was carried out 25 days prior to the start of the experiments in order to avoid the effect of shearing on the measured parameters (Slee and Sykes, 1967, and McNatty *et al.*, 1972).

Experiments were carried out in normal (hydrated) and water deprived ewes during each of the summer (July and August) and winter (January and February), seasons.

In each experiment each of the three groups was divided into two sub-groups, where one was given water *ad libitum* and the other deprived of water for 72 hr in summer and 96 hr in winter. Animals were weighed at the begining and every 24 hr thereafter during the experimental period and the percent dehydration was calculated.

Blood was collected by jugular venepuncture at zero time (08.00 h) and then again every 24 hr thereafter. Percent hematocrit (Ht) was measured using a microhematocrit centrifuge according to Bauer (1970).

Rectal (Tre) and skin (Tsk) temperatures, respiration rate par minute (RR) and pulse rate (PR) were measured at zero time (08.00 h) and then again every 12 hr thereafter. Tre and Tsk were measured using a Yellow Spring Telethermometer. The RR was done by counting flank movement and PR was measured by a clinical stethoscope placed on the apex of the heart.

The length and diameter of wool fibres were measured during summer and winter seasons using wool samples that were taken from the right-mid-side position of the animals. Fibre length and diameter were measured according to the I.W.T.O. (1952 and 1961).

Ambient temperature (Ta) (*i.e.* dry bulb temperature) and percentage of relative humidity (RH) were measured by a thermohygrograph located about 1.5 meters from the ground. The meteorological data are presented in Table (1).

Statistical analyses of the multifactor experiments having repeated measures on the same animal were carried out as described by Winer (1971). The "t" test was used to test the significace between the normal and dehydrated groups within each time and within each wool length group. (Snedecor and Cochran, 1973 and Ronald, 1974).

TABLE 1. **Meteorological data at the site of the experiments during the time of measurement.**

Season	Summer				Winter			
	Tac		RH%		Tac		RH%	
Water deprivation period	8 a.m.	8 p.m.	8 a.m.	8 p.m.	8 a.m.	8 p.m.	8 a.m.	8 p.m.
Zero-12 hr	28	26	60	65	15	13	70	68
24-36 hr	29	26	60	74	16	15	62	76
48-60 hr	28	25	56	76	15	14	56	78
72-84 hr	—	—	—	—	17	15	54	70
96 hr	—	—	—	—	18	—	52	—

Results and Discussion

Body weight

Regardless of the wool coat length, the percent body weight loss after 72 hr of water deprivation was 13.12% in summer. Respective figure in winter after 96 hr of water deprivation was 19.88%.

Rehydration

In winter, rehydration occurred rapidly, where the dehydrated ewes drank enough to restore about 85.9% of the water loss within 5-8 minutes. In summer, overhydration was observed, where the dehydrated ewes drank about 136.5% of their water loss within 2-6 minutes.

The data presented in this paper establish the remarkable ability of sheep to withstand dehydration up to 19.9% without exhaustion. Additionaly, the capacity for rapid of dehydration and overhydration is similar to other findings (Yousef *et al.*, 1970 and Khalil, 1990-a). The notable tolerance to high level of dehydration and the rapid of rehydration may be explained by the ability of the animals to regulate their plasma volume (Yousef *et al.,* 1970 and Khalil, 1990-a).

Rectal (Tre) and skin (Tsk) Temperatures

The average Tre and Tsk for all subgroups in both seasons are presented in Tables (2 and 3).

In both seasons, in the normal (hydrated) group either at 8 a.m. or at 8 p.m. the wool coat length had a significant ($P < 0.05$) effect on both Tre and Tsk. As wool length increased Tre and Tsk rose. This result is perhaps due to the thermal insulation of the fleece (Salem *et al.,* 1982 and Khalil *et al.,* 1985). Under shade, the heavy wool fleece acts as a protector by lowering heat loss (Khalil, 1980 and Khalil *et al.,* 1985). Thus, in summer the shorn sheep under shade were more heat tolerant than the unshorn ones.

In summer, regardless of both wool coat length and water deprivation period, the overall mean Tre in the normal (hydrated) group was 39.3 ± 0.06 and 39.7 ± 0.09 C at 8 a.m. and 8 p.m. respectively. Respective figures in winter were 38.9 ± 0.06 and 39.2 ± 0.05 C. The respective overall means of Tsk in summer were 38.4 ± 0.13 and 38.0 ± 0.2 C at 8 a.m. and 8 p.m. respectively. In winter, it was 36.7 ± 0.21 and 36.0 ± 0.27 C in the same respective order. The average differences between summer and winter was greater for Tsk (1.7 and 2.0 C at 8 a.m. and 8 p.m. respectively) than for Tre (0.4 and 0.5 C at 8 a.m. and 8 p.m. respectively). The fat-tailed breeds of Egypt were reported by several workers (Khalifa, 1982 and Khalil *et al.,* 1985 & 1989) to exhibit significant seasonal and diurnal variations in Tre and Tsk. Although the seasonal variations in Tre were statistially ($P < 0.05$) significant, their magnitude was only 0.4 and 0.5 C at 8 a.m. and 8 p.m. The relative thermostability of Barki fat-tailed sheep was also reported in Awassi (Degen, 1977). Strict homeothermy seems to be a characteristic of sheep in general (Johnson, 1971) even when dehydrated (Macfarlane, 1964). The remarkable thermostability of Barki sheep observed herein may be attributed to a greater ($P < 0.01$) seasonal difference in Tsk (1.7 and 2.0 C at 8 a.m. and 8 p.m.). Skin temperature is regulated by blood flow to the skin, thus reduced peripheral blood flow (Vasocanstriction), Contributes to decreased heat loss

TABLE 2. Means ± standard errors of rectal and skin temperatures, respiration rate (respiration/min) and pulse rate (pulse/min) of hydrated (control) and water deprived shorn, half-shorn and unshorn Barki ewes during 72 hr water deprivation period in summer season.

Wool coat length	Water deprivation period	Rectal Temp. C. Control	Rectal Temp. C. Water deprived	Skin Temp. C Control	Skin Temp. C Water deprived	Respiration rate Control	Respiration rate Water deprived	Pulse rate Control	Pulse rate Water deprived
Shorn	Zero time D.	38.8 ± 0.0	38.4 ± 0.3	37.3 ± 0.1	37.2 ± 0.1	18.8 ± 1.6	19.8 ± 2.2	52.0 ± 1.6	51.0 ± 3.8
	24 hr D.	39.2 ± 0.2	39.2 ± 0.1	37.6 ± 0.3	38.4 ± 0.1	21.8 ± 1.1	19.6 ± 1.9	106.0 ± 4.6	69.0 ± 3.8
	36 hr N.	39.9 ± 0.2	39.9 ± 0.0	37.3 ± 0.3	38.2 ± 0.1	17.2 ± 0.8	22.6 ± 1.9	96.0 ± 5.4	88.0 ± 1.9
	48 hr D.	39.3 ± 0.1	38.6 ± 0.1	38.3 ± 0.2	37.3 ± 0.1	21.8 ± 1.7	17.4 ± 0.4	88.0 ± 6.0	81.0 ± 4.8
	60 hr N.	39.4 ± 0.2	39.2 ± 0.1	37.3 ± 0.5	36.9 ± 0.3	16.0 ± 0.7	15.4 ± 0.2	76.0 ± 6.5	70.0 ± 2.8
	72 hr D.	39.2 ± 0.1	39.9 ± 0.1	38.5 ± 0.1	39.0 ± 0.1	57.8 ± 5.9	22.8 ± 0.2	89.0 ± 6.2	106.0 ± 3.5
Half-Shorn	Zero time D.	39.4 ± 0.1	39.0 ± 0.1	38.6 ± 0.1	38.3 ± 0.1	24.5 ± 6.5	22.2 ± 3.5	49.0 ± 0.7	46.0 ± 1.4
	24 hr D.	39.4 ± 0.1	39.5 ± 0.1	38.6 ± 0.2	38.8 ± 0.0	24.8 ± 0.9	37.6 ± 9.2	90.0 ± 10.0	72.0 ± 5.4
	36 hr N.	39.9 ± 0.1	40.1 ± 0.1	38.2 ± 0.2	39.0 ± 0.2	20.8 ± 0.8	21.2 ± 0.9	94.0 ± 14.5	85.0 ± 5.2
	48 hr D.	39.1 ± 0.2	39.1 ± 0.1	38.5 ± 0.2	38.1 ± 0.1	45.0 ± 12.7	17.2 ± 1.0	88.0 ± 14.7	77.0 ± 5.0
	60 hr N.	39.5 ± 0.1	39.3 ± 0.1	38.1 ± 0.1	37.7 ± 0.5	29.3 ± 9.4	17.2 ± 1.1	77.0 ± 11.2	65.0 ± 5.0
	72 hr D.	39.2 ± 0.1	40.3 ± 0.1	38.6 ± 0.2	39.8 ± 0.2	50.5 ± 19.1	48.6 ± 9.2	87.0 ± 3.6	98.0 ± 5.5

TABLE 2. (Cont.).

Un-Shorn	Zero time D.	39.1 ± 0.1	39.1 ± 0.1	38.4 ± 0.2	38.3 ± 0.1	47.8 ± 7.6	32.8 ± 4.7	48.0 ± 1.2	46.0 ± 2.2
	24 hr D.	39.4 ± 0.2	39.9 ± 0.1	38.3 ± 0.3	39.2 ± 0.1	49.0 ± 10.4	37.8 ± 5.8	85.0 ± 5.9	71.0 ± 4.6
	36 hr N.	39.7 ± 0.1	40.4 ± 0.1	38.5 ± 0.1	39.2 ± 0.1	23.8 ± 1.7	25.6 ± 2.8	89.0 ± 6.1	92.0 ± 6.1
	48 hr D.	39.6 ± 0.2	39.6 ± 0.2	38.8 ± 0.1	38.3 ± 0.2	69.0 ± 16.0	29.6 ± 4.1	84.0 ± 6.2	87.0 ± 4.0
	60 hr N.	39.5 ± 0.1	39.5 ± 0.2	37.8 ± 0.2	38.1 ± 0.3	26.2 ± 5.6	20.0 ± 2.3	76.0 ± 6.1	69.0 ± 8.8
	72 hr D.	39.3 ± 0.1	40.2 ± 0.2	38.7 ± 0.1	39.6 ± 0.2	57.0 ± 14.6	57.2 ± 8.6	85.0 ± 6.4	99.0 ± 7.2
Overall mean	Zero time D.	39.1 ± 0.1	38.8 ± 0.1	38.1 ± 0.2	37.9 ± 0.2	30.4 ± 4.8	24.9 ± 2.5	49.7 ± 0.9	47.8 ± 1.5
	24 hr D.	39.3 ± 0.1	39.5 ± 0.1	38.1 ± 0.2	38.9 ± 0.1	32.4 ± 4.9	31.7 ± 4.1	93.9 ± 4.4	70.9 ± 2.5
	36 hr N.	39.8 ± 0.1	40.1 ± 0.1	38.0 ± 0.2	38.8 ± 0.1	20.6 ± 0.1	23.1 ± 1.2	92.9 ± 5.0	88.2 ± 2.7
	48 hr D.	39.3 ± 0.1	39.1 ± 0.1	38.5 ± 0.1	38.0 ± 0.1	45.3 ± 8.3	21.0 ± 1.0	86.4 ± 5.1	81.9 ± 2.7
	60 hr N.	39.4 ± 0.1	39.4 ± 0.1	37.7 ± 0.2	37.6 ± 0.2	23.4 ± 3.4	20.0 ± 1.0	75.9 ± 4.1	67.7 ± 3.3
	72 hr D.	39.2 ± 0.1	40.1 ± 0.1	38.6 ± 0.1	39.5 ± 0.1	53.8 ± 6.9	42.9 ± 5.6	87.1 ± 3.2	101.3 ± 3.1

D = Measurement taken at 8 a.m.
N = Measurement taken at 8 p.m.

TABLE 3. Means ± standard errors of rectal and skin temperatures, respiration rate (respiration/min) and pulse rate (pulse/min) of hydrated (control) and water deprived shorn, half-shorn and unshorn Barki ewes during 96 hr water deprivation period in winter season.

Wool coat length	Water deprivation period	Rectal Temp. C		Skin Temp. C		Respiration rate		Pulse rate	
		Control	Water deprived	Control	Water deprived	Control	Water deprived	Control	Water deprived
Shorn	Zero time D.	38.9 ± 0.1	39.2 ± 0.1	37.2 ± 0.2	37.2 ± 0.3	20.3 ± 1.2	33.4 ± 1.5	93.0 ± 4.8	101.0 ± 2.0
	24 hr D.	38.8 ± 0.1	39.3 ± 0.1	35.3 ± 0.4	36.5 ± 0.3	18.6 ± 0.9	33.8 ± 5.3	75.0 ± 1.3	88.0 ± 2.3
	36 hr N.	39.0 ± 0.1	38.8 ± 0.2	35.1 ± 0.6	34.3 ± 0.4	20.3 ± 3.3	20.2 ± 1.3	71.0 ± 1.5	88.0 ± 3.8
	48 hr D.	38.7 ± 0.1	39.0 ± 0.7	37.6 ± 0.2	37.3 ± 0.2	21.0 ± 1.2	21.4 ± 1.4	61.0 ± 1.0	84.0 ± 5.3
	60 hr D.	39.2 ± 0.9	39.9 ± 0.1	36.7 ± 1.7	34.3 ± 0.2	19.3 ± 1.9	19.2 ± 1.1	84.0 ± 1.0	89.0 ± 2.6
	72 hr D.	38.7 ± 0.2	39.2 ± 0.1	36.3 ± 0.4	36.8 ± 0.3	23.3 ± 1.8	21.4 ± 2.0	72.0 ± 2.2	84.0 ± 5.7
	84 hr N.	39.0 ± 0.1	38.9 ± 0.1	35.5 ± 0.1	33.5 ± 0.1	15.3 ± 0.7	18.2 ± 1.0	87.0 ± 4.3	108.0 ± 3.2
	96 hr D.	38.5 ± 0.4	38.4 ± 0.2	35.4 ± 0.3	34.5 ± 0.4	23.0 ± 2.1	15.8 ± 0.9	76.0 ± 7.2	85.0 ± 3.9
Half-Shorn	Zero time D.	38.8 ± 0.1	39.2 ± 0.1	36.4 ± 0.1	37.2 ± 0.3	20.4 ± 1.0	35.2 ± 2.3	90.0 ± 5.1	98.0 ± 5.3
	24 hr D.	39.0 ± 0.1	39.2 ± 0.2	36.9 ± 0.3	35.7 ± 0.8	18.6 ± 1.0	21.6 ± 1.0	79.0 ± 3.5	88.0 ± 4.8
	36 hr N.	39.1 ± 0.1	39.0 ± 0.2	35.0 ± 0.3	34.1 ± 0.5	22.8 ± 2.0	23.4 ± 2.5	81.0 ± 1.7	85.0 ± 2.4
	48 hr D.	39.0 ± 0.2	38.9 ± 0.1	37.9 ± 0.1	37.1 ± 0.6	21.0 ± 0.7	19.4 ± 1.0	71.0 ± 3.6	82.0 ± 4.0
	60 hr N.	39.4 ± 0.1	39.2 ± 0.1	36.9 ± 0.2	35.0 ± 0.3	20.0 ± 1.2	18.4 ± 1.3	95.0 ± 5.7	98.0 ± 1.8
	72 hr D.	38.9 ± 0.1	39.1 ± 0.1	37.1 ± 0.3	36.9 ± 0.5	22.8 ± 1.6	18.6 ± 0.9	75.0 ± 3.3	87.0 ± 4.8
	84 hr N.	39.1 ± 0.1	39.3 ± 0.1	36.7 ± 0.4	33.3 ± 0.6	19.0 ± 2.0	19.6 ± 1.3	88.0 ± 2.5	108.0 ± 4.6
	96 hr D.	38.4 ± 0.1	38.9 ± 0.1	35.7 ± 0.4	34.4 ± 0.7	19.0 ± 1.5	15.2 ± 1.0	81.0 ± 4.6	98.0 ± 5.6

TABLE 3. (Cont.).

Un-Shorn	Zero time D.	39.1 ± 0.1	39.4 ± 0.3	37.4 ± 0.2	38.3 ± 0.1	27.0 ± 4.4	31.5 ± 1.9	87.0 ± 1.8	88.0 ± 4.8
	24 hr D.	39.4 ± 0.3	39.7 ± 0.4	36.4 ± 0.4	33.2 ± 0.5	26.5 ± 2.9	30.7 ± 11.4	76.0 ± 3.1	88.0 ± 5.5
	36 hr N.	39.2 ± 0.2	39.3 ± 0.2	35.0 ± 0.6	34.6 ± 0.3	27.0 ± 2.4	21.5 ± 1.9	76.0 ± 3.1	90.0 ± 6.0
	48 hr D.	39.0 ± 0.1	39.3 ± 0.2	37.7 ± 0.1	37.4 ± 0.1	23.0 ± 1.1	21.8 ± 1.1	71.0 ± 3.3	88.0 ± 2.8
	60 hr N.	39.4 ± 0.2	39.3 ± 0.2	36.8 ± 0.6	35.7 ± 0.2	24.5 ± 1.0	20.0 ± 0.4	94.0 ± 3.2	92.0 ± 7.4
	72 hr D.	39.1 ± 0.1	39.3 ± 0.1	37.1 ± 0.2	36.1 ± 1.0	25.8 ± 1.4	20.5 ± 2.1	73.0 ± 3.3	75.0 ± 5.3
	84 hr N.	39.0 ± 0.1	39.1 ± 0.2	36.7 ± 0.2	32.2 ± 0.4	23.3 ± 0.9	19.3 ± 1.4	88.0 ± 4.1	100.0 ± 4.5
	96 hr D.	38.9 ± 0.1	39.2 ± 0.1	36.6 ± 0.5	32.0 ± 0.10	24.5 ± 2.9	17.8 ± 1.5	80.0 ± 2.9	75.0 ± 3.2
Overall mean	Zero time D.	38.9 ± 0.1	39.3 ± 0.1	36.9 ± 0.2	37.5 ± 0.3	22.6 ± 1.7	32.8 ± 1.3	90.0 ± 3.0	96.0 ± 2.8
	24 hr D.	39.1 ± 0.1	39.4 ± 0.1	36.5 ± 0.2	35.4 ± 0.5	21.3 ± 1.5	28.8 ± 3.1	77.0 ± 1.8	88.0 ± 2.2
	36 hr N.	39.1 ± 0.1	39.0 ± 0.1	35.0 ± 0.2	34.8 ± 0.2	23.6 ± 1.5	22.0 ± 1.3	77.0 ± 1.9	87.0 ± 3.7
	48 hr D.	38.9 ± 0.1	39.0 ± 0.1	37.8 ± 0.1	37.3 ± 0.2	21.7 ± 0.6	20.8 ± 0.7	69.0 ± 3.3	85.0 ± 2.4
	60 hr N.	39.4 ± 0.1	39.1 ± 0.1	36.7 ± 0.2	34.9 ± 0.2	21.8 ± 1.0	19.1 ± 0.6	92.0 ± 2.8	94.0 ± 2.3
	72 hr D.	39.1 ± 0.1	39.2 ± 0.1	36.9 ± 0.2	36.6 ± 0.3	23.9 ± 0.9	20.3 ± 1.0	73.0 ± 1.6	83.0 ± 3.1
	84 hr N.	39.0 ± 0.1	39.1 ± 0.2	36.5 ± 0.2	33.1 ± 0.3	19.5 ± 1.2	19.0 ± 0.7	88.0 ± 3.5	106.0 ± 2.5
	96 hr D.	38.6 ± 0.1	38.8 ± 0.1	35.9 ± 0.3	33.7 ± 0.5	21.8 ± 1.4	16.4 ± 0.8	79.0 ± 2.6	87.0 ± 3.6

D = Measurement taken at 8 a.m.
N = Measurement taken at 8 p.m.

from the skin to the environment. On the other hand, increased peripheral blood flow (vasodilation), results in high heat loss from the skin to the environment (Folk, 1974). Thus, the response of the peripheral vasomoter system in sheep may act as regulator of body temperature by increasing or decreasing the rate heat loss.

Water deprivation for three days in summer increased Tre by 0.7, 0.3 and 1.3°C after 24, 48 and 72 hr. Respective values for Tsk were 1.0, 0.1 and 1.6°C. In the normal (hydrated) group the change in Tre and Tsk did not exceeded 0.2°C and 0.5°C, respectively. On the other hand, in winter Tre decreased 0.1, 0.3, 0.1 and 0.5°C after 24, 48, 72 and 96 hr of water deprivation. The decrease in Tsk was 2.1, 0.2, 0.9 and 3.8°C in the same respective order. In the hydrated group, Tre and Tsk decreased only 0.3 and 1.0°C respectively.

water deprivation reduced total body fluid in both summer and winter (Khalil, 1990-a). Thus during the hot season (summer) the dehydrated ewes were not able to increase evaporative water heat loss similar to that of the hydrated ones (Khalil *et al.,* 1985) resulting in a greater rise in Tre and Tsk. On the other hand, during winter (cold) the dehydrated ewes were not capable of increasing their metabolic heat production to the same level in the hydrated (Khalifa, 1982). thus Tre and Tsk decreased.

Cardiorespiratory activities

In summer, respiration rate was significantly ($P < 0.05$) affected by the presence of the wool coat. Generally, normal and dehydrated had the highest respiration rate when the animals were unshorn, however, the lowest and intermediate values were observed in the shorn and half-shorn groups respectively (Tables 2 and 3). The data suggest that the presence of long wool on the sheep's back in summer time may have hindered skin evaporative heat loss from the skin (Khalil *et al.,* 1985), and perhaps stimulated a greater rise in respiratory evaporative water loss.

Irrespective of the wool coat length,respiration rate in the hydrated group was 40.7 ± 5.0 and 22.3 ± 0.7 in summer and winter respectively. At higher ambient temperatures respiration rate increased resulting in greater heat loss (Salem *et al.,* 1982).

This may explain the significant ($P < 0.05$) seasonal rhythm observed herein at 8 a.m. in the normal group.

In summer, respiration rate was significantly ($P < 0.05$) higher in the normal group than that of the dehydrated group. The dehydrated animals may have reduced their RR in order to reduce oxygen consumption (Khalifa, 1982) and in turn heat production. As a consequence of decreased metabolic rate, less water is needed for evaporative heat loss as compared to that of the normal animals represent in an adaptive mechanism for water conservation during the hot season. Besides reducing RR decreased water loss by respiratory evaporation.

Pulse rate is known to be affected by various factors which are difficult to interpret. However, the comparison is possible between hydrated and dehydrated ewes where pulse rate was significantly ($P < 0.05$) higher in the dehydrated animals after 72 hr of water deprivation in summer and 72, 84 and 96 hr in winter. It has been previously noted that dehydration in sheep caused elevation in adrenaline and cortisol hormones (Khalil, 1980 & 1990-b and Elsherbiny, 1983). These hormones are known to increase the heart rate.

Hematocrit

The average percent hematocrite for all hydrated subgroups in summer was 23.5 ± 0.9, 21.5 ± 0.9, 24.6 ± 1.4 for the shorn, half-shorn and unshorn ewes respectively. In winter it was 23.5 ± 0.5, 24.2 ± 0.4 and 21.8 ± 0.5 in the same respective order. In the hydrated (normal) group regardless of wool coat length the overall mean of percent hematocrit was 23.4 ± 1.0 and 23.2 ± 0.4 in summer and winter respectively. There was no significant differences in percent hematocrit due to either season or wool coat length.

Dehydration had no significant effect on percent hematocrit either in summer or in winter. In summer, the overall mean percent hematocrit in the dehydrated group was 23.3 ± 0.5, 24.9 ± 0.7 and 23.9 ± 0.7 after 24, 48 and 72 hr of water deprivation. In winter, it was 23.8 ± 0.8, 24.5 ± 2.6, 25.4 ± 0.7 and 26.4 ± 1.0 after 24, 48, 72 and 96 hr of water deprivation. These results indicated that there was a gradual increase in the percent hematocrit in the dehydrated group in winter and not in summer. The relatively unchanged hematocrit reflects a clue to the stability of plasma valume and perhaps mininal circulatory adjustments (Khalil, 1990-a).

Acknowledgement

Thank are due to the late Prof. Ahmed S. El-Sheikh and Prof. Mohamed K. Yousef. This study was supported by the American National Science Foundation Grant No. 01P74-04785.

References

Bauer, J.D. (1970) Numerical evaluation of **red blood cells, white blood cells** and plateles. Part III. Haematology in **Grandwool Clinical Laboratory** Methods and Annerwirth, the C.V. Mosby Co., Saint Louis, 17 : 489.

Degen, A.A. (1977) Fat tailed Awassi and German Mutton Merino sheep under semiarid conditions. **J. Agric. Sci.,** 88 : 699.

El-Sherbiny, A.A. (1983) Daily and seasonal rhythm in cortisol, T_3 and T_4 in blood plasma of dehydrated sheep with different wool length. Al-Azhar Agric. Res. **Bull. Bull. No. 88.**

Folk, G.E. (1974) "Test Book of Environmental Physiology". Lea & Febigier, Philadelphia.

Hafez, E.S.E., Badereldin, A.L. and **Sharafeldin, M.A.** (1956) Heat tolerance studies of fat-tailed sheep in the subtropics. **J. Agric. Sci. 47 : 280.**

I.W.T.O. (1952) Measurements of wool fibre length. Wool Science Review. No. 9, Carlton Gradens, London, S.W.I.

I.W.T.O. (1961) Method of Determining Wool Fibre Diameter by The Projection Microscope. International Wool Secreteriat Research Department, Carlton Gardens, London, S.W.I.

Johnson, K.G. (1971) Body **temperature lability in sheep and goats during** short-term exposure to heat and cold. **J. Agric. Sci., 77 : 267.**

Juma, K.H., Gharib, F.H. and Eliya, J. (1971) A note on studies on heat tolerance in Awassi sheep. **Animal Prod. 13 : 369.**

Khalifa, H.H. (1982) Wool coat and thermoregulation in sheep under **Egyptian conditions. Ph.D. Thesis. Fac. of Agric. Al-Azhar Univ. Cairo, Egypt.**

Khalil, M.H. (1980) Studies on the wool coat of sheep and its relation to their adaptability to the Egyptian environment. Ph.D. Thesis, Anim. Prod. Dept. Fac. of Agric. **Al-Azhar University, Cairo, Egypt.**

Khalil, M.H. (1990-a) Effect of water deprivation and wool coat length on body fluid compartments in Barki sheep. **Egypt. J. Anim. Prod.,** 27 : 89.

Khalil, M.H. (1990-b) Effects of wool coat length and water deprivation on seasonal changes in thyroid and adrenal cortical functions. **Egypt. J. of** Anim. Prod., 27 : 213.

Khalil, M.H., Abd-el-Bary, M.H., Khalifa, H.H., El-Sharabassy, A.A.M. and El-Sherbiny, A.A. (1985) Effect of the wool coat and dehydration on the diurnal and seasonal rhythm of some physiological functions in sheep under sahara desert condition. Al Azhar Agric. Res. J., IV : 253.

Khalil, M.H., Khalifa, H.H., El-Gabbas, M.H. and Abdel Fattah, M. Sh. (1990) The adaptive responses to water deprivation in local and crossbred sheep. Egyptian J. of Anim. Prod. 27 : 195.

Macfarlane, W.V. (1964) Terestrial animals in dry heat : Ungulates. In : D.B. Dill, E.F. Adolph and C.C. Wilber, (eds.), **Handbook of Physiology.** Section 4 : Adaptation to the Environment. Amer. Physiological Soc., Washington, D.C.

McNatty, K.P., Cashmore, M. and Young, A. (1972) Diurnal variation in plasma cortisol levels in sheep. **J. Endocrinol., 54 : 361.**

Morrison, F.B. (1959) "Feeds and Feeding", 2nd (ed.). The Morrison Publication Co., Inc., Clinton, Iowa.

Ronald, E.W. (1974) "Introduction to Statistics". Macmillan Publishing Co. Inc., New York.

Salem, M.H., Yousef, M.K., **El Sherbiny, A.A. and Khalil, M.H.** (1982) Physiology of sheep and goats in the tropics. In : **"Animal Production in the Tropics".** M.K. Yousef, pp. 148. Praeger Publishers, U.S.A.

Slee, J. and Sykes, A.R. (1967) Acclimatization of Scottish Black Face sheep to cold. I. Rectal temperature response. **J. Anim. Prod. British., 9 : 33.**

Snedecor, G.W. and Cochran, W.G. (1973) **"Statistical Methods". 6th (ed.)** Iowa State Univ. Press. Ames. Iowa, U.S.A.

Winer, B.J. (1971) In "Statistical Principles in Experimental Design" 2nd ed. McGraw-Hill, pp. 515.

Yousef, M.K., Dill, D.B. and Mayes, M.G. (1970) **Shifts in body fluids during** dehydration in the burro, Equus asinus. **J. Applied Physiology, 29 : 345.**

تأثير التعطيش وطول الغطاء الصوفى على الاختلافات الموسمية فى المقاييس الفسيولوجية ومكونات الــــدم

مدحت حسين خليل محمـد

قسم الانتاج الحيوانى ـ كلية الزراعة ـ جامعة الازهر ـ مدينة نصر ـ القاهرة ـ مصر .

استخدم فى هذا البحث عدد ٢٩ نعجة من نعاج البرقى غليظة الاليــــة المصرية . قسمت النعاج تبعا لطول غطائها الصوفى الى عشرة نعاج مجزوزة وعشرة نعاج عليها غطاء صوفى متوسط الطول وتسعة نعاج عليها غطـاء صـــوفى طـــويل .

قسمت كل مجموعة من المجموعات السابقة الى مجموعتان اعطيت احدهما الماء بكميات مفتوحة والاخرى منع عنها الماء لمدة ٧٢ ساعة صيفا و ٨٦ ساعة شتاء . وخلال هذه الفترة كانت كل النعاج تحت الظل مع فصل المجموعة المعطشة من المجموعة المقارنة . وأخذت المقاييس الفسيولوجية كل ١٢ ساعة بينما اخذت عينات الدم كل ٢٤ ساعة .

أظهرت النتائج تحمل الاغنام المعطش حتى فقد من وزنها حوالى ١٩٫٩ ٪ وتستعيد مافقدته أو أكثر منه بدون حدوث مضاعفات . فى كــل مــن الصيف والشتاء كان لطول الغطاء الصوفى اثر معنوى ٥ ٪ على كل من درجة حرارة المستقيم والجلد ومعدل التنفس .

أدى التعطيش الى زيادة درجة حرارة الجلد والمستقيم فى الصــيف بينما ادى الى نقصهم فى الشتاء كما ادى التعطيش أيضا الى نقص معدل التنفس فى الصيف والى زيادة بسيطه فى نسبة كرات الدم الحمــراء (الهيماتوكريت) فى الشتاء .