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Effect of feed deprivation in Anglo-Nubian, Baladi goats and their crossbred under subtropical conditions

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ABSTRACT

Feed deprivation for 3 days progressively reduced body weight, feed and water intake in Egyptian Baladi, exotic Anglo-Nubian and Anglo-Nubian × Baladi crossbred goats during winter and summer. Rectal temperature, pulse rate and respiration rate markedly decreased during starvation. Haemoglobin, packed-cell volume and red blood cells values increased and glucose concentration decreased during starvation, mainly in Anglo-Nubian goats during summer. Response of white blood cell counts to starvation was variable between breeds and seasons. Results reflected a better adaptability of the native Baladi goats in the harsh conditions of newly reclaimed desert areas of Egypt.

Goats adapt to a wide variety of agro-climatic conditions. This ability varies in relation to the environment and between breeds (Silanikove 1985). The aim of this study was to seek information on physiological responses of the imported and local goat breeds to various environmental conditions, and their ability to withstand feed deprivation. These are of practical importance in terms of adaptation.

MATERIALS AND METHODS

Animals and management

The study was conducted on 18 male goats, 6 each of Anglo-Nubian (A), Baladi (B) and crossbred F1 (A × B). These animals belonged to the University of Alexandria Experimental Station. The animals were 1 to 1.5 years old and weighed 25 to 40 kg at the beginning (winter) of the experiment. Animals were individually confined in semi-open pens, in which feed and water intake could be measured. Pens provided enough shade and ventilation in summer and winter. Animals were fed roughage and concentrate supplements according to their body requirements (NRC 1985). The concentrate mixture contained at least 61% TDN and 11.5% DCP. Wheat straw was used as roughage during both summer and winter. Water was offered to animals twice daily in buckets (at 9.00 and 16.00 hr). All animals remained free from disease and behavioural abnormalities throughout the experiment. The same animals were used during summer and winter.

In each season the experiment involved 3 periods, each of 3 days: control (usual feeding), starvation (feed was withheld while water supply continued) and recovery. Body weight was recorded daily before feeding and watering. Feed intake was measured by adding the amount of

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Table 1. Analyses of variance and mean squares for body weight (BW), total feed intake (TFI), total water intake (TWI), rectal temperature (RT), pulse rate (PR), respiration rate (RR), haemoglobin (Hb), red bloods cells (RBC), packed-cell volume (PCV), white blood cells (WBC) and glucose

SOV	df	BW	TFI	TWI	RT	PR	RR	Hb	RBC	PCV	WBC	Glucose
Season(s)	1	5208.83**	11351.72**	56879.60**	10.03**	7374.04**	1514.51**	1437.67**	730.47**	59.46**	1271.32**	21573.08**
Breed (B)	2	1574.07**	110.61	21680.72**	2.23**	653.78**	3.04	4.15**	7.67*	108.82**	101.03**	267.44**
Treatment (T)	2	155.71	209514.42**	396084.69**	10.61	15604.48**	804.45**	61.28**	157.65**	435.10**	25.39**	4012.79**
Day/treat (D/T)	6	21.37	35516.63**	57976.63**	0.66**	484.25**	41.38**	4.53**	9.05	115.63**	2.76	548.44**
S*B	2	202.69**	315.44	9073.98**	2.31**	197.79	29.11**	31.58**	30.12**	367.00**	63.09**	369.54**
S*T	2	25.71	3217.24**	38779.92**	0.25	1867.96**	128.63**	4.81**	6.93	2.44	39.65**	384.48**
B*T	4	4.00	120.17	1651.92	0.05	213.55	12.77	0.49	4.55	6.67	2.04	273.26**
Error	304	31.04	114.85	1067.16	0.15	101.39	5.86	1.01	2.61	14.04	4.52	35.57

*P<0.05; **P<0.01.

roughage and concentrate mixture consumed by each animal. Total daily water intake (TWI) for each animal was calculated by adding the amount of drinking water to the amount of water ingested in the feed. Rectal temperature (RT), respiration rate (RR) and pulse rate (PR) were recorded daily at 09.00 hr during the 9-day experimental period. Daily blood samples were collected from the jugular vein of the animals before access to feed and water. Haemoglobin (Hb), packed-cell volume (PCV), red blood cell (RBC), total white blood cell (WBC) counts (Hepler 1966) and glucose (Hyvarinen and Nikkilla 1962) were determined.

The minimum and maximum ambient air temperature and relative humidity recorded during the summer experimental period were 23° and 30.5°C and 70.5%. The corresponding values in winter were 10.3° and 18°C and 69.2% respectively.

Statistical analyses

Data obtained were statistically analyzed using the statistical analysis system (SAS 1982) to visualize the effects of breed, season, treatment and their interactions on the different parameters.

RESULTS AND DISCUSSION

Starvation caused significant ($P<0.01$) decline in body weight (BW) in all the 3 animal groups during winter and summer (Table 1). The decrease in BW during winter was more pronounced in Anglo-Nubian than in Anglo-Nubian × Baladi crossbred and Baladi goats (Table 2). During summer the crossbred goats had higher reduction (-11.0%) in BW than in Anglo-Nubian or Baladi goats which responded similarly in that respect (-7.6%). This could be due to breed differences in their adaptability to environment. In our study, feed deprivation resulted in a significant ($P<0.1$) decline in total water intake (TWI) in all groups. Season of the year had a significant ($P<0.01$) effect on

TWI of animals (Table 1). The percentage decline in (TWI) was higher in Anglo-Nubian (-64.4%) followed by crossbred (-56.9%) and Baladi goats (-53.4%) in winter. However, it was higher in crossbred (-80.1%) followed by Baladi (-72.1%) and Anglo-Nubian (-70.5%) in summer (Table 2). The higher percentage change in TWI during summer than during winter was due to the high consumption of water during control period in summer (Table 1). The decrease in BW might be attributed to the decrease in water intake as a result of feed deprivation of animals (Rule *et al.* 1985, Cole *et al.* 1986, Aly 1989).

The season of the year had significant ($P<0.01$) effect on body weight and water intake after starvation. However, the interaction between season and treatment was significant ($P<0.01$) only with TWI. After starvation during winter, high BW loss noted was mainly due to the increase in metabolic rate and energy production in cold environment (Degen and Young 1981). Rule *et al.* (1985) stated that during fasting the rate of fatty acid mobilization from a depose tissue is accelerated to conserve energy, especially during winter.

RT, RR and PR tended to be higher in animals during summer than in winter (Table 2). During the control period (normal feeding), in animals of all breeds, RR and PR were higher during summer than during winter, suggesting a heat load on animals during hotest months of the year. In Baladi breed body temperature was stable (38.9°C) in winter and summer, whereas in Anglo-Nubian crossbred goats RT increased from winter to summer. The decrease in RT on the third day of starvation was higher in Anglo-Nubian than in Baladi goats both during winter and summer (Table 2). The same trend was observed for changes in the PR. However, changes in RR were different, the decrease was higher in Baladi than in Anglo-Nubian goats either in winter or in summer respectively (Table 2). The crossbred responded somewhere between the two breeds. The interaction of season and breed (Table 1) for the above parameters showed significant effects except for PR. The changes in RR during summer enhanced heat dissipation. This

Table 2. Percentage, changes in various physiological paramters after 3 days starvation in Anglo-Nubian (A), Baladi (B) and their crossbred (AB) goats during summer and winter seasons

Parameter	Winter			Summer		
	A	B	AB	A	B	AB
Body weight	-16.7	-12.1	-12.2	-7.6	-7.5	-11.0
Total water intake	-64.4	-53.4	-56.9	-70.5	-72.1	-80.1
Water intake (drinking)	-36.3	-32.5	-33.2	-55.6	-59.2	-54.9
Rectal temperature (RT)	-2.3	-1.8	-1.8	-2.3	-1.5	-2.3
Respiration rate (RR)	-18.5	-29.2	-29.4	-31.5	-39.1	-38.8
Pulse rate (PR)	-24.4	-19.7	-28.2	-37.1	-29.5	-36.9
Haemoglobin concentration	+11.6	+15.7	+20.7	+22.9	+9.1	+20.0
Red blood cells	+18.3	+14.4	+22.3	+19.4	+13.2	+24.3
Packed cell volume	+20.8	+10.8	+17.6	+20.2	+18.0	+19.6
White blood cells	-27.9	-3.0	+6.0	+17.9	+5.0	-3.6
Glucose concentration	-36.9	-8.9	-41.9	-43.6	-34.4	-24.3

was sufficient to prevent greater changes in RT during summer. This means that Baladi goats can dissipate heat in high environmental temperature by a route other than pulmonary evaporation. Aly (1989) reported that exposure of Egyptian sheep and goats to feed deprivation caused significant decline in RT, RR and PR. These observations were in agreement with our findings. The reduction in these parameters is attributed to the reduction in metabolic rate associated with fasting (Finch and King 1992).

The increases ($P<0.01$) in Hb, RBC and PCV values during starvation are mainly due to the decrease in TWI causing a reduction in blood and plasma volumes (Table 1). These findings are in agreement with those of Schaefer *et al.* (1990). The higher increase in Hb and PCV values in Anglo-Nubian than in the other 2 breeds, particularly during summer, may indicate inadaptability of this breed to the environmental condition of subtropical areas characterized by hot climate and inadequate feed source. The results clearly showed that the withdrawal of feed had inconsistent effects on WBC counts. These values decreased during winter and increased during summer in Anglo-Nubian and Baladi goats. The crossbreds behaved differently either in winter or in summer. The increase in WBC values in Anglo-Nubian and Baladi goats during summer may be explained partly by the haemoconcentration, but their decrease during winter is not understood. Lee and Kim (1989) found that WBCs in blood tended to increase at early periods of fasting and to decrease thereafter. The significant decreases ($P<0.01$) in blood glucose after starvation in all these breeds and during both seasons were expected (Table 1) and were in agreement with the results of Ozutsumi *et al.* (1984) and Shorthose and Wythes (1988). The hypoglycemic state was obvious in Anglo-Nubian goats than in Baladi goats, indicating the ability of the native breed to tolerate poor feeding because of light body weight and smaller energy requirements. This breed difference in maintenance was reported by Silanikove *et al.* (1980) in their study on Bedouin goats.

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