

EFFECT OF FEED DEPRIVATION ON SOME BIOCHEMICAL PARAMETERS OF ANGLO-NUBIAN AND BALADI GOATS AND THEIR CROSSBRED UNDER SUBTROPICAL CONDITIONS

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SUMMARY

Anglo-Nubian, Baladi and their crossbred goats were subjected to three days feed restriction during winter and summer seasons. Water was provided ad-libitum throughout the experiment. Blood samples were collected every morning from the jugular vein of the treated animals and were used for chemical analysis.

Feed deprivation caused decreases in blood and plasma volumes of all animals during winter and summer seasons which were mainly attributed to reduced feed and water intakes. This in turn caused elevation in plasma osmolality. In addition, starvation caused elevation in serum contents of total protein (TP), albumin (A), globulin (G), urea-Nitrogen (U-N), creatinine (Cr), glutamic oxaloacetic transaminase (GOT), and glutamic pyruvic transaminase (GPT). However, alkaline phosphatase (AP), showed reduced levels in starved animals than during the control period.

Variations in these parameters were found between animals and between seasons. With exception of alkaline phosphatase the Anglo-Nubian breed showed the greatest elevation in most of these parameters followed by crossbred, then Baladi goats.

This indicated better tolerance of the native goats to feed deprivation than the pure exotic breed.

Keywords: Anglo-Nubian goats, Baladi goats, Feed restriction, Season, Blood, Biochemical parameters

INTRODUCTION

The importance of goats is limited to rural areas where their milk and meat are consumed. Goats are known by their great adaptation to desert life where they travel long distances searching for food. Food is essential for maintenance of animal homeostasis and proper performance. However, the availability of feed to animals is limited sometimes due to environmental conditions or during animal transport. There is lack of information which shows the extent of physiological change in animals during and after short-term feed restriction.

Several attempts were made in Egypt to improve the performance of the local breeds by crossbreeding for upgrading them with improved breeds imported from several countries. Anglo-Nubian goat breed was imported to Egypt since it proved in many countries its outstanding adaptability expressed in terms of high reproductive performance and weight gain (Devendra and Burns, 1970). The objective of the present study was to evaluate the performance of the Anglo-Nubian and Baladi goats and their crossbred under conditions of feed restriction during winter and summer seasons in Egypt, in terms of changes in certain blood biochemical parameters.

MATERIALS AND METHODS

Animals and Management

The animals used in this study were 18 male goats [6 Anglo-Nubian (A), 6 Baladi (B) and 6 crossbred (AxB, F₁)] belonging to the University of Alexandria Experimental Station. The animals were 1 to 1.5 years of age and weighing between 25 to 40kg at the beginning of the experiment. The animals were individually confined in semi-open pens, in which feed and water can be measured. The pens provided adequate shade and ventilation in

summer and winter. Animals were fed roughage and concentrate supplement according to their body requirements (Morrison, 1959). The concentrate mixture contained at least 61% total digestible nutrients (TDN) and 11.5% digestible protein. Animals were also provided with wheat straw during summer and winter as a source of roughage. Water was offered to animals twice daily in buckets (at 9.00 and 16.00h). All animals were free from disease and behavioral abnormalities throughout the experiment. The same animals were used during summer and winter to study the effect of feed deprivation on the physiological parameters of these animals in both seasons.

The experimental period in each season involved three periods, 3 days each, of control (usual feeding), starvation (food was withheld while water supply continued) and recovery. Daily blood samples were collected from the jugular vein of the animals before access to feed and water. Blood volume (BV) and plasma volume (PV) were determined at the end of each of the three experimental periods by Evans Blue Dye Method (Oser, 1976). Plasma osmolality was measured using an osmometer (Osmett A 5002). Serum was analyzed for total protein (Armstrong and Carr, 1964) and albumin (Doumas *et al.*, 1971). Serum globulin was obtained by subtraction. Glutamic oxaloacetic transaminase (GOT), glutamic pyruvic transaminase (GPT), alkaline phosphatase (AP), urea-Nitrogen and creatinine were measured in serum by using bio-Mericux Kits. During the experimental periods, the minimum and maximum ambient air temperature and relative humidity were 23 and 30.5°C and 70.5% in summer and 10.3 and 18°C and 69.2% in winter, respectively.

Statistical analyses

Data obtained were statistically analyzed for the effect of season, breed, treatment and their interactions on the different parameters according to the model:

$$Y_{ijkl} = U + S_i + B_j + T_k + D(T)_{lk} + (S*B)_{ij} + (S*T)_{ik} + (B*T)_{jk} + e_{ijkl}$$

Where: U = overall mean, S_i = season effect, B_j = breed effect, T_k = treatment effect, $D(T)_{lk}$ = days within treatment effect, $(S*B)_{ij}$ = interaction of season and breed, $(S*T)_{ik}$ = interaction of season and treatment, $(B*T)_{jk}$ = interaction of breed and treatment,

e_{ijkl} = residual effect.

Statistical analysis system (SAS, 1982) was used to analyze the data.

RESULTS

Table (1) shows the percentage changes of some blood parameters after three days of starvation in Anglo-Nubian (A), Baladi (B) and their crossbred (AB) goats during winter and summer seasons. Feed deprivation resulted in marked ($P < 0.001$) decline in blood volume (BV) and plasma volume (PV) in all animal groups during winter and summer (Table 1 and Fig.1). Variations ($P < 0.05$) in BV and PV were noted between animals in their response to feed restriction during both seasons. Blood volume of AB goats was less affected (-13.2%) by starvation during winter than that of A and B goats. However, Baladi goats were the least affected (-14.0%) in this parameter during the summer season. On the other hand, B goats showed the least decrease in plasma volume (-13.9%) during winter, whereas AB goats showed the greatest response (-29.8%) to starvation during the summer season. After refeeding (recovery), BV and PV values returned to about control levels. A and AB goats showed slight increase in BV and PV than control values after recovery especially during the winter season.

In response to starvation plasma osmolality increased ($P < 0.0001$) in all animals due to decreased blood volumes. The increase in plasma osmolality of animals ranged from (11.6 to 13.5%) during winter and from (11.4 to 15.8%) during summer. A and AB goats were more affected in this parameter than B goats during the summer season.

Starvation also increased ($P < 0.01$) the concentration of serum total protein (TP), albumin (A), globulin (G), Urea-Nitrogen (U-N), creatinine (Cr), glutamic oxaloacetic transaminase (GOT) and glutamic pyruvic transaminase (GPT) in all animal groups during winter and summer seasons (Table 1 and Figures 2 & 3). The percentage changes in TP, G, U-N and GOT showed higher ($P < 0.05$) values in summer than in winter. On the other hand, percentage changes in A, Cr and GPT were higher ($P < 0.05$) in winter than in summer in all animal groups. In the mean time, animal groups varied ($P < 0.05$) in their responses of the above parameters to starvation during

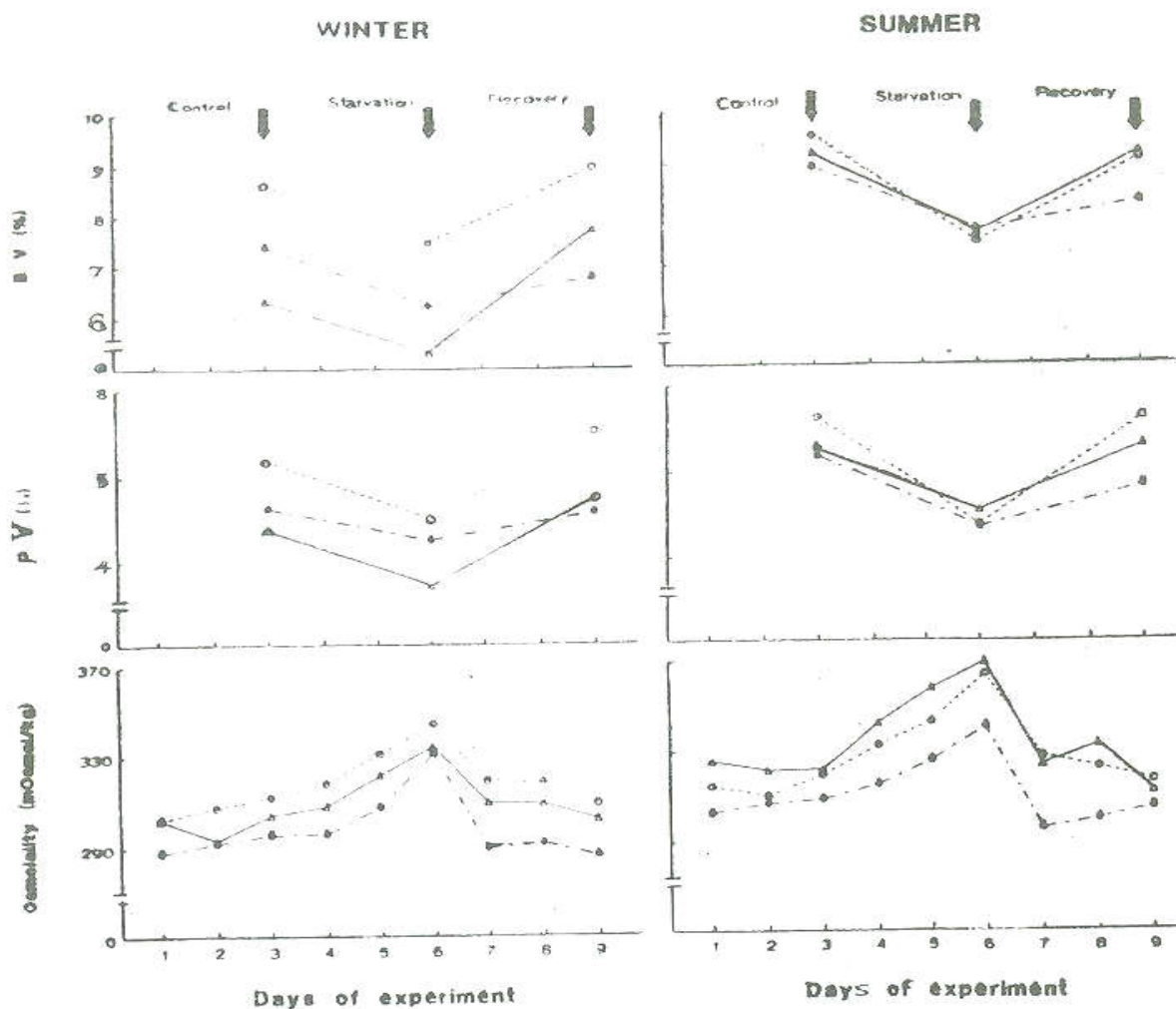


Fig. 1. Changes in blood volume (BV), plasma volume (VP) and plasma osmolality during starvation in Anglo-Nubian (\triangle - \triangle), Baladi (\circ - \circ) and their crossbred (\square - \square) goats in summer and winter seasons.

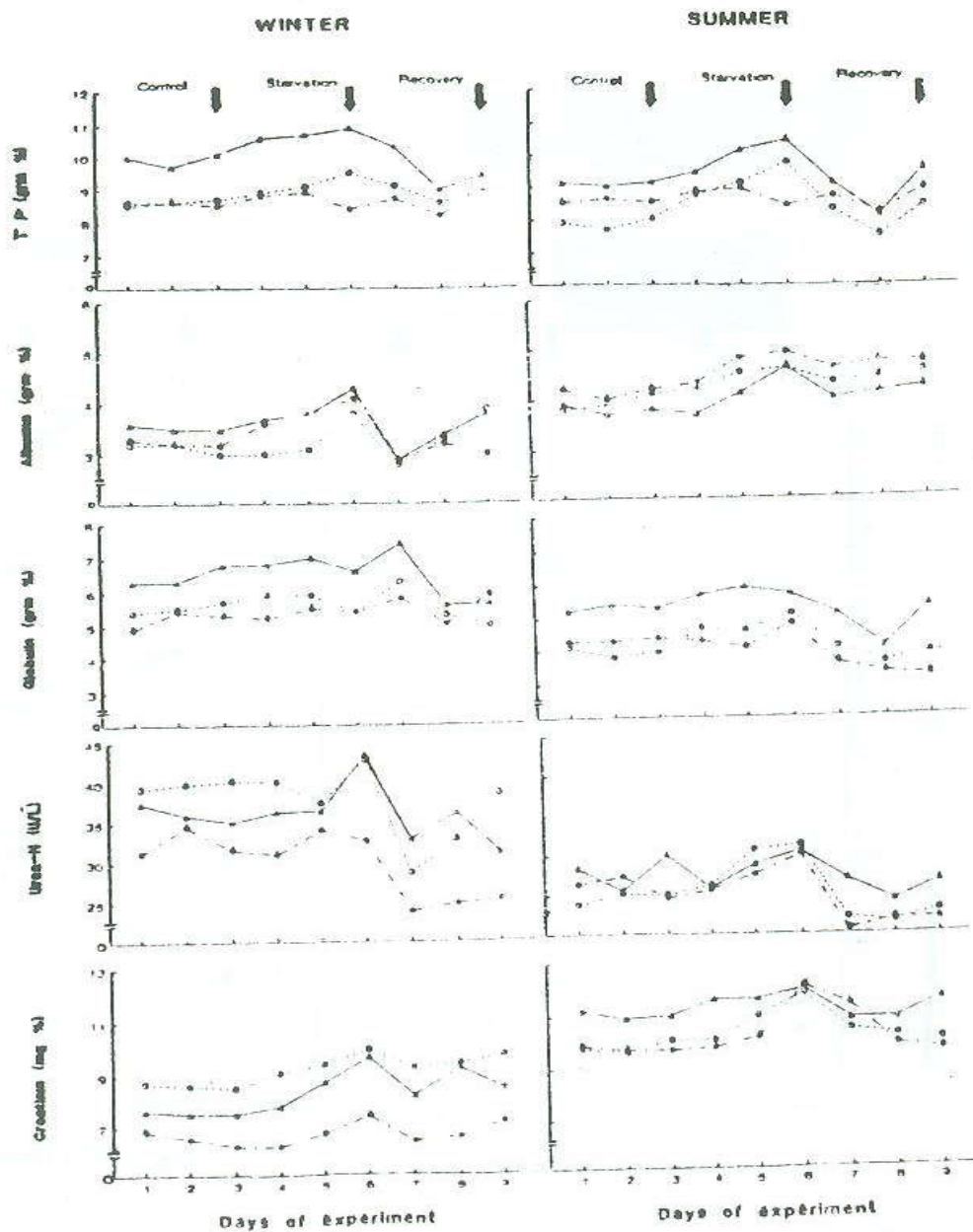


Fig. 2. Changes in serum total protein (TP), albumin, globulin, urea-Nitrogen and creatinine during starvation in Anglo-Nubian (Δ - Δ), Baladi (\circ - \circ) and their crossbred (\square - \square) goats in summer and winter seasons.

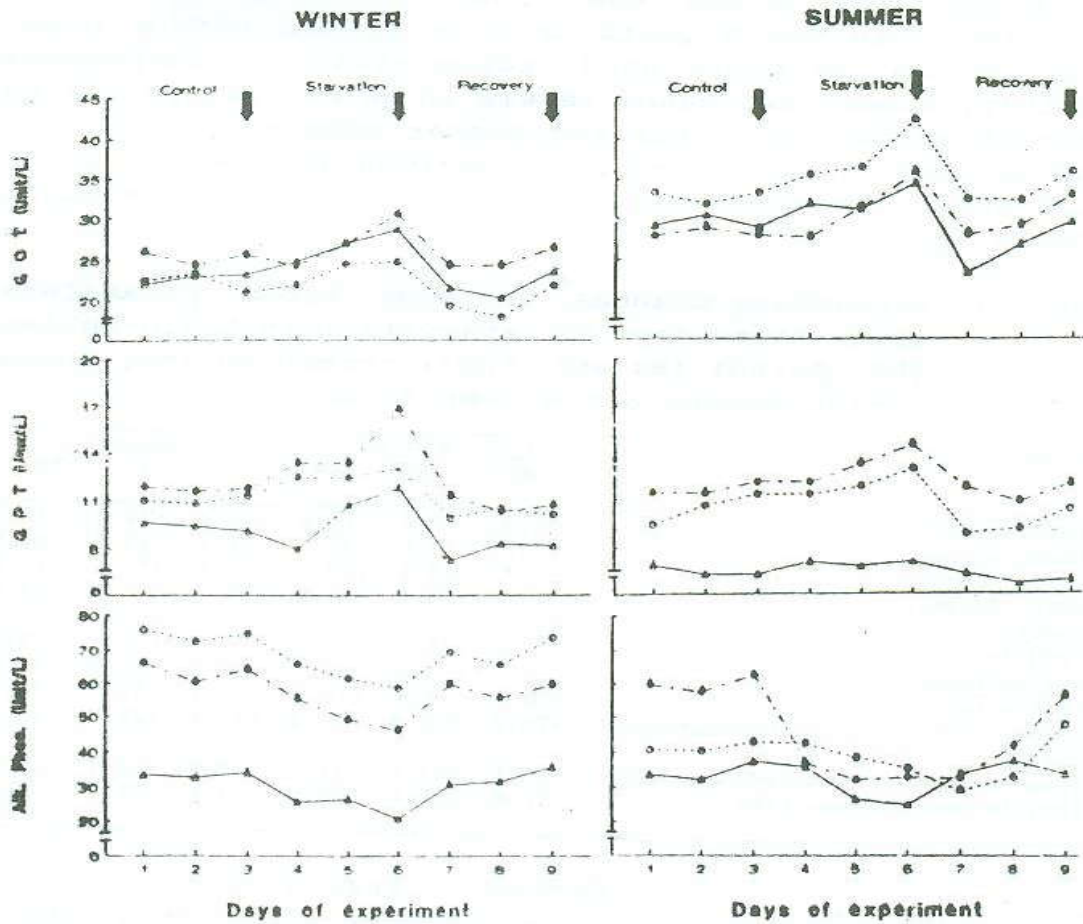


Fig. 3. Changes in glutamic oxaloacetate transaminase (GOT), glutamic pyruvate transaminase (GPT) and Alkaline phosphatase activities during starvation in Anglo-Nubian ($\Delta-\Delta$), Baladi ($\bullet-\bullet$) and their crossbred ($\circ-\circ$) goats in summer and winter seasons.

winter and summer seasons. Anglo-Nubian and AB goats showed higher percent changes in TP, U-N and Cr than B goats during winter season. In summer, TP and A were the least affected in Anglo-Nubian goats than other animal groups. Serum transaminase activities showed different trends between animal groups in winter and summer seasons. In winter, GOT and GPT showed higher percent changes in A and B goats than their crossbred, whereas in summer the B and the crossbred goats were more affected than the A goats in this regard (Table 1 and Fig. 3). On the other hand, serum alkaline phosphatase activity showed decreased levels in animal groups due to starvation during winter and summer seasons (Fig. 3). The percent changes were more obvious in A and B goats than their crossbred goats in winter and summer seasons (Table 1).

Table 1. Percentage changes* in some blood parameters after three days of 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
Blood volume	-15.9	-15.6	-13.2	-17.4	-14.0	-17.7
Plasma volume	-27.8	-13.9	-21.1	-22.6	-23.1	-29.8
Plasma Osmolality	+11.6	+13.5	+12.1	+14.5	+11.4	+15.8
Total Protein	+10.1	+9.3	+10.5	+15.6	+14.1	+22.8
Albumin	+22.9	+24.2	+18.8	+21.1	+16.7	+17.9
Globulin	+1.5	+3.8	+1.8	+7.5	+11.6	+9.3
Urea-Nitrogen	+7.1	+3.5	+7.3	+8.9	+14.9	+14.0
Creatinine	+20.0	+13.8	+16.3	+7.1	+13.7	+16.0
Glutamic Oxaloacetic Transaminase (GOT)	+26.9	+20.9	+11.9	+17.5	+27.9	+22.3
Glutamic pyruvic Transaminase (GPT)	+25.5	+42.4	+19.1	+9.5	+24.1	+24.0
Alkaline phosphatase (AP)	-37.8	-27.5	-20.8	-27.6	-35.2	-13.8

$$* \text{ Percentage change} = \frac{\text{Control} - \text{Starvation}}{\text{Control value}} \times 100$$

DISCUSSION

Feed restriction is associated with decreases in water intake and consequently in body weight gain. Okab *et al.* (1994) found decreases in total water intake of Anglo-Nubian, Baladi and their crossbred after three days

starvation. The decreases in blood and plasma volumes of all animals after three days starvation are mainly due to the reduced water and feed intakes. This in turn caused an elevation in plasma osmolality of all animals. Variations between animals and between seasons in response to the above parameters are presented in Table 1 and Fig. 1. Hassan (1989) reported a decrease in plasma volume and an increase in plasma osmolality of Anglo-Nubian, Baladi and their crossbred after three days dehydration. In the present study, the increase in plasma osmolality in Baladi goats was not as high as in Anglo-Nubian and the crossbred goats during the summer season. This may be attributed to a slow rate of absorption from the rumen, which acts as a reservoir to protect the vascular system from sudden dilution. Starvation caused elevation in TP, A, G, U-N, Cr, GOT, and GPT in all animals. The increase in serum proteins during starvation could be due to the decrease in blood volume and/or the movement of proteins from tissue to blood (Hassan, 1989). The increase in blood proteins, particularly albumin, seems to play a significant role in the change in blood osmolality that was observed in the present study. Comparison of the magnitude of changes in these parameters in the three breeds of goats indicates that the exotic breed (Anglo-Nubian) had higher elevations in the overall values of TP, A, and Cr. U-N and Cr tests are common for measurements of kidney function. The increased levels above control of these tests may indicate stressful condition or impaired kidney function which were associated with feed deprivation mainly in Anglo-Nubian followed by the crossbred goats during winter and summer seasons. Keenan *et al.* (1986) showed that submaintenance feeding in sheep caused elevation in plasma creatinine levels. Ali *et al.* (1984) found that Nubian goats restricted for 96 or 168 hrs raised the plasma activity of aspartate transaminase and plasma concentrations of lactate, pyruvate, non-esterified fatty acids, cholesterol, ketone bodies and bilirubin. However, concentration of total plasma protein decreased. These observations agree with our results on Cr, and transaminases. However, the variable response of the three groups of animals in these parameters due to feed restriction indicated better tolerance of the native Baladi goats to harsh environment (feed deprivation and

season). Crossbreeding of pure exotic breeds with native breeds could be the best way to form type of animals adapted to environment and contain the potential genetic merit for high production.

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تأثير التجويع على بعض المعايير البيوكيميائية لدم الماعز الانجلو نوبى
والبلدى وخليطها فى المناطق الحارة (شبه الاستوائية)

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جوعت ماعز الانجلونوبين والبلدى وخليطهما لمدة ثلاثة ايام خلال فصلى
الشتاء والصيف فى حين اعطى الماء بحرية خلال فترة التجربة. جمعت
عينات من الدم صباح كل يوم من الحيوانات المعاملة. تم تقدير بعض
المعايير البيوكيميائية للدم.

أظهرت النتائج ان التجويع سبب انخفاض حجم الدم وحجم البلازما فى
حين ان اسموزية البلازما زادت فى الحيوانات خلال فصلى الشتاء
والصيف.

أدى التجويع ايضا الى زيادة محتوى السيرم من البروتين
الكلى، الالبومين، الجلوبيولين، نيتروجين اليورما، الكرياتينين، جلوتاميك
او كسالواستيك ترانسامينز، جلوتاميك بيروفيك ترانسامينز. فى حين أن تركيز
انزيم الفوسفاتيز القاعدى انخفض فى الحيوانات الجائعة مقارنة بفترة المقارنة.
اتضح من الدراسة ان هناك اختلافات فى هذه المعايير بين السلالات
المختلفة وكذلك بين مواسم السنة باستثناء انزيم الفوسفاتيز القاعدى.

اظهرت ماعز الانجلونوبين زيادات عالية فى قيم هذه المعايير اتبعت
بالماعز الخليط ثم البلدى. الامر الذى يدل على قدرة الماعز البلدية على
تحمل تأثير الجوع مقارنة بالماعز الاجنبية النقية .