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Research Article

Effects of some management factors (Housing condition and watering regimen) on blood parameters of desert goats

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Abstract

This study aimed to assess the effects of housing condition and watering regimen on some blood parameters during the period May 2018- February 2019. Desert goat Package Cell Volume% (PCV %) were highest during January, February and lowest during May, and August. Goats had the highest (P<0.001) blood Hemoglobin (Hb%) during May and July with very slight fluctuations throughout the seven months of the experimental period. Goats under shade had comparatively higher PCV% and slightly lower Hb% in comparison with those under direct sunlight. Plasma Calcium was low during February and January and rose during December with higher levels during May, June and July. Goat plasma phosphorus concentrations followed an opposite picture being highest (P<0.01) during October, December, and February and lowest (P<0.01) during other months. Plasma Calcium (Ca) and Phosphorus (P) concentrations were slightly (P>0.05) higher for goats under shade compared with those under direct sunlight. The main effects of months on blood metabolites were highly significant (P<0.01). The highest goat blood protein was during, June-July and lowest (P<0.01) during other months. Goat blood albumen levels were highest (P<0.001) for August- September- October and lowest for January- February whereas blood glucose levels were highest (P<0.01) during January- February and with very slight fluctuations throughout the seven months of the experimental period. Blood protein, blood albumin and blood glucose levels were relatively higher (P>0.05) for goats under shade compared with those under direct sunlight. Goats watered everyday had slightly lower blood protein and albumin and slightly higher blood glucose in comparison with goats watered every other day.

Introduction

Under normal circumstances, livestock are able to maintain their body temperature at a safe range, so long as they have shade and plenty of water. In extreme heat, they will decrease their grazing time and spend more time in the shade, especially during the hot hours of the day. They will graze mostly in the evening and early morning hours, and rest during the heat of the day [1]. While heat stress (exhaustion or stroke) is not very common in sheep and goats in temperate climates, it may occur; especially if stocks are handled during the hottest part of the day [2]. Clinical signs of heat stress include continual panting, rapid.

The lower values of PCV and Hb concentrations obtained during dry summer in Nubian goats with low level of nutrition

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were attributed to depression of food intake of goats with a rise in ambient temperature [3]. The viscosity of blood plasma protein was negatively correlated to environmental temperature [4]. The authors [5,6] found that serum total protein levels were higher in hot summer than in winter Mean mineral concentrations in the blood of animals are above the critical limit during dry and wet seasons with no significant seasonal differences [7]. This study was conducted with the ultimate objective of delineating the effects of housing condition and watering regimen on some Blood parameters of Desert goats.

Materials and methods

The study area

This study was conducted at El-Obeid, Sheikan Province, North Kordofan State (latitudes 11°:15¯-16°:30¯N; longitudes 27°-32°E. The average temperature varies between 30°C-35°C during most of the year with peaks of above 40°C during April, May and June. The rainy season extends from July to October with maximum rainfall in August. The long-term average annual rainfall is about 280 mm/Year [8].

Experimental animals

28 Sudan Desert goats (3-4 months old, average body weight 11.8±1.35 kg) were used in these trials. Goats were ear-tagged, vaccinated against, pox and HS and treated with Ivomec (IvomectinR) at 0.5 ml/goat/body weight administered twice at an interval of three weeks, against internal and external parasites. The goats were also injected with oxytetracycline as an anti-coccidian treatment applied at 0.5 ml/goat/body weight. All goats were allowed one week as an adaptation period.

Trials layout

The goats were randomly divided into two equal groups based on their initial body weight and age. One group was randomly allocated to a shaded condition in pens of 9x4 m^2 while the other group was left on the open with no shade. All goats were tethered and were provided with individual feeding and watering troughs. Each group was again randomly subdivided into two similar groups based on initial body weight and age. One received water every day whereas the other one was watered every other day. Feed was offered *ad libitum* and consisted of grass straw and hay of browse trees

Blood collection and processing

Blood samples (10 ml) were drawn from the jugular vein of animals using disposable syringes. One ml of blood was immediately was transferred to a capped test tube containing an anticoagulant (K EDTA) for blood analysis. One ml of blood was kept in a test tube and after centrifugation; the plasma sample was used for glucose determination. The rest of the blood sample was allowed to stay for 4-5 hrs at room temperature and then centrifuged (Gallenkamp Junior) at 3000 rpm for 15 min. Hemolysis-free serum was transferred to clean plastic vials and immediately frozen at -20°C for subsequent analysis.

Packed Cell Volume (PCV): PCV was determined in duplicate using a micro-hematocrit centrifuge (Hettich, Tuttlingen, Germany). The hemoglobin concentration was determined by the cyano-methemoglobin method [9].

Plasma glucose: The plasma glucose level was determined by the enzymatic colorimetric method using a kit (Randox Laboratories Ltd, London) according to the methods of [10].

Serum metabolites: Serum total protein concentration was determined using Biuret reagent (King, and. Wootton, 1956). Serum albumin concentration was determined by a colorimetric method according to [11].

Blood minerals concentrations: P and Ca in blood plasma were determined according to the methods of [10].

Statistical analysis

The experimental design is a Complete Randomized Design (CRD) that has seven treatments and four replicates. The data is analyzed using analysis of variance [12]. The difference among treatment means were detected using least significance difference test [13].

Results

The main effects of months, house condition and watering regimen on goat hematological indices and plasma calcium and phosphorus levels are displayed in Tables 1,2. Monthly differences in hematological indices and plasma Ca and P levels were highly significant ($P<0.001$). PCV reported low value during May and August and rose during December and February through January (Figure 1). Goats had the highest ($P<0.001$) Hb% during May, and July with very slight fluctuations throughout the seven months of the experimental period (Figure 2). Goat plasma Ca and P concentrations were significantly ($P<0.001$) affected by months. Plasma Ca was low during February and January, and rose during December, with higher levels during May, June and July followed by August, September and October Goat plasma P concentrations followed an opposite picture being highest ($P<0.01$) during Oct, Dec and February and lowest ($P<0.01$) during other months with no differences ($P>0.05$) between summer and rainy seasons (Table 2). Housing condition exerted no main effect ($P>0.05$) on any of the hematological indices of plasma Ca and P concentrations. Nonetheless, goats under shade had comparatively higher PCV% and slightly lower Hb% in comparison with those under direct sunlight. Plasma Ca and P concentrations were slightly for goats under shade compared with those under direct sunlight. Respective PCV% for the two goat groups were 39.0 and 38.5% whereas respective Hb% were 66.114 and 68.36%. Plasma Ca and P concentrations (mg/100 ml) for goats under shade and those under direct sunlight were 12.3 and 12.1 mg Ca/100 ml, and 9.9 and 9.8 mg P/100 ml, respectively (Table 2). Interaction effects among the three factors studied (months, housing condition and watering regime) were not significant ($P>0.05$).

Effects of months, housing condition and watering regimen on blood metabolites

Table 3 depicts the main effects of months, housing

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condition and watering regimen on blood metabolites of Sudan Desert goats. Monthly main effects on blood metabolites were highly significant (P<0.01). The highest goat blood protein was during, June Jul and lowest (P<0.01) during other months (Figure 3). Goat blood albumen levels were highest (P<0.001) during September and October and lowest (P<0.001) during January and February whereas blood glucose levels were highest (P<0.01) during Jan and February and with very slight fluctuations throughout the seven months of the experimental period (Figure 4). Housing condition affects on protein no effect (P>0.05) on albumen levels and blood glucose. However, blood protein, blood albumin and blood glucose levels were relatively higher (P>0.05) for goats under shade compared with those under direct sunlight. Respective blood protein levels were 42.8 and 40.5, blood albumin levels were 33.9 and 32.9, and blood glucose levels were 152.3 and 123.2 mg/100 ml for goats under shade and those under direct sunlight, respectively (Table 3). The watering regimen had no effect (P>0.05) on goat blood protein, goat blood albumen, or goat blood glucose (Table 3). Nonetheless, goats watered everyday had slightly lower blood protein and albumin and slightly higher blood glucose in comparison with goats watered every other day. Blood protein values for goats watered every day and those watered every other day were 41.9 and 41.6 mg/100 ml, respectively, their respective albumen levels were 33.2 and 33.6 mg/100 ml,

Table 1: Main effects of Housing Condition (HC), watering regime (WR) and Months (M) on hematological indices.

Factors	PCV%	HB%
Housing Conditions:		
Shade	39.008	66.114
Sunlight	38.523	68.365
SE±	1.320 NS	1.728 NS
Watering Regime:		
Daily	37.890	64.031
After day	39.640	70.448
SE±	1.335 NS	1.686*
Month		
May	7.299	148.857
June	35.190	45.597
Jul	37.640	70.891
Aug	25.130	55.805
Sep	38.458	52.267
Oct	38.760	56.776
Dec	56.490	56.776
Jan	47.724	64.136
Feb	53.196	54.050
SE±	2.818***	3.915 ***
Interaction: SE±		
HC × WR	1.874 NS	2.410 NS
HC × M	4.114 *	4.998***
WR × M	4.061 NS	5.220**
HC × WR × M	5.503 NS	7.382 NS

PCV: Package Cell Volume; HB: Blood Hemoglobin

Table 2: Main effects of Housing Condition (HC), Watering Regime (WR) and Months (M) on Plasma Calcium (Ca) and Phosphorus (P) concentrations

Factors	Ca	P
Housing Conditions:		
Shade	12.378	9.984
Sunlight	12.142	9.853
SE±	.160 NS	.163 NS
Watering Regime:		
Daily	12.232	9.556
After day	12.288	10.282
SE±	.156 NS	.164**
Month		
May	14.297	9.420
June	14.836	10.107
Jul	15.340	10.084
Aug	14.695	7.135
Sep	14.326	8.076
Oct	11.303	12.738
Dec	9.464	11.457
Jan	8.848	10.615
Feb	7.231	11.638
SE±	0.351***	0.353 ***
Interaction: SE±		
HC × WR	.234 NS	.234 NS
HC × M	.493 NS	.499*
WR × M	.517 NS	.500 NS
HC × WR × M	0.697 NS	0.678 NS

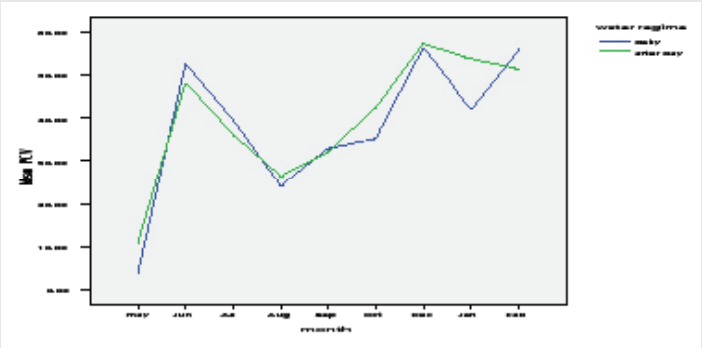

Figure 1: Blood PCV of Desert Goats during Different May 2018- February 2019.

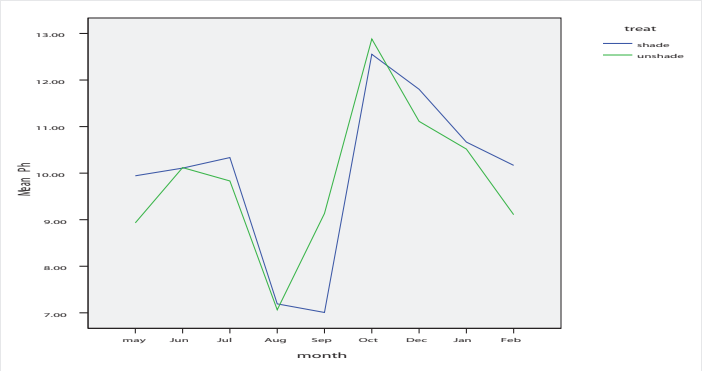

Figure 2: Blood Ph of Desert Goats during Different May 2018- February 2019.

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and their respective blood glucose levels were 155.2 and 120.3 mg/100 ml (Table 3). No significant interaction effects (P>0.05) were revealed among the three factors studied.

Discussion

PCV was affected either by housing condition or watering regime. This was in disagreement with the findings of some workers who reported that Yankasa sheep [14,15], Awassi sheep [3,16] and goats [17,18] subjected to water restriction had increased PCV%. Nonetheless, the results of this study were supported by [19] who found no significant variation in PCV values of goats restricted to 50 % and 30 % of their free choice water intake but monthly variations were different (P<0.01). The same results were obtained for Hb, with no main effects of housing condition and watering regimen but significant monthly effects. This result was in line with [7] working on goats, and [6,20,21] working on sheep who found relatively high mean PCV values under restricted watering regimen. Lower PCV and Hb values during summer season could be ascribed to the lower nutritional value of grazing resources during the dry period of the year [22]. Plasma Calcium and Phosphorus levels were not affected (P>0.05) by both housing condition and watering regime. This was in accord with the findings of [23] who reported that the Inorganic phosphorus level was not

Table 3: Main effects of Housing Condition (HC), Watering Regime (WR) and Months (M) on Blood Metabolites (Protein, Albumin Albumin and Glcouse).

Factors	Protein mg/100ml	Albumin mg/100ml	Glcouse mg/100ml
Housing Conditions:			
Shade	42.889	33.959	152.340
Sunlight	40.577	32.951	123.245
SE±	.646*	.380 NS	31.851 NS
Watering Regime:			
Daily	41.630	33.223	155.220
After day	41.909	33.687	120.365
SE±	0.645 NS	0.374 NS	33.128 NS
Month			
May	53.905	33.043	50.193
June	60.112	31.362	129.070
Jul	60.050	30.064	67.854
Aug	56.989	33.636	69.972
Sep	28.596	45.268	134.584
Oct	28.188	42.541	91.893
Dec	28.364	30.657	161.769
Jan	29.289	28.924	180.017
Feb	33.432	25.602	254.783
SE±	1.417***	.821***	67.837 NS
Interaction: SE±			
HC × WR	.963 NS	.533 NS	46.16 NS
HC × M	1.908*	1.131*	99.08 NS
WR × M	2.228*	1.052 NS	86.94 NS
HC × WR × M	2.818 NS	1.537 NS	117.23 NS

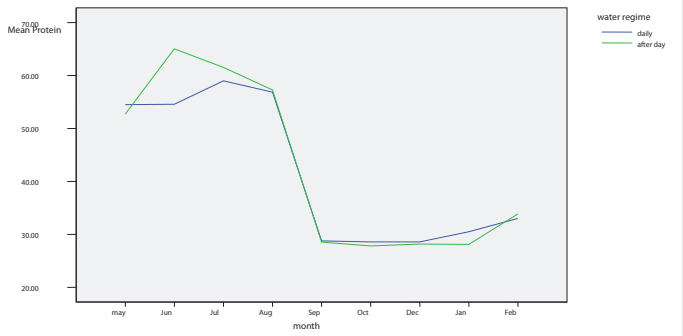

Figure 3: Blood protein of Desert Goats during Different May 2018- February 2019.

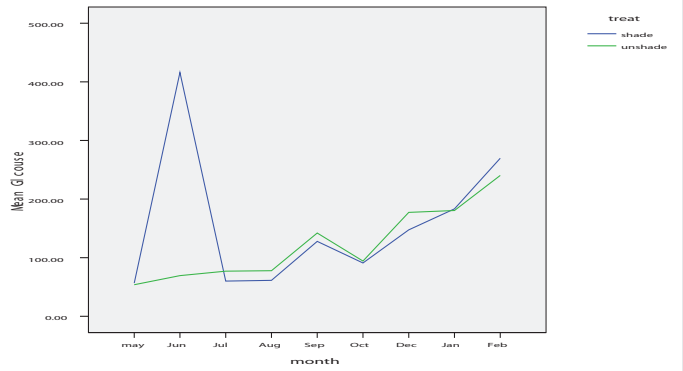

Figure 4: Blood glucose of Desert Goats during Different May 2018- February 2019.

affected by exposure to direct sunlight from 8.30. (32.3°C) for 3 consecutive days in Patanwadi sheep but significantly affected by month. Authors [5,24] noted that the inorganic phosphorus level was significantly lower during summer than in winter, in Karakul sheep, whereas in this study plasma P level was highest during October, December and February and plasma Ca was highest during May, June and July. On the contrary [25] reported phosphorus levels in Rambouillet, Chokla Malpura and Rambouillet x Malpura ram plasma to increase during hot conditions while [26] found that plasma Calcium concentration of goats on grasses was higher during wet season Blood metabolites are affected by month's variations [6]. Serum total protein was lowest in June Jul and highest (P<0.01) during other months, whereas serum albumin was highest during September and October and lowest during January and February. This was in disagreement with [4] who reports that serum total protein levels were lower in summer than in winter in Karakul sheep also. However, the results were supported by [5] who found that serum total protein levels were higher in hot summer than in winter in Chios lambs. Blood glucose level was not affected by either housing condition or watering regimen [23] stated that blood glucose was not affected by exposure to direct sunlight from 8.30 (32.3°C) to 14.30 h (37.7°C) for three consecutive days during the last week of May and watering regime but showed high significance on months differences. Blood glucose levels were highest during January and February and lower during the rainy season, contrasting the findings of [25,27-30] who found that mature Ossimi ewe's blood glucose levels were higher during summer than winter.

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