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Research Article

EFFECTS OF TREE BROWSE AND FOLIAGE (DICHROSTASHYS CINERAE AND GREWIA TENAX) FEEDING AND SEASON ON SOME BLOOD PARAMETERS OF DESERT GOAT IN NORTH KORDOFAN, SUDAN

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ABSTRACT

Twenty eight female goats, 4-6 months of age, with an initial body weight of 11.8±1.35 kg were used to study effect of supplemental browse trees (*Grewiatenax* and *Dicrostachyscinerea*) leaves and soft stems, pods meal and their mixtures on blood metabolites, hematological indices and minerals (Ca and P). The animals were randomly assigned to four dietary treatments. The dietary treatments consisted of *Grewiatenax* foliage and *Dichrostashysceineria* pods, (20% and 30%). Blood samples were collected and assayed for blood metabolites, hematological indices and minerals (Ca and P). Simple correlation coefficients between body weights, hematological indices and blood metabolites were computed. Blood hematological indices (Hb% and PCV%) showed an increase during winter months for PCV% and during the rainy season months for Hb% Plasma calcium and phosphorus levels did not differ (P>0.05) among goats during the three seasons, with summer season recording slightly the highest plasma Ca levels. The highest blood protein levels were recorded for Ration 1 during the summer season, highest blood albumin levels were for Ration 1 during the rainy season and highest blood glucose levels were recorded for goats on Rations 2 and 3 during the winter season. There were high positive correlation coefficients between feed intake, water consumption, blood metabolites and mineral profiles. Therefore, it could be concluded that, feeding browse trees' foliage and pods to goats to improved feed intake and body weights as evidenced by blood metabolites, with some seasonal differences among goats on different rations.

Keywords: Desert Goats Dicrostachyscinerea,Grewiatenax, hematological indices

INTRODUCTION

Goats play an important role in the livelihood of wide sector in Sudanese communities. Goat population is estimated at about 43 million heads, distributed mainly in arid and semi-arid zones (AOAD, 2001; MAR, 2012). They play a vital role in rural economy and traditional agricultural production. The main types of goat in Sudan are Sudan Desert, Nubian and Tagger (Ageeb, 1992, Behnke, 2012). Use of improved forages, tree foliage and legumes as supplementary feeds for livestock have been investigated (Ates*et al.,* 2018).Nutritionally-related blood metabolites, routinely used in the dairy industry, include glucose, non-esterified fatty acids, cholesterol, blood urea nitrogen, creatinine and total proteins. Studies have been conducted to determine metabolites that indicate energy status in goats and the effect of variation in nutrient supply on blood metabolites (Pambu-Gollah*et al.,* 2000). Many types of foliage improve the feed supply in times of shortage of natural pasture (ThengKouch*et al.,* 2003). According to Shayo (1997), leaves of multipurpose trees are highly digestible; contain high concentration of crude protein and minerals, and low cell wall contents. Feed is generally adequate during the wet season but insufficient and deficient during the dry season. Trees and shrubs produce pods and leaves which could be harvested and processed as supplementary feed during the dry season for livestock including goats. This calls for strategies to bridge the feed gap between the dry and wet seasons. Trees and shrubs pods are high in nutritive value (Ncube and Mpofu, 1994) and can be used as supplements to low quality roughages. Grewiatenax fodder young leaves are consumed by livestock, usually at the end of dry seasons, and have fairly good feed value (Orwa*et al.,* 2009). Therefore, the object of this study was to investigate the effect of supplemental browse trees (Grewiatenax and Dicrostachyscinerea) leaves and soft stems, pods meal and their mixtures on some blood parameters of the desert goats.

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MATERIALS AND METHODS

This study was conducted in Sheikan Locality, North Kordofan State, Sudan. North Kordofan State is located between latitudes 11°15'-16°.45'N and longitudes 27°:05'-32°:0'E. It covers an area of about 245,000 km^2, representing two third of Kordofan region. The main occupations are livestock raising and traditional farming. These activities depend primarily on natural resources in pure form at a low level of technology input (Behnke., 2010 ; Yagoub, 2006).

Feed preparation

Foliage of (Grewiatenax) and pods of (Dichrostashysceineria) were used throughout the study, the basal diet, groundnuts haulm and Sorghum straw used in the present study was collected from randomly selected peasant association in Sheikan province and chopped approximately to 4-5 cm length to increase its intake and decrease rate of selectivity by goats. Dichrostachyscinerea pods were

collected from random areas of great Kordofan state. Grewiatenax small side branches containing the green leaf was cut when leaf mass was maximal.

Experimental animals and feeding trials layout

Twenty eight female goats, approximately 4-6 months of age, with an average body weight (BW) of 11.8±1.35 kg were randomly chosen from farmers flocks at market of El Ain El Siefia village in SheikanLocaltiy, North Kordofan. All goats were first vaccinated against internal and external parasites. The animals were kept in individual pens of 1×1.5m and animals were randomly assigned to four dietary treatments (Table 1).

Table 1: Experimental rations percentage

Item	Ration 1	Ration 2	Ration 3	Ration 4
Rations' Ingredients:				
Straw	50	50	50	50
Groundnut hulls	29	29	19	19
Grawiatenax	20	-	-	30
Dichriostachyscinerea	-	20	30	-
Common salt	1	1	1	1
Total	100	100	100	100

Data Recorded

The goats were weighed initially and every month thereafter. Weightings were made following an overnight fast. Blood samples were collected from the jugular vein of each goat at the start of the feeding trials and every month, up to the end of the experiment. These samples were assayed for blood protein (Poppi*et al.,* 1995), blood glucose (Jane, 2018) and plasma P and Ca levels (Allen, 1989). Packed cell volume (PCV %) (Allen, 1989) and hemoglobin (Hb) (Pambu-Gollach*et al.*,2000) were also measured. All blood samples were collected early in the morning in order to minimize the effects of animal stress and exercise, hemolysis and temperature (Pambu-Gollach*et al.,* 2000).

Statistical analyses

Feeding trials were analyzed as factorial experiments for Ration x Season and Simple correlation coefficients between body weights, hematological indices and blood metabolites were also computed (Steel and Terrie, 1980).

RESULT AND DISSECTION

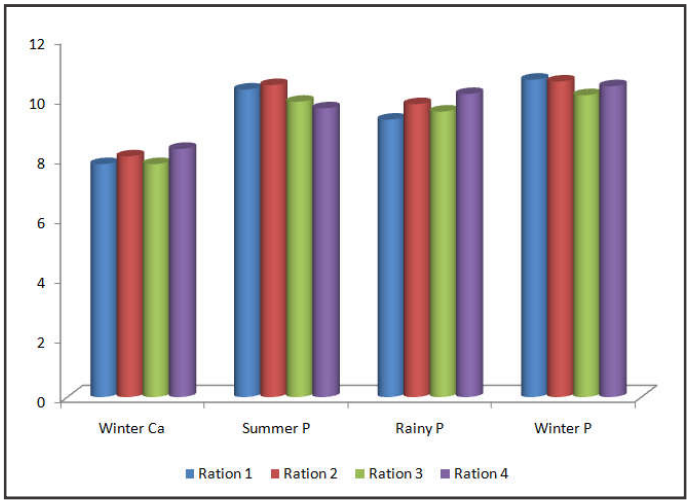
Seasonal and feed type effects on haematological indices and plasma calcium and phosphorus levels:

Table (2) shows the main effects of season and ration on haematological indices and plasma calcium and phosphorus levels of goats. Seasonal variations were significant for haemoglobin level (P<0.001) and packed cell volume percentage (P<0.01) but not significant for plasma calcium and phosphorus levels (P>0.05). Hb% in goats ranged from as low as 55.4% during the rainy season to a high level of 84.3% during the summer season, with winter season recording about 58.4%. Differences between rainy and winter seasons were not significant (P>0.05).Packed cell volume (PCV %) was highest (P<0.05) during winter and lowest during summer. Rainy season Hb% in goats was comparatively higher than that during summer but significantly lower compared with winter levels.Plasma calcium and phosphorus levels did not differ (P>0.05) among goats during the three seasons (Table 2). However, goats had higher plasma Ca levels during the summer season (Figure 1).Feed type seemed to exert no main effect (P>0.0%) on haematological indices and plasma calcium and phosphorus levels (Table 8). Nonetheless, Ration 4 resulted in comparatively the highest Hb% and PCV% whereas goats on Ration 1 had relatively the lowest Hb% and those on Ration 2 the lowest PCV%. Monthly haematological indices (Hb and PCV), averaged overall rations, showed a steady trend throughout the experimental period (Figure 2). However, goats had higher plasma Ca levels during summer season (Figure 6). Poppi and McLennan (1995) and Devendra and Sevilla (2002), reported that during the early to mid-hot season, rangelands are not an adequate source of energy and minerals.Calcium plasma levels were comparatively highest for goats on Ration 1 while phosphorus plasma levels were slightly highest for those on Ration 2. Season x ration interaction effects were not significant (P>0.05) for neither haematological indices nor plasma Ca and P levels (Table 2). In goats, there are great variations in the hematological parameters (Al-Eissa*et al.,*2012).

Table 2: Main effects of season and feed type on haematological indices, plasma phosphorus and calcium levels of goats

Factor	Haemoglobin (Hb %)	Packed Cells Volume (PCV %)	Calcium (Ca) (mg/100)	Phosphors (P) (mg/100ml)
Season				
Summer	84.3	32.7	14.9	10.1
Rainy	55.2	37.8	14.9	9.7
Winter	58.4	50.2	14.9	10.4
SE±	3.0***	2.18**	0.25^{ns}	0.28^{NS}
Feed type (FT):				
Ration 1 (G. 20%)	64.9	39.0	12.0	10.1
Ration 2 (D.20%)	64.8	38.3	11.8	10.3
Ration 3 (D.30%)	66.4	40.9	11.8	9.9
Ration 4 (G.30%)	67.8	43.0	11.8	10.1
SE±	3.7^{NS}	2.5^{NS}	0.29^{NS}	0.32^{NS}
Interaction:				
SE±	4.4^{NS}	4.5^{NS}	0.50^{NS}	0.55^{NS}

Means in the same column under the same factor with different superscripts are significantly different (^{NS} Not Significant P>0.05, ** Highly Significant P<0.01)



Seasonal and Feed Type Effects on Goat's Blood Metabolites:

The main effects of season and feed type on goat blood metabolites are presented in Table (10). Seasonal main effects on blood metabolites were highly significant (P < 0.001). The highest blood

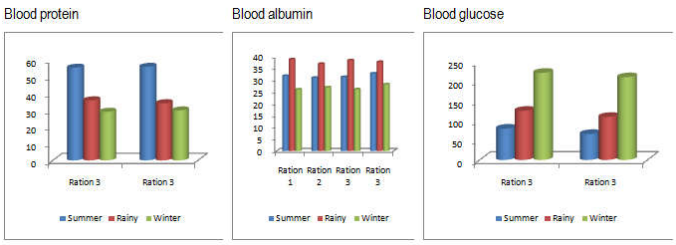
protein (mg/100 ml) values were recorded in goats during winter season while the lowest values were during the rainy season. Goats blood albumin contents ranged from a low value of 31.9 mg/100 ml for goats during summer to a high (P<0.001) value of 38.2 mg/100 ml during both rainy and winter seasons. Goat blood glucose levels were highest (P<0.001) during winter season (216.5 mg/100 ml), followed by rainy season levels (114.3 mg/100ml) and lowest during the summer season (71.4 mg/100 ml).Feed type main effects on goat blood metabolites were not significant (P>0.05). Goats on Ration 3 had comparatively higher blood protein levels, followed by those on Ration 1, Ration 2, and the lowest for those on Ration 1. Blood albumin contents were slightly (P>0.05) higher for goats on Ration 4 and comparatively (P>0.05) lower for those on Rations 2 and 3. Goats blood glucose levels were not affected (P>0.05) by the type of feed consumed. However, blood glucose levels were relatively higher (P>0.05) for goats on Ration 3 (142mg/ml), followed by those on Ration 2 (139.6 mg/ml) and comparatively lower for those on Ration 4 (129.4 mg/ml) and Ration 1 (124.5 mg/ml). Season x feed type interaction effects were not significant (P>0.05) for any of the blood metabolites studied (Table 3). However, higher blood protein levels were for Ration 1 during the summer season, higher blood albumin levels were for Ration 1 during the rainy season and higher blood glucose levels were recorded for goats on Rations 2 and 3 during the winter season (Figure 2).

Table 2: Main effects of season and feed type on goat blood metabolites

Factor	Protein (P) mg/100ml	Albumin (Al) mg/100ml	Glucose mg/100ml
Season (S):			
Summer	57.9	31.9	71.4
Rainy	35.6	38.2	114.3
Winter	30.6	38.2	216.5
SE±	1.2***	0.65***	6.24***
Feed type (FT):			
Ration 1 (G. 20%)	40.4	32.5	124.5
Ration 2 (D.20%)	44.0	31.8	139.6
Ration 3 (D.30%)	45.0	31.8	142.9
Ration 4 (G.30%)	40.5	33.1	129.4
SE±	1.4 NS	0.76NS	7.3 NS
Interaction: SE±			
FT ×S	3.5 NS	4.6NS	12.5 NS

Means in the same column under the same factor with different superscripts are significantly different (NS Not Significant P>0.05, ** Highly Significant P<0.01)

Figure 3: Seasonal blood metabolites for goats on the four rations



Blood haematolgical indices (Hb% and PCV %) were not affected by feed type but were significantly (P<0.05) affected by season (Table 9) where they showed an increase during winter months for PCV% and during the rainy season months for Hb% (Figure 7). In goats, there are great variations in the hematological parameters (AlEissa*et al.,* 1994). In contrast, Agenas*et al.,* (2006) found marked decrease in the red blood cell count and PCV without a significant change in Hb concentration during late pregnancy in sheep.Plasma calcium and phosphorus levels did not differ (P>0.05) among goats during the three seasons (Table 9). However, goats had higher plasma Ca levels during summer season (Figure 6). Poppi and McLennan (1995) and Devendra and Sevilla (2002), reported that during the early to mid-hot season, rangelands are not an adequate source of energy and minerals. Blood biochemical parameters such as glucose, cholesterol and non-esterifies fatty acids (NEFA) are becoming important in determining the energy status of ruminants (Agenas*et al.,* 2006; Adewuyi, 2004). The standard concentrations and the factors that influence the concentrations of these nutritionally-related energy metabolites and mineral profiles on communal rangelands have, however, not been established. Such information is critical in developing appropriate feeding and disease prevention strategies. Plasma protein contents are found to be negatively correlated to environmental temperature (Al-Eissa*et al.,* 2012), being lower in summer than in winter in Nubian goats. In this study, blood protein concentrations was not significantly affected (P>0.05) by feed type and also albumin (Al) was not significant affected (P>0.05) by feed type (Table 3). However, higher blood protein levels were reported in Ration 1 during summer season, higher blood albumin levels were for Ration 1 during the rainy season and higher blood glucose levels were recorded for goats on Rations 2 and 3 during winter season (Figure 8). This was supported by the findings of Baumgartner and Parnthaner, (1994) who found that serum total protein levels were higher in hot summer than in winter in Chios lambs. In contrast, in mature Ossimi ewes the blood glucose level was higher during summer than in winter and it seems that decrease in plasma glucose level does not necessarily parallel that of food intake (Singh et al., 1982).

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