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Effect of Feeding Graded Levels of *Prosopis Juliflora* (MESKIT) Pods on Some Hematological and Biochemical Parameters of Sudanese Nubian Goats Kids

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Abstract:

The investigation was carried out to assess the effect of feeding graded level of *Prosopis juliflora* pods (PJ P) in complete feed mixture (CFM) on the blood and serum biochemical parameters on goat kids. Twenty-four kids of Sudan Nubian goats of similar age and weight were randomly blocked by the body weight (14.1 ± 4 kg) into four groups of six animals for each. Each group was allotted experimental dietary treatment and was offered complete feed mixture (CFM) ad lib. in feeding trough under individual feeding system for 50 days. The experimental diets components were, sorghum grain, dry berseem (*Medicago sativa* hay), ground nut cake, wheat bran, molasses and salt. Sun dried (PJP) were ground to pass through a 4 mm sieve before thoroughly mixed with required quantities of the diet ingredients. There were four treatment T1-T4 with 0, 100, 150 and 300 g/kg DM of *Prosopis* pods (PJP) respectively. None of the diets tested had significant effect on erythrocytic series (RBC, Hb and PCV), erythrocyte sedimentation rate (ESR) and clotting time ($p < 0.005$). Blood indices (MCV, MCH and MCHC) were significantly different ($p < 0.005$). Total leukocyte count (TLC) was not affected significantly by dietary treatment. Serum glucose concentration was significantly affected ($p < 0.005$). Certain serum metabolic indices that are known to be sensitive indicator to liver function cholesterol, triglyceride, total bilirubin, direct bilirubin, enzyme alanine transaminase (ALT), aspartate (transaminase (AST) and alkaline phosphatase (ALP) were not significantly affected. The kidneys related serum parameters (urea, cl) as well as serum total protein and albumin were not affected. It concluded that addition of *Prosopis juliflora* pods (PJ P) in complete feed mixture (CFM) up to 30% had no adverse effect on the blood and serum biochemical parameters of goats kids.

Keywords: *Prosopis, juliflora pods, Heamatologica, Parameters, Kids*

1. Introduction

Ruminant animals are important in term of converting grasses into highly nutritious protein product. Protein of the animal origin contains more essential amino acids required for human nutrition. Tree and shrubs are important source of fodder for ruminants in tropical and dry environment. For grazing animals and as supplement to improve productivity of animals fed low quality feed. Genus *Prosopis* is multipurpose, leguminous and copious pod producing tree. High pods production is coinciding the driest months of the year. Pods were found to be palatable and relish by livestock. It is use as animal feed was reported from many regions in the semiarid environment (Riveros, 1992). The feeding value of the pods is often superior to the dry grasses because pods has a high crude protein containing nearly all essential amino acids (Topps, 1992). The pods are rich in sugars, minerals and present high digestibility coefficient for gross energy. Incorporation of the pods up to 20% in ration formulas for animals and particularly, goats was beneficial (Mahgoub et al., 2005b). The presence of anti-nutritive factors in the pods is accused for the appearance of negative effects on the animals fed *Prosopis* pods as sole diet (Bhatta et al. 2002). However small quantities of tannin about 4% is beneficial to ruminant animals (Barry et al., 1986). Nutritional status of an animal is dependent on dietary intake and effectiveness of metabolic process. Goats are predominantly browser and browse constitute about (60-80%) of their diet in free range (Lopes EA and Stuth, 1984). Many feed products are fed to goats without recourse to their health and physiological implication on the animals. Moreover comparison of blood picture and biochemical indices with nutrient intake might indicate the need for adjustment of certain nutrient in the diet of goats. The haematological and biochemical profile constitute an index for measurement of health and nutritional status of the animals. In the present experiment, the blood profile and serum metabolites were examined in Sudan Nubian goat kids, with respective to diets containing graded levels of *Prosopis* pods.

2. Material and Method

2.1. Experimental Site

The experiment was conducted at dairy farm, small ruminant section of Sudan University of Science and Technology, Kuku, East Nile, Khartoum State, Sudan. The site is at latitude 15° 37' 11.30" N and longitude 32° 33' 51.35" E. The area has tropical arid climate with a mean annual rainfall of (100- 200 mm) and average daily temperature between 17.9- 44.1°C.

2.2. Experimental Animals and Housing

The animals used in this study were twenty-four Nubian goat's kids. The goats kids were approximately (3-4 months) old and had an average body weight of (14.1±4 kg) at the beginning of the study. The animals were clinically healthy and were given prophylactic dose of antibiotic and antihelmentic. The animals were hair clipped and sprayed with insecticide for ectoparasites. The animals were housed individually in pens constructed with steel, having cemented floor and shaded with corrugated iron. Each pen was provided with individual watering and feeding arrangement throughout the experimental period.

2.3. Collection and preparation of Prosopis Pods

Ripen fallen *Prosopis pods* (PJP) were collected from under the trees, cleaned from contaminant and insects debris and transferred to study area in plastic bags. Thereafter, the pods were exposed to sun-air drying and coarse ground to particles size up to 2Cm in farm mill. Further grinding to pass 2mm sieve was made before mixing with other experimental diet components.

2.4. Experimental Diets

The experimental diets were formulated to be is nitrogenous, is caloric and were consist of sorghum grain, ground nut cake, dried berseem (Medaga stavia hay), wheat bran, molasses, and salt (Table 2). In the farm the animals were ear tagged, blocked according the body weight and were randomly allotted either one of the four dietary treatment, i.e. six animals per treatment. The treatments were designated T₁, T₂, T₃ and T₄ for animal fed containing 0%, 10%, 15 and 30% (PJP) respectively. The animals had 14 days preliminary and adjustment period during which animals were fed breseem hay or Abu 70 fodder and given mixture of experimental diet. The experimental period last for 50 during which each group of animals fed their respective diet. Animals were fed every morning at 8:0 am, drinking water and mineral lick is available all the time.

Ingredients	Dietary treatments				PJP
	0	10	20	30	
Prosopis pods	0	10	20	30	
Sorghum (feterita)	30	30	30	28	
Wheat bran	20	15	5	8	
Molasses	13	8	8	5	
Groundnut cake	10	10	15	17	
Berseem Hay	25	25	20	10	
Limestone	1	1	1	1	
Salt (NaCl)	1	1	1	1	
Total	100	100	100	100	

Table 1: Percent experimental ration composition (fresh basis) fed to Sudan Nubian Goats kids

Parameters	Prosopis%				
	0	10	20	30	PJP
DM	90.66±0.01	90.77±0.01	90.87±0.01	90.93±0.01	95.17±0.09
CP	16.9±0.1	16.86±0.1	16.9±0.1	16.87±0.1	12.64±0.21
CF	12.14±0.1	12.98±0.1	13.28±0.1	13.55±0.1	18.89±0.30
EE	2.77±0.01	2.72±0.01	3.24±0.01	3.5±0.01	1.21±0.08
NFE	50.08±0.69	50.08±1.06	49.58±1.0	50.18±0.91	57.78±0.31
Ash	8.77±1.0	8.13±1.0	7.87±0.95	6.83±0.90	3.87±1.19
MEMJ/Kg	10.86± 1.05	10.9±1.0	10.9±1.00	11.1±1.0	
TT					2.236
TC					0.559

Table 2: Chemical composition on dry matter basis of experimental rations

DM: Dry matter, CP: Crude protein, CF: Crude fibre, EE: Ether extract and NFE: Nitrogen free extract Calculated ME MJ/KG metabolizable energy. PJP: *Prosopis juliflora* pods, TT total tannins TC condensed tannins

2.5. Blood Sample Collection

Two sets of blood samples were taken weekly from the experimental animals via jugular venipuncture using 5mL syringe. A 2mL blood sample was collected into labeled sterile bottles containing EDTA as anticoagulant and the contents were gently mixed for hematology. A 3 mL of blood sample for serum analysis were collected into anticoagulant free bottles, allowed to clot for 2h at room temperature. Then samples were centrifuged at 3000rpm for 15min and haemolysis free sera were harvested into vials and stored at -20°C in freezer for subsequent biochemical analysis.

2.6. Chemical Analysis

Dried samples of feeds were milled using a mm sieve in a hammer mill. Samples were analyzed for nitrogen by micro-Kjeldahl method (AOAC, 1990). Dry matter content (DM), ether extraction and ash content were determined according to the Official Method of Analysis (AOAC, 1990).

2.7. Blood Analysis

The methods described in Schalm's Veterinary Haematology (Jain 1986) with modifications suggested by Dacie and Lewis (1990) were used for determination of haematological values. The anticoagulated blood samples were used immediately for the measurement of packed cell volume (PCV) by micro-haematocrit method and hemoglobin concentration by the cyanomethaemoglobin method. Red blood cells (RBC), total white blood cells count (WBC) were determined using the improved Neubauer hemocytometer counting chamber (Hawksley and Sons, Ltd England) after appropriate dilution. The values derived from measurement of the erythrocytic series (RBC, Hb and PCV) were used to calculate the haematological indices, Mean corpuscular hemoglobin (MCH), mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC) according to Dacie and Lewis (1990). Urea nitrogen was determined by enzymatic colorimetric method according to Harold 1988. Serum total protein and albumin were determined by the method of (Peters et al. 1984). Cholesterol was measured by method of (Allain et al 1974). Plasma glucose level was determined by the enzymatic colorimetric method using kit (Plasmatec Laboratory at Product Ltd Germany). The serum triglyceride, serum enzymes ALT, ALP and AST were determined colorimetrically using commercially available reagent kits (Randox® Test Kits). The serum concentration of Cl was analyzed by colorimetric method (Schoenfeld and Lewellen, 1964).

2.8. Statistical Analysis

The statistical analysis of the data was performed using statistical Package for Social Science Program (SPSS) using widows (Version 10.0, 1999) One-way analysis of variance (ANOVA) test was used to determine the effect of diets on the parameters investigated. Mean separation was performed using Tukey test at 5% significance level.

3. Results

The chemical composition of *Prosopis* pods and the experimental diets is presented in table 1. The crude protein (CP) content of *Prosopis* was high (12.64±0.21) and dry matter (DM) was (95.17±0.09). The experimental diets were formulated to be isonitrogenous (CP 17) and isocaloric and suppose to support effectively goat's growth requirements according to (NCR). The *Prosopis* pods (PJP) used in the study was collected from Elqutainah with tannin content of 9.1g/kg.

The total leukocyte count (TLC) for T₁ to T₄ range from 8.57±1.32 to 9.86±1.50. The erythrocytes (RBC) highest count (13.5±0.93) was for T₄ and the lowest count (12.20±0.51) was for T₁. The PCV obtained for animals on treatment T₁, T₂, T₃ and T₄ ranged between 29.77±2.73 and 27.17±1.51. Haemoglobin concentration (HB) range from 8.93±1.04 to 9.25±0.81 for T₁ to T₄. The highest value for erythrocyte sedimentation rate (ESR) was 5.5±1.71 and the lowest value was 3.97±2.12 for T₄ and T₃ respectively. Clotting time (CT) for T₁ to T₄ range from 1.24±0.10 to 1.4±0.15. None of blood indices were significantly affected (p<0.05) by dietary treatments. The mean corpuscular volume (MCV) T₁ to T₄ range from 24.44±12.02 to 25.75±14.13. The mean corpuscular haemoglobin did not significantly affected by dietary treatment and from 7.89±0.83 to 8.16±0.89 for T₁ to T₄. Mean corpuscular haemoglobin concentration were on the range of 32.03±1.23 to 32.15±1.27 for the treatment group.

Parameters	Percentage(%) of <i>Prosopis</i> pods in dietary treatments				SIG
	0%	10%	20%	30%	
TLC (×10 ³ /mm ³)	9.66±1.66	10.23±1.89	10.86±1.50	9.57±1.32	NS
TEC (×10 ⁶ /mm ⁶)	12.20±0.51	13.34±3.59	12.53±1.68	13.50±0.93	NS
PCV (%)	29.77±2.73	27.17±1.51	27.73±3.50	29.77±2.44	NS
Hb(g/dl)	9.20±1.56	8.93±1.42	9.25±0.81	9.00±1.21	NS
CT	1.24±0.10	1.25±0.16	1.25±0.08	1.40±0.15	NS
ESR (mm/h)	4.56±0.33	4.56±0.83	3.97±2.12	5.50±1.71	NS
MCV(fl)	24.48±8.39	24.44±12.02	25.10±9.71	25.75±14.13	NS
MCH (pg)	7.92±0.97	7.89±0.83	8.04±1.40	8.16±0.89	NS
MCHC (%)	32.15±1.27	32.12±1.34	32.06±1.35	32.03±1.23	NS

NS: Non significance

Table 3: Values of haematological parameters of experimental Sudanese Nubian Goats kids fed different level of *Prosopis* pods (s.d.). (Mean ± sd)

Blood serum metabolites of goats kids fed varying level of *Prosopis* pods (PJP) are presented in table (4). The concentration of total protein, albumin cholesterol, enzyme ALP, ALT and chloride were not significantly ($p < 0.05$) affected by dietary treatment. Total protein ranged between (6.53 ± 1.2 to 6.64 ± 1.05) in T_2 and T_4 respectively. The albumin has the lowest value (3.29 ± 0.35) in T_4 and the highest value (3.29 ± 0.35) in T_2 . Cholesterol decreased with increasing in *Prosopis* level and ranged from 56.85 ± 4.53 to 45.47 ± 5.94 in T_1 and T_4 . High chloride value of 106.35 ± 6.44 was in T_1 and lowest was (104.83 ± 5.92) in T_4 . Enzyme ALP was the highest (88.89 ± 6.70) in T_4 and lowest in T_1 . Enzyme ALT was the lowest in T_4 (16.07 ± 2.62) followed by T_1 . The concentration of glucose, urea, triglyceride, total bilirubin, direct bilirubin and enzyme AST were significantly ($p < 0.05$) affected by dietary treatment. Both glucose and urea concentration were significantly higher for kids fed 30% *Prosopis*. The animals in T_4 had shown the lowest triglyceride concentration.

Parameters	Percentage(%) of <i>Prosopis</i> pods indietary treatments				SIG
	0%	10%	20%	30%	
Glucose (g/dl)	60.10 ± 2.29^b	60.33 ± 3.32^b	65.93 ± 3.84^a	67.2 ± 7.61^a	**
Total protein(g/dl)	6.57 ± 1.2	6.53 ± 0.99	6.62 ± 1.3	6.64 ± 1.05	NS
Albumin (g/dl)	3.29 ± 0.35	3.19 ± 0.48	3.23 ± 0.34	3.19 ± 0.35	NS
Urea(mg/dl)	33.70 ± 2.14^b	32.41 ± 6.70^b	37.09 ± 5.22^a	37.18 ± 3.50^a	**
ALP (U/L)	84.9 ± 6.30	85.89 ± 6.43	86.8 ± 9.57	88.89 ± 6.70	NS
AST(GOT) (U/L)	22.87 ± 0.97^b	23.00 ± 2.71^b	24.80 ± 1.80^{ab}	26.30 ± 1.35^a	*
ALT(GPT) (U/L)	16.13 ± 2.887	16.89 ± 2.89	16.32 ± 2.74	16.07 ± 2.62	NS
Chloride (mEq/l)	106.35 ± 6.44	106.16 ± 4.78	105.53 ± 6.36	104.83 ± 5.92	NS
Cholesterol (mg/dl)	56.85 ± 4.53	50.39 ± 4.19	53.55 ± 4.91	45.47 ± 5.94	NS
Triglycerides (mg/dl)	37.33 ± 4.84^a	29.07 ± 1.42^b	19.30 ± 3.60^c	19.63 ± 2.02^c	**
Total billirubin (mg/dl)	0.68 ± 0.14^a	0.64 ± 0.08^a	0.45 ± 0.03^b	0.40 ± 0.05^b	**
Direct billirubin (mg/dl)	0.19 ± 0.02^b	0.20 ± 0.07^{ab}	0.16 ± 0.02^c	0.27 ± 0.06^a	*

a, b, c, means in the same row values have different superscripts are significantly different ($p < 0.05$).
 * Significant
 ** Highly Significant

Table 4: Values of serum parameters of experimental Sudan Nubian Goats kids fed diets of different level of *Prosopis* pods with (S. D.) (Mean \pm s.d.)

4. Discussion

4.1. Effect of Feeding *Prosopis* Pods in Blood Hematology

The animals were in excellent condition throughout the experimental period without signs of abnormal health. Feeding *Prosopis* pods to the goats for 50 days did not affected their health or growth. As health problems were encountered in goats fed *Prosopis* in study by (Tabosa et al., 2000). Haematological data obtained from the present study were within the normal range reported for healthy ruminants of the same age (Blood et al., 1983). Similar results were obtained from many experiments of feeding *Prosopis* pods (Mahgoub et al., 2008; Singh and Bhatia 1998). The normal PCV values here in the current experiment contradict the low PCV observed by Mahgoub et al (2008) for sheep fed non-conventional diet, but falls within the range of 21-35% reported by Daramola et. al., (2005). Haemoglobin concentration (Hb) did not significantly affected by the dietary treatments and were within the reference range (8- 14 g/dl) for goats (Sirois, 1995). Haemoglobin concentration values were suggestive for the absence of microcytic hypochromic anaemia caused by iron deficiency. Similar values of Hb concentration were reported by Bhatt et al (2007) in kids and lambs fed *Prosopis* leaves containing diet. The (TEC) value reported in this experiment were within the range reported by (Tambuwal et al., 2002). The erythrocytic indices (MCV, MCH and MCHC) which are important in characterization of anaemia, did not significantly affected in goats fed *Prosopis* and were within the normal ranges (Merck, 1979). The leukocytes count were within the range of the normal values (Schalm et al., 1975) and did not affected by dietary treatments confirming the fact that the animals health did not adversely affected. These results were opposite to that of Mahagoub et al.(2008) in the sheep feeding experiment. The values of clotting time and ESR were within the range reported for normal goats. The ESR values were similar to those reported by Akinoyemi et al. (2010) with sheep fed *Moringaoleifra*.

4.2. Blood Metabolite

Glucose is relatively good indicator of energy balance. Reduced level of glucose in animals result in gross reduction in weight gain and milk yield and in change in the fatty acid composition of the milk (Zapta, et al., 2003). The hypoglycaemic effect of browsetrees was reported by (Akbar and Gupta, 1985), Blood glucose concentrations in the study were significantly different among treatments and were increased with increase inclusion of *Prosopis* in the diet. Glucose concentration of all treatments were within the values reported by Dhanotiyo, (2004). The current values were higher to those of McDougall, (1991) and relatively similar to those of Okonkwo, et al., (2010) in Nigerian goats and Babeker and Elmansoury, (2013) in Sudanese desertgoats. The serum total protein and albumin were not affected by dietary treatments. The values were in the minimum limits of physiological range of 6 g/dl and 3 g/dl for blood total protein and albumin concentrations respectively (Kaneko, 1989). Higher serum total protein values (7 to 9.5) than

observed in this study, was reported by Ikhimiya and Imasuen (2007) in goats fed trees leaves. Urea concentration gives a good estimation of adequacy of dietary protein levels (Blackwell and Libby, 1982). Serum urea concentration were on the range between 37 to 54 mg/ dl. The treatments effect on serum urea concentrations were highly significant. However, urea values in the experiment were greatly increased, they were similar to the values of (10-60 mg/dl) reported by Mitruka and Rawnsley (1977) for goats. Opera et al., (2010) reported urea concentration of $(34.5 \pm 1.7$ to 40.1 ± 3.6 mg/dl) in apparently healthy West African Dwarf goat. The results of urea concentration obtained from this study were high in contrast to that reported in goats fed up to 90% *Prosopis* by (Cook et al. 2008). The high serum urea concentrations values could be due to high CP of the experimental diets (Schmidely et al. 1999). A close relationship between protein intake and BUN levels in growing-finishing lamb was observed by (Preston et al 1965). Cholesterol levels did not change in this study and were lower than the range of (70- 116 mg/100) reported by (Scott, 1999; Zubcic, 2001). But the levels were similar to (Okonkwo, et al, 2010), who also found that cholesterol level in Nigerian goats is inversely proportional to the glucose concentration. Serum triglyceride concentration exhibited significant changes and they were lower than that reported by Elitok, (2010) for clinically healthy Saanen goats. Both total and direct bilirubin were affected by treatments but variation was within the normal range of (0.00- 0.9 mg/100ml total bilirubin) given by (Singh, 2004). These serum enzymes (AST, ALT and ALP,) as well as total bilirubin and direct bilirubin are conventionally used as indicator of hepatic damage (Silanikove and Tiomkin, 1992). These blood biochemical constituents did no change by inclusion or *Prosopis* in this experiment or tree leaves as reported by (Raghuvansi, 2007). The serum concentration of these constituents were within the reference values of goats.

5. Conclusion

The results of this study revealed that animals fed graded level of *Prosopis* pods 20% to 30% maintained normal haematological profile and normal serum metabolites. The experimental goats were on an excellent healthy status. However, inclusion of *Prosopis* pods in diet of goats could be encouraged in order to improve ruminant's productivity. Consequently, use of pods as dry season feed may alleviate the nutritional stress of animals and contribute to adequate management of *Prosopis* trees.

6. References

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