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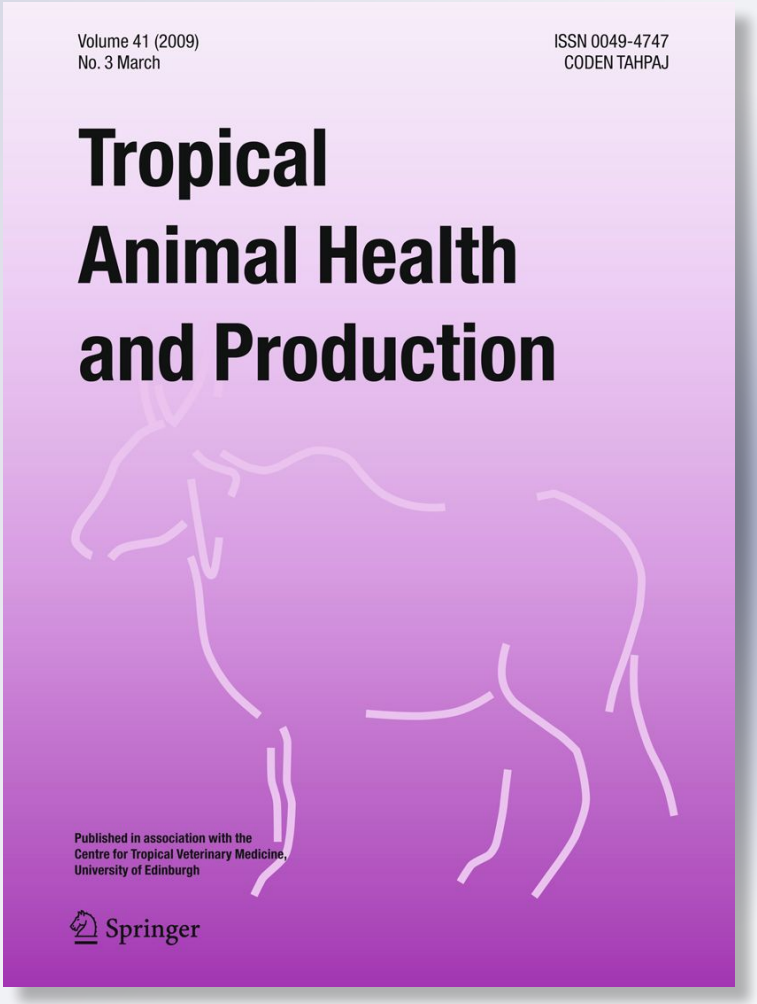

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ORIGINAL RESEARCH

Haematological and serum biochemical parameters of West African Dwarf goats fed dried cassava leaves-based concentrate diets

Adebayo Olusoji Oni · Oluwasanmi Moses Arigbede · Olusiji Sunday Sowande · Uchenna Young Anele · Oluwakemi Oluremilekun Oni · Chryss Friday Ijeoma Onwuka · Olufemi Sunday Onifade · Kafayat Omowumi Yusuf · Peter Aniwe Dele · Ronke Yemisi Aderinboye

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Abstract The study was conducted to investigate the effects of feeding different levels of dried cassava leaves at 0%, 20%, 40% and 60%, respectively, using guinea grass as basal feed, on the haematological and serum biochemical parameters of West African Dwarf (WAD) goats. The study lasted for 116 days during which haematological and serum biochemical parameters were monitored in 40 male goats before and after, using a completely randomized design. At the start of the experiment, packed cell volume (PCV) ranged from 21.5% to 25.5% while haemoglobin concentration (Hb) and RBC significantly ($P<0.01$) ranged from 7.3 to 8.6 g/dl and 10.4 to 13.2×10^{12}/l, respectively. White blood cells reduced significantly ($P<0.05$)) from 16.4 to 11.7×10^{9}/l) as dried cassava leaves increased in the diets. At the end of the trial, there was a slight increase in the values of PCV and Hb in the diets ($P>0.05$). Lymphocyte reduced significantly ($P<0.05$) from 50.0% to 63.5% in the diets. Neutrophils, however, increased ($P>0.05$) at the 0% to 40% levels and reduced at the 60% level of dried cassava leaves inclusion. At the start of the experiment, values for glucose significantly ($P<0.05$) ranged from 40.1 to 56.0 mg/dl. Total protein and albumin values ranged significantly ($P<0.05$) from 56.0 to 68.5 g/dl and 30.6 to 38.4 g/dl, respectively. At the end of the experiment, serum creatinine increased significantly ($P<0.05$) as the level of dried cassava leaves increased from 0% to 60% in the diets. The study revealed that inclusion of dried cassava leaves in the diets of West African Dwarf goats had no deleterious effects on the haematological and serum biochemical parameters of WAD goats and could therefore be included in ruminant diets up to 60%.

Keywords Haematology · Serum · Cassava leaves · Goats · West African dwarf

A. O. Oni (✉) · C. F. I. Onwuka · K. O. Yusuf · R. Y. Aderinboye
Department of Animal Nutrition, College of Animal Science and Livestock Production, University of Agriculture,
P.M.B. 2240,
Abeokuta, Ogun State, Nigeria
e-mail: profoni2003@yahoo.com

O. M. Arigbede · U. Y. Anele · O. S. Onifade · P. A. Dele
Department of Pasture and Range Management, College of Animal Science and Livestock Production,
University of Agriculture,
P.M.B. 2240,
Abeokuta, Ogun State, Nigeria

O. S. Sowande
Department of Animal Production and Health, College of Animal Science and Livestock Production, University of Agriculture,
P.M.B. 2240,
Abeokuta, Ogun State, Nigeria

O. O. Oni
Department of Agricultural Education, School of Vocational Education, Federal College of Education,
Osiele,
PMB 3096 Abeokuta, Ogun State, Nigeria

Introduction

Ruminant feeding systems based on poor quality tropical foliages, crop residues or agro-industrial by-products, in which protein is one of the first limiting factors, may require additional protein and roughage to maintain an efficient rumen ecosystem that will stimulate nutrient intake and improve animal performance. The increasing pressure on the use of cereals by the human population and livestock feed millers, coupled with a deficit of animal protein intake especially in developing countries necessitate the use of unconventional feedstuffs for livestock production. One

such feedstuff is cassava which has been successfully incorporated into diets not only for ruminants but also for non-ruminants to replace maize completely.

Nutrition, breed, sex, age, reproductive status, environmental factors, stress and transportation are known to affect haematological and biochemical parameters (Balikci et al. 2007) and thought to play major roles in the differences in haematological and biochemical parameters observed between tropical and temperate animals (Opara and Fagbemi 2009). Belewu and Ogunsola (2010) asserted that serum creatinine helps in evaluating the liver function and diseases while serum urea evaluates renal function, and it may also indicate dehydration. Haematological and biochemical indices of animals may give some insight as to the production performance potentials of West African Dwarf goats (Orheruata and Akhuomobhogbe 2006). There is a great variation in the haematological and biochemical parameters as observed between breeds of goats (Tambuwal et al. 2002) and in this regard, it may be difficult to formulate a universal metabolic profile test for goats. These differences have further underlined the need to establish appropriate physiological baseline values for various breeds of livestock in Nigeria, which could help in the realistic evaluation of the management practice, nutrition and diagnosis of their health condition (Opara et al. 2010). While it is apparent that a lot of work have been done and reported on the feeding values of cassava leaves, little or no work have been reported on the haematological and biochemical parameters of West African Dwarf (WAD) goats fed dried cassava leaves. The present study is therefore, designed to determine the effects of different levels of inclusion of dried cassava leaves in the diets of WAD goats on their haematological and serum biochemical parameters.

Materials and methods

Location and climate of the study area

The study was conducted in the Small Ruminant Experimental Unit, College of Animal Science and Livestock Production, University of Agriculture, Abeokuta, Nigeria. The experimental site was located in the derived savannah vegetation zone of south-western Nigeria. The climate in this area is tropical, with a wet season from March to October and a dry season from November to February. Annual rainfall averages about 1,100 mm, and the peak rainfall occurs in the period June–September. The temperatures and relative humidity ranges during the study were 32–35°C and 75–83%, respectively. The experiment was conducted in the dry season (i.e. December–March 2008).

Experimental animals and their management

Forty WAD male goats aged 10–12 months with an average live weight of 6.62±0.06 kg were used for this study. The animals were housed intensively in well-ventilated individual pens (1.2 m×0.90 m), in an open-sided type of house with corrugated aluminium roofing sheet and a wooden floor, which had been disinfected with Izal solution before the arrival of the animals. The goats were vaccinated against *Peste des petit de ruminant*, given prophylactic treatments, which consisted of intramuscular application of oxytetracycline and vitamin B complex at the dosage of 1 ml/10 kg body weight of the animal. They were dewormed with 1 ml/10 kg body weight of albendazole® and treated against ectoparasites with 0.5 ml/10 kg body weight of Ivomec®. They were allowed an adaptation period of 4 weeks during which they were maintained on elephant grass and concentrate supplement with gradual withdrawal of the grass. Fresh water was supplied ad libitum.

Experimental feed

The cassava foliage (leaves+petiole) used was obtained from farms within and around the University environment after root harvesting. The foliage was harvested fresh and sun-dried for 3 days until the leaves and petiole were brittle and thoroughly dried. *Panicum maximum* was used as the basal feed. Four experimental concentrate diets were compounded to include dried cassava leaves at 0%, 20%, 40% and 60%. Other ingredients in the diets were dried brewers' grains, wheat bran, molasses, sulphur, salt and vitamin/mineral premix (Table 1). After the adaptation period, the animals were divided into four treatment groups of ten animals each and assigned to one of the four different

Table 1 Ingredient composition (grams per kilogram) of the experimental concentrate diets

Composition (g/kg)	Levels of inclusion of dried cassava leaves			
	0%	20%	40%	60%
Dried cassava leaves	0.0	200.0	400.0	600.0
Dried brewers' grains	600.0	400.0	200.0	0.0
Wheat offal	285.0	285.0	285.0	285.0
Molasses	100.0	100.0	100.0	100.0
Salt	7.0	7.0	7.0	7.0
Sulphur	3.0	3.0	3.0	3.0
Premix[a]	5.0	5.0	5.0	5.0
Total	1,000	1,000	1,000	1,000

[a] Each kilogram contains vitamin A, 10,000 IU; vitamin E, 70,000 IU; vitamin D, 1,600,000 IU; Fe, 50 g; Zn, 40 g; Mn, 40 g; Co, 0.1 g; Cu, 10 g; Se, 0.1 g; I, 0.5 g

Table 2 Chemical composition (grams per kilogram DM) of experimental concentrate diets, dried cassava leaves and *P. maximum*

Composition[a]	Levels of inclusion of dried cassava leaves					
	0%	20%	40%	60%	Dried cassava leaves	*P. maximum*
Dry matter	897	895	896	896	901	367
Crude protein	173	173	175	176	208	84
Neutral detergent fibre	416	428	429	428	613	675
Acid detergent fibre	199	204	205	205	480	382
Condensed tannins	0.2	2.9	4.3	6.6	21.6	3.3
HCN (mg/kg DM)	–	16.6	23.6	32.4	78.6	–
ME (MJ/kg DM)[b]	7.7	7.6	7.6	7.5	4.1	8.6

[a] Mean values (*df*=2)

[b] Estimated according to MAFF (MAFF 1984) equation (ME=DOM%×0.15)

experimental diets formulated. Each animal was kept and fed separately during the entire period of the experiment. The concentrate supplements were given to the animals at 8.00 A.M. while wilted *P. maximum* that had been harvested the previous day was given to the animals in the evening. The *P. maximum* which had earlier been cut back in sequence was harvested from 8 weeks old regrowth of the small ruminant paddock of the University farm. During the 112-day experimental period, quantities of feeds offered and refused were measured daily to compute feed intake.

Collection of blood samples

Blood samples (approximately 10 ml) were collected from each goat via jugular vein puncture using hypodermic syringes before feeding. Blood collection was at the start and end of the experiment. Blood, 5 ml, was drawn into a heparinized tube to prevent coagulation while the remaining 5 ml was left in the syringe to coagulate. Blood samples were then analysed for packed cell volume (PCV), Hb, white blood cells (WBC), red blood cells (RBC), serum protein, serum glucose, serum albumin and globulin, serum creatinine, serum urea, mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), serum glutamate oxalate transaminase and serum glutamate pyruvate transaminase (SGPT).

Chemical analyses

Aliquots of daily feed samples (concentrate and basal) were collected, oven-dried, ground and sieved through a 2-mm sieve and stored in airtight containers for proximate (AOAC 1995, reference ID numbers DM 930.15, CP 984.13) and fibre (Van Soest et al. 1991) analyses. Metabolisable energy (ME) was estimated according to the Ministry of Agriculture, Fisheries and Food (MAFF) (MAFF 1984) equation: ME=digestibility of organic matter (DOM) percentage×0.15, where DOM percentage=(0.92×DOM percentage)−1.2, where EE is ether extract, ADF is acid detergent fibre and ADL is acid detergent lignin.

The packed cell volume was measured for each animal in fresh ethylene diamine tetra acetic acid (EDTA) anticoagulant samples within 24 h of collection using the micro-haematocrit method. Haemoglobin concentration was also measured in fresh EDTA anticoagulant samples using the Sahl's (acid haematin) method (Benjamin 1978). RBC was measured in fresh EDTA with the aid of Neubaur counting chamber (haemocytometer). Blood smears were used for total thrombocyte, total WBC counts (Tavares-Dias et al. 2008), and WBC differential relative and absolute counts. Differential relative and absolute counts were classified as lymphocytes, neutrophils, eosinophils, basophils and monocytes. Plasma glucose was measured in fluoride oxalate anticoagulant blood samples using the

Table 3 Nutrients intake of WAD goats fed graded levels of dried cassava leaves

Parameters	Levels of inclusion of dried cassava leaves				SEM	Probability[a]		
	0%	20%	40%	60%		L	Q	C
DM intake (g/d)								
Concentrate	259	294	298	285	11.8	NS	NS	NS
Grass	223	232	239	242	2.75	**	*	*
Total	482	526	527	528	13.6	NS	NS	NS
CP intake (g/d)	101	111	112	112	2.74	NS	NS	NS
NDF intake (g/d)	534	569	589	584	15.2	NS	NS	NS
CT intake (g/d)	1.80	1.95	2.04	2.12	0.04	**	NS	NS
HCN intake (mg/kg DM)	0	5.52	7.86	10.3	0.92	**	**	**

NS not significant

[a] Probability for Linear (L), Quadratic (Q) and Cubic (C) trends

*$P<0.05$; **$P<0.01$

Table 4 Haematological parameters of West African Dwarf goats fed graded levels of dried cassava leaves

Parameters	Normal values[a]	At the start of experiment								At the end of experiment							
		Levels of inclusion of dried cassava leaves				SEM	Probability[b]			Levels of inclusion of dried cassava leaves				SEM	Probability[b]		
		0%	20%	40%	60%		L	Q	C	0%	20%	40%	60%		L	Q	C
Packed cell volume (%)	22–38	25.5	22.0	21.5	25.5	0.60	NS	**	**	27.5	25.5	24.0	26.0	0.65	NS	NS	NS
Haemoglobin concentration (g/dl)	8–12	8.6	7.5	7.3	8.6	0.20	NS	**	**	9.0	8.6	7.9	8.7	0.25	NS	NS	NS
Red blood cells ($\times 10^{12}$/l)	8–18	13.2	10.5	10.4	12.7	0.42	NS	**	**	13.0	12.3	11.4	12.4	0.36	NS	NS	NS
Mean Corpuscular haemoglobin (Pg)	5.2–8.0	6.6	7.3	7.0	6.8	0.11	NS	NS	NS	7.0	7.1	6.9	7.1	0.04	NS	NS	NS
Mean corpuscular haemoglobin concentration (g/dl)	30–36	33.8	33.9	33.8	33.7	0.08	NS	NS	NS	33.0	33.4	32.8	33.1	0.18	NS	NS	NS
White blood cells ($\times 10^{9}$/l)	4–13	16.4	13.4	12.1	11.7	0.73	**	**	*	13.5	8.7	7.8	9.6	0.96	NS	NS	NS
Lymphocyte (%)	50–70	64.8	59.0	70.3	51.0	3.23	NS	NS	NS	52.5	50.0	63.5	55.0	2.42	NS	NS	*
Neutrophil (%)	30–48	33.8	39.0	28.8	56.0	3.98	NS	NS	NS	47.0	48.5	35.0	49.5	2.38	NS	NS	*
Basophil (%)	0–2	0.0	0.0	0.0	0.0	0.00	NS	NS	NS	0.0	0.0	0.8	0.0	0.19	NS	NS	NS
Eosinophil (%)	3–8	0.0	1.5	0.5	0.5	0.30	NS	NS	NS	0.0	0.5	0.3	0.3	0.14	NS	NS	NS
Monocyte (%)	0–4	1.5	0.5	0.5	0.0	0.30	NS	NS	NS	0.0	0.3	0.0	0.0	0.06	NS	NS	NS

NS not significant

[a] Normal values according to Fraser and Mays (1986)

[b] Probability for Linear (L), Quadratic (Q) and Cubic (C) trends

*$P<0.05$; **$P<0.01$

enzymatic glucose oxidase method (Bauer et al. 1974). MCH and MCHC values were calculated from PCV, Hb and RBC values (Jain 1986). Total serum protein was measured in serum for individual animal using the biuret method. Serum glutamate pyruvate transaminase and serum glutamate oxalate transaminase were analysed spectrophotometrically by using commercially available diagnostic kits (Randox® Test Kits). Serum albumin and globulin were determined using bromocresol purple method of Varley et al. (1980). Serum creatinine was determined using the principle of Jaffe reaction as described by Bousnes and Taussky (1945).

Statistical analyses

All data were laid out as completely randomized design and analysed with one-way analysis of variance using SPSS (1999). Model sums of square were partitioned to test linear, quadratic and cubic trends (Gomez and Gomez 1983).

Results

The dry matter (DM) for the experimental concentrate diets was similar for all the diets while *P. maximum* had a dry matter content of 367 g/kg DM (Table 2). The DM intake ranged from 482 to 537 g/day and significantly (L, Q, C: $P>0.05$) increased with increasing levels of dried cassava leaves in the diets (Table 3).

Table 4 presents the haematological parameters of West African Dwarf goats fed graded levels of dried cassava leaves. At the commencement of the trial, PCV ranged from 21.5% to 25.5% while Hb and RBC ranged from 7.3 to 8.6 (g/dl) and 10.4 to 13.2×10^{12}/l, respectively and were significant at (Q, C: $P<0.01$) at quadratic and cubic trends. White blood cells reduced significantly (L, $P<0.01$; Q, $P<0.01$; C, $P<0.05$)) from 16.4 to 11.7×10^{9}/l) as dried cassava leaves increased in the diets. At the end of the trial, there was a slight increase in the values of PCV and Hb in the diets ($P>0.05$). Table 5 shows the serum biochemical and enzyme parameters of West African Dwarf goats fed graded levels of dried cassava dried. At the start of the experiment, values for glucose ranged from 40.1 to 56.0 mg/dl and were significant (L, $P<0.05$) at the linear trend. Total protein and albumin values ranged from 56.0 to 68.5 and 30.6 to 38.4 g/dl, respectively and were significant (L, $P<0.01$; Q, $P<0.05$; C, $P<0.05$) at the linear, quadratic and cubic trends. At the end of the experiment, glucose increased ($P>0.05$) in the diets at the 0%, 20% and 40% levels and reduced ($P>0.05$) at the 60% level. Total protein increased ($P>0.05$) across the dietary treatments while urea showed a slight reduction at the 40%

Table 5 Serum biochemical and enzyme parameters of West African Dwarf goats fed graded levels of dried cassava leaves

Parameters	Normal values[a]	At the start of experiment							At the end of experiment						
		Levels of inclusion of dried cassava leaves				SEM	Probability[b]			Levels of inclusion of dried cassava leaves				SEM	Probability[b]		
		0%	20%	40%	60%		L	Q	C	0%	20%	40%	60%		L	Q	C
Glucose (mg/dl)	48.2–76	40.1	43.5	40.3	56.0	2.58	*	NS	NS	52.4	47.4	48.3	54.0	2.05	NS	NS	NS
Total protein (g/l)	61–74.5	56.0	62.2	61.7	68.5	1.64	**	*	*	70.4	70.2	71.3	71.6	1.27	NS	NS	NS
Urea (mg/dl)	12.6–25.8	30.4	30.7	33.0	28.2	1.37	NS	NS	NS	30.4	35.8	28.1	29.9	2.19	NS	NS	NS
Albumin (g/l)	23.5–35.7	30.6	33.6	32.7	38.4	1.02	**	*	*	34.0	31.7	37.4	37.3	1.19	NS	NS	NS
Globulin (g/l)	27–44.3	24.6	28.6	29.0	30.1	0.98	*	NS	NS	37.6	38.7	33.9	34.3	1.40	NS	NS	NS
Creatinine (mg/dl)	0.7–1.5	0.8	0.9	0.9	0.9	0.02	NS	NS	NS	0.8	0.9	1.0	1.2	0.06	**	*	*
SGOT (IU/l)	66–230	52.5	53.8	48.5	54.5	1.68	NS	NS	NS	26.0	29.3	27.0	18.8	1.86	NS	NS	NS
SGPT (IU/l)	15.3–52.3	45.0	46.8	43.5	44.3	0.98	NS	NS	NS	10.5	15.3	16.8	7.0	1.37	NS	**	*

SGOT serum glutamate oxalate transaminase, *SGPT* serum glutamate pyruvate transaminase, *NS* not significant

[a] Normal values according to Fraser and Mays (1986)

[b] Probability for Linear (L), Quadratic (Q) and Cubic (C) trends

*$P<0.05$; **$P<0.01$

level of inclusion in the diet. SGPT values showed a significant (Q, $P<0.01$; C, $P<0.05$) quadratic and cubic reduction across the dietary treatment. The mean differences in values of all the parameters were reflected in Table 6.

Discussion

The high DM concentration of the diets was sufficient to support a reasonable amount of DM intake. The high CP content (172.6–175.5 g/kg DM) obtained in the study involving feeding graded levels of dried cassava leaves to WAD goats was consistent with Ledin et al. (2005) and Oluremi and Ngi (2006). Mean PCV values obtained in this study were within the range of 25–30% reported by Opara et al. (2010). In contrast to this, Taiwo and Ogunsanmi (2003) reported higher values of 36.9% and 35.5% for clinically healthy WAD goats and sheep. The implication of these observed PCV values, going by the reports of Ganong (2001) is that all the animals on the various diets could probably have a relatively reduced tendency for a return of PCV to normal level following an infection through compensatory accelerated production. The Hb range in this study fell within the range of 7–15 g/dl reported by Daramola et al. (2005) but higher than the values of 5–6 g/dl obtained by Belewu and Ogunsola (2010) for goats fed fungi-treated *Jatropha curcas* kernel cake rations. With the relatively higher Hb concentration obtained in this study, the dietary treatments generally seemed to be capable of supporting high oxygen carrying capacity blood in the goats. The RBC counts reported in this study were within the range of 9.2–13.5 g/l reported by Tambuwal et al. (2002), 9.9–18.7 g/l by Taiwo and Ogunsanmi (2003), and $10.25–12.85\times10^{12}$/l) obtained by Ajala et al. (2000). The reduced RBC counts recorded for goats in the control and 60% inclusion diets present a likely susceptibility to anaemia-related disease conditions by these goats. The WBC counts which reduced across the dietary treatments was within the range of $6.8–20.1\times10^{9}$/l) reported by Daramola et al. (2005) and the range of 7.5–27.9 mm^3 cited by Orheruata and Aikhuomobhogbe (2006). WAD goats seem to possess a protective system, providing a rapid and potent defence against any infectious agent, and this is probably the physiological basis for the adaptation of this species in their ecological zone (Daramola et al. 2005). The

Table 6 Mean differences of haematology, serum biochemical and enzyme parameters of West African Dwarf goats fed graded levels of dried cassava leaves

Parameters	Levels of inclusion of dried cassava leaves				SEM	Probability[a]		
	0%	20%	40%	60%		L	Q	C
Packed cell volume (%)	0.35	1.10	0.60	0.18	0.27	NS	NS	NS
Haemoglobin concentration (g/dl)	2.00	2.25	2.50	1.00	0.57	NS	NS	NS
Red blood cells ($\times10^{12}$/l)	−2.00	1.85	1.00	−0.25	0.51	NS	NS	NS
Mean corpuscular haemoglobin (Pg)	0.41	−0.19	−0.13	0.29	0.12	NS	NS	NS
Mean corpuscular haemoglobin concentration (%)	−0.80	−0.50	−1.00	−0.60	0.01	NS	NS	NS
White blood cells ($\times10^{9}$/l)	−2.75	−3.45	−4.30	−0.40	0.78	NS	NS	NS
Lymphocyte (%)	−12.30	−9.00	−6.80	4.00	2.84	**	*	*
Neutrophil (%)	13.20	9.50	6.20	−6.50	4.24	*	NS	NS
Basophil (%)	0.00	0.00	0.75	0.00	0.19	NS	NS	NS
Eosinophil (%)	0.00	−1.00	−0.25	−0.25	0.22	NS	NS	NS
Monocyte (%)	−1.50	−0.25	−0.50	0.00	0.29	NS	NS	NS
Glucose (mg/dl)	12.25	3.85	8.00	−2.00	2.33	NS	NS	NS
Total protein (g/l)	13.05	8.05	9.60	3.15	1.05	**	**	**
Urea (mg/dl)	8.35	2.38	1.40	0.20	1.66	NS	NS	NS
Albumin (g/l)	3.40	−1.90	4.70	−1.10	0.96	NS	NS	NS
Globulin (g/l)	11.20	9.95	4.90	4.25	1.33	*	NS	NS
Creatinine (mg/dl)	−0.05	0.05	0.05	0.35	0.06	*	*	NS
SGOT (IU/l)	−26.50	−24.50	−21.50	−39.00	2.57	NS	*	*
SGPT (IU/l)	−34.50	−31.50	−27.50	−38.00	1.33	NS	*	*

SGOT serum glutamate oxalate transaminase, *SGPT* serum glutamate pyruvate transaminase, *NS* not significant

[a] Probability for Linear (L), Quadratic (Q) and Cubic (C) trends

*$P<0.05$; **$P<0.01$

values obtained in this study fell within the broad range of 47–82% and 51.6% reported by Daramola et al. (2005) and Tambuwal et al. (2002) for lymphocytes and 17–52% and 36.4% for neutrophils reported by the same authors, respectively. These values are suggestive of a well-developed immune system in the WAD goats with such number of immune cells to proffer good health (Daramola et al. 2005). The result also implies that an increase in neutrophils is associated with a decrease in lymphocytes and vice versa (Lazzaro 2001). However, the reduced lymphocytes in 0–40% treatments experienced in this experiment may be attributed to physiological stress response arising from the animal's social behaviour which consists of aggressiveness and hierarchical fights. Zapata et al. (2003) noted that physiological stress response is accompanied by increase lymphopenia. Serum protein obtained in this study at the end of the experiment, though not significant, compared favourably with values reported by Daramola et al. (2005) and Tambuwal et al. (2002). The diets in this study did not significantly affect the globulin levels in the serum of the goats, thus indicating the safety of these leaves as supplements for goats. The higher values for total protein, albumin and globulin in this study compared to reports by Esugbohungbe and Oduyemi (2002) suggest that the cassava leaves could contain low levels of tannins known to diminish nutrient permeability in gut walls as well as increase excretion of endogenous protein which is subsequently passed out in the faeces and so may not alter protein metabolism. Serum urea levels reported in this study were high compared to values reported for apparently healthy Marwari goats (Tanwar et al. 2000). This may probably have been due to persistent hypoglycemia since according to Radostits et al. (1994), catabolic activity is increased for gluconeogenesis thus resulting in high serum urea levels.

In this study, the relatively close but low mean levels observed in the transaminases even at the highest level of 60% inclusion at the end of the experiment, could be an indication that the test diets did not differ in their effects on enzyme secretion mechanism. However, the result of this study suggests a reverse in this regard indicating the potential of dried cassava leaves in the feeding of goats and confirming the observation of Ekpenyong and Biobaku (1986) with rabbits that liver enzymes are known to be high in the blood when the plane of nutrition is low.

Conclusion

It is concluded from this study that dried cassava leaves can be included in the diets of goats up to 60% without deleterious effects on the haematological and serum biochemical parameters of West African Dwarf goats.

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