



Haematology and Serum Biochemistry of Kano Brown Bucks Fed Diets Containing Varying Levels of *Piliostigma Thoningii* Pods in a Semi – Arid Region of Nigeria

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Abstract

The study was conducted to evaluate the influence of feeding different inclusion levels of *Piliostigma thonningii* pods on the haematology and serum biochemistry of Kano Brown bucks. Sixteen (16) growing Kano Brown bucks weighing averagely $10 - 12 \pm 1.2$ kg were randomly allocated to four treatments in a Completely Randomized Design (CRD) with four (4) replications per treatment. Four (4) diets containing *Piliostigma thonningii* pods at 0%, 5%, 10% and 15% were fed at 3.5% of body weight for the period of 84 days. The results of haematological parameters shows that there were significant ($P < 0.05$) differences in haemoglobin concentration and packed cell volume. The results of serum biochemical parameters indicated that there were no significant ($P < 0.05$) differences for most parameters evaluated except blood urea nitrogen (BUN) and albumin (ALB). It was concluded that 15% inclusion level of *P. thonningii* pods had no effect on haematology and serum biochemistry of Kano Brown bucks. It was therefore, recommended that, *P. thonningii* pods could be included up to 15% level in the diet of Kano Brown bucks without any adverse effect.

Keynote: *Piliostigma thonningii*, Bucks, Haematology and Serum

Introduction

Animal protein is considered as the most important component in human diet, whereby its consumption differed from one country to another (Okai *et al.*, 2005). Frequent increase in human population associated with low protein intake results in major problems and reduced livestock population in developing countries like Nigeria, the demand of protein from animal origin has far exceeded the supply (Ani and Adiegwu, 2005).

Small ruminants play an important role in the livestock sub sector of the Nigerian agricultural economy (Lakpini *et al.*, 2002). Goats are generally considered efficient browsers and consume all browse plants that are ignored by cattle and sheep on pasture. Economically, goats are ideally suited for

poorer rural folks due to their low cost of maintenance to marginal and landless people and are also considered as capital investment (Bawala *et al.*, 2006). Goat production in Nigeria has resulted in an increase in the production of high quality animal protein and reduced the rate of poverty alleviation over the years (Ibrahim *et al.*, 2014). Thus small ruminants are ranked as the second most important suppliers of animal protein to the population after cattle (Ahmed and Egwu, 2014). Productivity of these livestock depends to a large extent on their ability to utilize feed resources that have no value in human feeding (Odeyinka *et al.*, 2007). Therefore, efforts have to be intensified in search for alternative non-conventional feed resources which has no nutritional importance to humans to incorporate into the feed (Mukhtar *et al.*,

2011). Haematological parameters are related to the blood and blood-forming organs. The haematological and lipid serum-examination is among the methods which may contribute to the detection of some changes in health status, which may not be apparent during physical examination but which affect the fitness of the animal (Daramola *et al.*, 2015). There is need to investigate the influence of *Piliostigma thonningii* pods on the haematology and serum biochemical indices of Kano brown bucks.

Materials and Methods

Study area

The study was conducted at Kano University of Science and Technology Teaching and Research Farm, Wudil, Kano State. The region is located in the Sudan savanna vegetation zone of North-Western Nigeria and it lies within Latitude 12°58'N and Longitude 8°25'E on an altitude of 408 m above sea level. The climatic condition is characterized by low relative humidity with an annual rainfall of 890 mm (occurring between May and October with a peak in August) and an annual temperature range of 38 - 43°C (Olofin *et al.*, 2008). The soil type of the area is loamy, with little organic matter.

Experimental Materials and Diets

Piliostigma thonningii pods were collected within and outside the University Farm during the dry season when it was ripe (brown in color and fully matured). The pods were shade dried on a concrete floor until completely dried, milled to coarse form and bagged. Ingredients used in formulating the experimental diets include wheat bran, cowpea husk, maize bran, rice milling residue, sorghum chaff and salt.

Experimental Animals and their Management

Sixteen (16) Kano Brown bucks with an average body weight of 10-12 ± 1.2 kg were purchased from Wudil Livestock Market and

used for the study. They were housed individually; antibiotic prophylaxis was administered using oxytetracycline (LA) 20% at a rate of 10 mg/kg body weight. Similarly, animals were dewormed using Ivermectin injection SQ 1% and Albendazole suspension (oral) at a rate of 7.5 mg/kg/body weight. The experimental diets were offered to the animals twice daily at 3.5% body weight i.e morning hours (8.00 am) and afternoon (4:00 pm). Clean water and mineral salt lick were also offered *ad libitum*. Ground nut haulms were given as roughage within the remaining hours of the day. The animals were subjected to two weeks adaptation and then transferred into individual feeding pens, where they were fed the experimental diets. The experiment lasted for 12 weeks (84 days).

Experimental Design and Treatments

The experimental animals were randomly allotted into four (4) treatments with four (4) animals per treatment in a complete randomized experimental design (CRD).

Blood Sample Collection

At the end of the feeding trial, blood samples were individually drawn from three (3) animals of each treatment for haematology and blood serum biochemistry determination. The area was scrubbed using cotton wool and methylated spirit to inhibit the activities of pathogenic microbes. Ten (10 ml) milliliters of blood sample was withdrawn from the animal after restraining via jugular vein using sterile needle and syringe at the early hour of the day (8:00 am) and then placed in the EDTA sample bottle. Five (5 ml) milliliters of each blood sample collected was placed in a bottle containing ethylene diamine tetra acetate acid (EDTA) as an anticoagulant for hematological studies. The remaining 5mls was placed in a universal bottle and allowed to stand for about 2 hours at room temperature. The blood samples in the universal bottle were thereafter

centrifuged at x 3000 rpm for 20 minutes to separate and decant the serum. The serum was stored at -20°C for biochemical analysis (Ogunsanmi *et al.*, 2002).

Determination of Haematological Profile

The blood samples in ethylene diaminetetra acetate (EDTA) bottle were analysed for haemoglobin (HB) content using cyanmethemoglobin (Coles, 1986). Packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC) counts were determined according to the methods described by Coles (1986). Mean corpuscular volume (MCV), mean corpuscular hemoglobin concentration (MCHC) were calculated according to the formula stated in The Merck Veterinary Manual (2016) ($MCV = PCV\% \div RBC \times 10$; $MCH = Hbg/DL \div RBC \times 10$ and $MCHC = Hbg/dl \div PVC \times 100$).

Determination Serum Biochemistry Indices

The blood urea nitrogen (BUN) concentration was determined by Nessler's reaction (Tanis and Naylor, 1968). Serum total protein (TP) was determined by Biuret method as described by Kohen and Allen (1995). Albumin (ALB) was determined by Bromocresol green (BCG) method (Peter *et al.*, 1982). Alkaline phosphatase (ALP) activities were determined using spectrophotometric method as described by Rej and Hoder (1983). Blood glucose (BG) was determined by oxidase method.

Proximate Composition of Experimental Diets

Representative samples of experimental diets were analyzed for proximate composition (dry matter, crude protein, crude fiber, ether extract, ash and nitrogen free extract) according to AOAC (2005) procedures.

Statistical Analysis

The collected data were analyzed using analysis of variance (ANOVA) procedures of the Systems Analytical Statistics (SAS, 2009) software version 9.2 and the means with significant differences were separated using Least Significant Difference (LSD) at 5% level of probability ($P < 0.05$).

Results and Discussion

Proximate composition (%) of experimental diets.

The results of the proximate composition of the experimental diets are presented in Table 1. Dry matter values varied from 90.89% in (T₁) to 96.13% in (T₄). Crude protein value increased numerically across the treatments with an increase in the level of *Piliostigma thonningii* pods (12.48 to 13.97%) while crude fiber values decreased (21.48 to 20.86%). Ether extract values recorded ranged from 1.25 to 1.93%. The ash values of the diets also ranged from 5.40% to 9.52% and nitrogen free extract from 55.10% in (T₄) to 58.71% in (T₁). The experimental diets in this study had DM values similar to those (94.49% - 94.65%) reported by Abdurrahman (2017) at 0% and 15% inclusion levels of *P. reticulatum* pods in diets of small ruminants. However, values were also similar to those (94.00% - 95.00%) obtained by Sirajo *et al.* (2010) for diets containing graded levels of poultry litter. The values of crude protein obtained in the present study for the diet were lower than the range 16 - 18% recommended by Norton (1998) for growing sheep and goats, however, the range of CP obtained in the present study diets were above the 6-8% recommended by NRC (1998) for ruminants in the tropics. Gatenby (2002) recommended 10-12% CP as the moderate level of CP for ruminant production. Therefore, the CP of the diets might be adequate for the growing Kano Brown bucks. The CF values obtained in this study were higher than values (16.88 - 17.77%) reported by Abdurrahman (2017). However, the values obtained were higher than those 18.10 -

21.50% reported by Garba *et al.* (2010) when *Guiera senegalensis* was fed as complete diets. The NFE values obtained in this study were higher than 49.68 – 50.35% obtained by Abdurrahaman (2017). In contrast, the ash and EE content obtained in this study were lower than those (13.05 – 15.23% ash and 3.88 – 5.18% EE) reported by Abdurrahaman (2017). The differences might have occurred possibly as a result of different experimental location and stage of maturity of the test material. The values of ash obtained in present study were lower than the values 8.98 – 11.10% reported in the studies of Nayawo *et al.* (2010) when wheat offals replaced rice milling residue in the diets of Yankasa rams.

The results for hematological parameters of Kano Brown buck fed different inclusion levels of *Piliostigma thonningii* pods are presented in Table 2. There were significant ($P < 0.05$) differences in haemoglobin concentration, packed cell volume, red blood cells and mean corpuscular haemoglobin. No significant ($P > 0.05$) differences were observed for white blood cells, mean corpuscular volume and mean corpuscular haemoglobin concentrations. The mean values of haemoglobin concentration (11.73g/dl) and packed cell volume (35.3%) in T₄ were significantly ($P < 0.05$) higher, but similar to those in T₁ (control) and T₂ (5% inclusion) while T₃ (10% inclusion) recorded the lowest values (9.10 and 27.00%) of both haemoglobin and packed cell volume. Blood parameters have been considered as the major indices of physiological, pathological and nutritional status of an animal. Therefore, metabolic state of an animal and the quality of feed could be an explanation for changes in blood constituents compared to normal values (Ashiru, 2014). The values obtained for haemoglobin (Hb) in this study were higher than that (8.03-9.80 g/dl) obtained by Abdurrahaman *et al.* (2015) for Red Sokoto goats and falls within the range of 8-15 g/dl

recommended for caprine species by Ganti (1983). Similarly the values obtained for haemoglobin were within the normal range (5 - 13g/dl) for goats recommended by Merck (2016). Packed cell volume (PCV) is used as an index of toxicity and its composition varies with breeds (Ahamefule *et al.*, 2005). In the present study, PCV values obtained fell within the normal physiological range of 22-38% reported by Krammer (2000) for healthy goats. The differences could be as a result of different stage of maturity of the test material and possibly the location where test materials were collected. Using different feeding materials and animals, Ashiru *et al.* (2019) reported higher PCV value of (29.17%) for Yankasa Sheep fed sugarcane waste Silage. Aikhuomobhogbe and Orheruata (2006) observed that low PCV results in anemia, which is attributed to reduced oxygen carrying-capacity of blood, increased pulse rate and consequently heart failure. Red blood cells characterize anaemia and other conditions affecting red blood cells in animals. The RBC values obtained in this study were slightly higher than 2.12-3.07% reported by Abdurrahaman *et al.* (2015) for Red Sokoto goats fed *P. reticulatum* pods. The present results showed that the diets supported good health status of the goats, and hence the animals were not anaemic. The values obtained for MCV in the present study were in agreement with the values (94.95-107.55%) reported by Abdurrahaman *et al.* (2015) for Red Sokoto goats fed different levels of *Piliostigma reticulatum* pods. Thus, indicating that *Piliostigma thonningii* pods have less tannin when supplemented in the diet of small ruminants. The value of MCH is within the range of 26.4 ± 1.23 pg reported by Njidda *et al.* (2013) for goats fed on natural grazing land of Northern Nigeria. The MCHC values obtained in this study were lower than 30.68 - 35.45% and 30.46 - 34.12% reported by Abdurrahaman *et al.* (2015) and Olafadehan (2011) for Red Sokoto goats, respectively. The

non-significant differences between the treated groups and the control in RBC, WBC, MCV and MCHC may be an indications that the test material is safe at these inclusion levels.

The results of serum biochemistry are presented in Table 3. It revealed no significant (P<0.05) differences for most parameters evaluated except alkaline phosphates. The mean alkaline phosphates values did not show any discernable trend though T₃ animals had the highest value (64.38) and T₄ the least (46.67), however, all values were within the normal range (26.9-156.1 µ/L) reported by Merck (2016). Serum biochemical parameters are used to determine the level of liver damage and evaluate protein quality and amino acids utilization by animals (Harper *et al.*, 1999). The blood urea levels were within the normal range of 2.09 - 4.68 mmol/l (Tambuwal *et al.*, 2002). The value of blood urea in this study indicated that the amino acids of the diets were balanced because amino acid imbalance will result in an increase in blood urea (Ranjhan, 2001). Ikyume *et al.* (2018) reported that serum total protein values are indications of both quantity and quality of protein utilization in the diets. Similarly, it was reported that lower protein contents of feeds result in depressed total protein values (Etana *et al.*, 2011). Blood glucose levels observed in this

study were within the normal range of 40 – 100 mmol/L (Merck (2016). The blood glucose obtained in this study were within the range (3.30-3.68 mmol/L) reported by Abdurrahaman *et al.* (2015) for Red Sokoto goats fed different levels of *Piliostigma reticulatum* pods, and is in agreement with 3.00 – 3.81 mmol/L reported by Olafadehan (2011) for Red Sokoto bucks. Albumin values obtained in this study were lower than 62.25-74.25g/L reported by Abdurrahaman *et al* (2015) for Red Sokoto goats.

Conclusion

It can be concluded that *Pillio stigma thonningii* pods can be included up to 15% in the diets of Kano Brown bucks without adverse effect on their haematological and biochemical parameters.

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Table 1. Proximate composition of the experimental diets

Parameters (%)	Treatments			
	T ₁	T ₂	T ₃	T ₄
Dry matter	94.61	96.13	92.17	90.89
Crude protein	12.48	13.16	13.54	13.97
Crude fiber	21.48	21.25	21.12	20.86
Ether extract	1.93	1.57	1.39	1.25
Ash	5.40	9.52	7.69	8.82
Nitrogen free extract	58.71	54.50	55.20	55.10

Table 2. Haematological parameters by Kano Brown bucks fed different inclusion levels of *Piliostigma thonningii* pods

Parameters	Treatments				LSD	Normal Values*
	T ₁ (0%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)		
HB (g/dl)	10.40 ^{ab}	10.43 ^{ab}	9.10 ^b	11.73 ^a	0.69	8 – 12
PCV (%)	31.33 ^{ab}	33.04 ^{ab}	27.00 ^b	35.33 ^a	2.32	22 – 38
RBC (×10 ¹² /l)	2.99 ^b	3.25 ^{ab}	3.05 ^b	3.62 ^a	0.44	8 – 18
WBC (×10 ⁹ /l)	6.07	6.27	6.62	6.43	0.70	4 – 13
MCV (fl)	37.8	37.53	34.50	36.43	8.83	26 – 40
MCHC (g/dl)	33.14	33.17	33.20	33.03	0.56	30 – 36
MCH (pg)	37.8 ^a	32.09 ^{ab}	29.83 ^b	32.40 ^{ab}	0.99	26 – 40

^{abc} Means within the same row with different superscript differs significantly (P<0.05) LSD least significant difference, HGB = haemoglobin, PCV = packed cell volume, RBC = red blood cell, WBC = white blood cell, MCV = mean corpuscular volume, MCH = mean corpuscular haemoglobin, MCHC = mean corpuscular haemoglobin concentration. * Source: the Merck Veterinary Manual (2016).

Table 3. Serum biochemical parameters of Kano Brown bucks fed different inclusion levels of *Piliostigma thonningii* pods

Parameters	Treatments				LSD	Normal Values*
	T ₁ (0%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)		
Blood urea nitrogen	6.30	5.90	5.87	5.63	0.70	3.7 - 9.3
Blood glucose (mmol/L)	3.32	3.56	3.09	3.70	0.53	2.4 - 4.5
Akaline phosphates (μ/L)	62.07 ^{ab}	53.33 ^b	64.38 ^a	46.67 ^c	11.22	26 – 156
Serum total protein (g/L)	58.67	58.66	61.67	58.66	6.53	5.9 – 7.8
Albumin (g/L)	3.33	3.33	2.30	3.67	1.76	2.2 – 3.7

^{abc} Means within the same row with different superscript differs significantly (P<0.05), LSD = least significant difference. * Source: the Merck Veterinary Manual (2016).