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Blood profiling and growth response of goats fed diets containing tomentosa nilotica seed meal

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ABSTRACT

The feed quality have direct/indirect impact on the blood profiles of animal and determines health status. Hence, this study was carried out to investigate the dietary effect of T. nilotica seed meal (TNSM) on haematology and serum biochemical indices of goats. 15 West African Dwarf goats with a similar age range of 12- 18 months old and body/live-weight of 6.88±0.26 kg were randomly allocated to 5 dietary treatments with 3 goats per replicate in a Completely Randomized Design arrangement for 12 weeks. Unprocessed TNSM were collected, screened and milled and were used to replace palm kernel cake at 20% (diet B), 30% (diet C), 40% (diet D) and 50% (diet E) replacement levels in a complete concentrate diets while diet A (control diet) had no T. nilotica. Nutrient composition, intake and animals' blood samples were assessed. Results revealed that all parameters observed were significantly ($p<0.05$) different. At 20%, DWG, FGR were best. PCV, RBC, Hb values of the goats decreased with increased with replacement level of PKC with TNSM. It could be concluded that TNSM could serve as protein source in place of PKC in goat diet up to 20% without any adverse effects on growth and health status.

Keywords: tropics, underutilized plants, nitrogen, weight, goats

INTRODUCTION

Goats' farming offers ample opportunity for meat production and availability. They are easy to keep, require smaller capital investment compare to cattle raising, play significant role in socio-economic life of the people as they contribute about 35% of Nigerian meat supply (Oloche et al., 2015) and provides income to farmers (Peacock et al., 2005). West African Dwarf goats are the most prevalent and trypano-tolerant breed in the derived

and guinea savannah zones (Eroarame et al., 2006; Udo et al., 2016). However, small ruminants have the ability to convert poor quality feedstuffs, such as grasses, legumes, forages, farm wastes and crop residues that are unsuitable for human body tissues to gain weight and flesh.

The cost of finished feeds is perhaps the main limiting factors in profitable livestock production. This is because the conventional ingredients consumed by man attract high cost and has forced most farmers out of livestock enterprise and in some cases dampened the interest of some would- be livestock farmers (Akpodiete and Inoni, 2000).

Also, as a result of high cost of conventional feedstuffs and in attempt to reduce competition between man and livestock, nutritionists are in search for alternative non-conventional feedstuffs that are cheap, under-utilized, with nutritional potentials and readily available like Tomentosa nilotica seed meal. It is therefore imperative, to source for alternative but cheaper resources that have high nutritive value and are adapted to tropical environment and able to substitute these expensive ingredients in animal diets (FAO, 2012).

The examination of blood provides the opportunity to clinically investigate the presence of several metabolites and other constituents in the body and it plays a vital role in the physiological, nutritional and pathological status of the animal (Aderemi, 2004; Doyle, 2006). Haematological constituents reflect the physiological responsiveness of the animal to its internal and external environments which include feed and feeding (Esonu et al., 2001).

According to Daramola et al. (2005), haematological values could serve as baseline information for comparisons of nutrient deficiency, physiology and health of farm animals. Therefore, whatever affects the blood such as nutrition will certainly affects the entire body adversely or moderately in terms of health, growth, maintenance and reproduction (Oke et al., 2007, Etim, 2010). Hence, this study was designed to investigate the dietary effect of raw/unprocessed Tomentosa nilotica seed on haematological, serum and growth response of goats.

MATERIALS AND METHODS

Research site

The feeding trial was conducted at the Ruminant Unit of the Livestock Section, Teaching and Research Farm Federal University of Technology Akure, while laboratory analysis was carried out at Nutritional Laboratory of the Department of Animal Production and Health, Federal University of Technology Akure, Ondo state, Nigeria. The University is located in the humid rainforest zone of western Nigeria characterized by early and late rainy season. The range annual rainfall is about 1200 – 1500 mm and the rain last

for nine months usually from March to November every year. The mean annual relative humidity is over 75% and that of temperature is about 270C with Latitude 70 15"N and Longitude 50 15"E (Ajibade et al., 2014).

Collection and Processing of Tomentosa nilotica Seeds and Cassava peels

Matured Tomentosa nilotica pods were harvested within the campus of the Federal University of Technology, Akure, Nigeria, and the seeds were sun dried for 7 – 10 days based on the intensity of the sun to facilitate easy grinding. The ground/ milled cotyledon were removed and stacked for later use. Cassava peels were sourced at cassava processing industry in Igbatoro, Akure, sun-dried for 3 - 5 days to reduce the moisture and hydro-cyanide content. Other feed ingredients were purchased from a reputable feed mill in Akure.

Experimental animals and management

A total of fifteen West African Dwarf (WAD) goats of similar age range (12-18months) and average live weight of 6.88±0.26 kg were selected from the flock available fron the Teaching and Research Farm, FUTA and were randomly allotted to five (5) dietary treatments of three (3) goats per treatment in a Completely Randomized Design experiment. Five (5) experimental diets (A-E) were formulated such that PKC were replaced with Tomentosa nilotica seed meals having high quality nutrients profile at 0, 20, 30, 40 and 50% replacement levels while other feed ingredients were at fixed proportions as shown in (Table 1). The animals were housed individually, monitored, fed 3.5 – 5% of their body weight and water given ad libitum. Feed intake were measured by subtracting the left-over from quantity given per day throughout the trial period – 84 days. Weekly weight change were monitored using digitalized hanging scale before feeding in the morning.

Haematological and biochemical indices analysis

At the end of the study, about 10 mL of blood samples were collected through the jugular vein from each goat and were dispensed into sterile test tubes and Ethylene Diamine Tetra-Acetic acid (EDTA) bottles. Blood samples in sterile test tubes were slanted and allowed to clot, after which serum was harvested and used for biochemical analysis while blood sample in EDTA bottles were rocked gently to prevent coagulation and later used for haematological analysis. The analysis was carried out using standard procedures.

Statistical Analysis

Data collected were subjected to one-way Analysis of variance (ANOVA) using SPSS version 17 package and where there are significant differences

($p<0.05$) exists, Duncan's Multiple Range Test (DMRT) of the same package was used to compare the means.

Table 1. Gross Composition of Experimental Diets fed to West African Dwarf goats

Ingredients (%)	**Replacement value of PKC for T. nilotica seed meal**					
	A (0%)	**B (20%)**	**C (30%)**	**D (40%)**	**E (50%)**	*T. nilotica* seed meal
Cassava peel (milled)	50.00	50.00	50.00	50.00	50.00	
Palm kernel cake	30.00	24.00	21.00	18.00	15.00	
Tomentosa nilotica seed meal	0.00	6.00	9.00	12.00	15.00	
Wheat offal	10.00	10.00	10.00	10.00	10.00	
Urea	1.00	1.00	1.00	1.00	1.00	
Rice waste	5.00	5.00	5.00	5.00	5.00	
Bone meal	2.50	2.50	2.50	2.50	2.50	
Salt	1.00	1.00	1.00	1.00	1.00	
Premix	0.50	0.50	0.50	0.50	0.50	
Total	100.00	100.00	100.00	100.00	100.00	
Nutrient (analyzed)						
Dry matter	89.23	88.99	89.63	90.49	90.81	88.16
Crude protein	15.00	18.00	18.90	19.00	19.09	30.35
Crude fibre	14.00	15.42	15.57	15.88	16.01	12.66
Ether extract	13.40	18.02	18.50	18.80	18.90	21.67
Ash	6.00	6.40	7.01	7.20	3.80	4.30
Nitrogen free extract	51.60	42.16	40.02	39.12	38.20	31.02
Neutral detergent fibre	20.38	22.70	23.00	23.50	23.80	30.48
Acid detergent fibre	12.20	13.70	13.90	14.00	15.60	20.10
Acid Detergent Lignin	3.90	4.00	4.30	4.40	5.60	9.62

Note: n = 3

RESULTS AND DISCUSSION

Nutrient composition

The nutrient composition of Tomentosa nilotica seed meal and the diets is presented in Table 1. From the results, T. nilotica seed is a good source of protein (30.35%CP), lipids (21.67%EE), and fibre (12.66%CF). The DM, CP, and CF contents of the raw Tomentosa seed obtained in this present study compared favourably with 83.50% (DM), 24.40% (CP) and 19.40% (CF) reported by Barma and Rai (2006), Mlambo et al. (2008) and Ngwa, et al. (2002) for Acacia nilotica seed. The protein quality of the seed meal positively influenced the quality of the diets and consequently their intake (Table 2). The high ether extract content of the seed suggests that Tomentosa nilotica seed can be classified as an oil- rich seed. The values recorded for neutral detergent

fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) fell within the range of (15.4 -51.1%) NDF, (1.4-31.6%) ADF and (5.1-20.60%) ADL for various browse fodder species reported by Abdulrazak et al. (2000) and Mokoboki et al. (2006).

Table 2. Nutrients Intake (g/day) by WAD Goats Fed *Tomentosa nilotica* seed meal diets

	Diets				
Nutrients (g/day)	**A**	**B**	**C**	**D**	**E**
Dry matter	384.2±0.2^{ab}	394.7±0.20^{a}	361.9±0.20^{b}	358.5±0.30^{c}	330.1±0.30^{d}
Crude protein	57.63±0.20^{c}	71.04±0.30^{a}	68.39±0.25^{b}	68.04±0.20^{b}	66.60±0.2^{bc}
Crude Fibre	53.79±0.30^{b}	82.48±0.2^{ab}	92.64±0.3^{ab}	107.56±0.3^{a}	108.56±0.3^{a}
Ether extract	70.70±0.25^{b}	92.70±0.3^{ab}	92.6±0.2^{ab}	108.9±0.25^{a}	106.6±0.2^{a}
Ash	30.70±0.58	35.60±0.58	34.40±0.58	36.57±0.58	36.96±0.58
NFE	171.3±0.3^{a}	112.79±0.3^{a}	77.8±0.25^{bc}	36.6±0.58	35.3±0.58
NDF	58.87±0.2^{b}	66.30±0.2^{ab}	61.16±0.2^{ab}	72.42±0.3^{ab}	84.25±0.4^{a}
Acid detergent fibre	39.19±0.5^{b}	42.23±0.4^{bc}	43.06±0.2^{ab}	43.74±0.20^{ab}	57.58±0.30^{a}
ADL	7.30±0.30^{c}	7.89±0.25^{bc}	10.90±0.25^{b}	14.66±0.30^{a}	17.32±0.25^{a}

a, ab, b, c = Means within the same row with different superscripts are significantly ($p<0.05$) different, n=3. NFE - Nitrogen free extract, NDF - Neutral detergent fibre, ADL - Acid detergent lignin

Serum biochemical indices

Table 3 shows the serum biochemical indices of WAD goats fed Tomentosa nilotica seed meal diets. There were significant ($p<0.05$) differences among all the parameters determined except albumin, urea and alanine aminotransferase. The total protein values obtained in this study indicated that increase in Tomentosa nilotica in the diets improved the protein quality and consequently, the serum protein. The serum total protein content observed ranged from 67.92g/l (diet A) to 75.56g/l (diet E). Although Radostitis et al., (1994) reported that the concentration of total serum protein in normal goats is 60g/l to 1- 75g/l. This is also corroborated by the finding of Opera et al. (2010) that normal range of serum total protein content of healthy goat ranged between 64 and 78g/l, it implies that the diets furnished adequate crude protein because high values of serum total protein are indicators of quality protein of the experimental diet (Aletor et al., 2000). The normal range of values of albumin in a healthy goat is from 24g/l to 44g/l (Opara et al, 2010) and when compared to the value gotten from this study, the albumin values were in the range; this indicates that the platelets are available for blood clotting if the need arises. The globulin values ranged from 31.49 g/l to 44.01 g/l which compared favourably with the normal range (34.40g/l to55.70g/l) in a healthy goat. Awojobi and Opiah (2000) observed that the higher the value of globulin, the greater the ability to fight infection. AST is an enzyme abundantly found in the liver and heart muscles and plays an

important role in amino acid metabolism (Vojta et al., 2011). The AST obtained (40.33 µ/I - 48.66 µ/I) were within range of 43 to 132 IU/I reported by Sirois (1995). Blood urea level is commonly considered in ruminant to reflect the protein quality of the diet (Oloche et al., 2015).

Table 3. Serum biochemical indices of WAD goats fed *Tomentosa nilotica* seed meal diets

Parameters	A	B	C	D	E
Total protein (g/I)	67.92±0.89^{b}	69.17±1.89^{b}	71.21±1.62^{ab}	71.52±2.6^{ab}	75.56±1.3^{a}
Albumin (g/l)	36.43±3.80	34.54±2.05	34.94±0.55	33.62±4.38	31.55±1.75
Globulin (g/l)	31.49±2.20^{d}	34.63±1.50^{c}	36.27±2.50^{b}	37.90±1.50^{b}	44.01±3.0^{a}
Albumin : Globulin	1.16±0.90^{a}	1.00±0.05^{a}	0.96±0.03^{b}	0.89±0.07^{b}	0.72±0.40^{c}
Glucose (%)	64.16±16.5^{a}	56.68±5.8^{b}	51.1±10.02^{c}	49.67±4.10^{c}	58.15±1.53^{b}
Urea (%)	22.54±3.22	33.97±15.22	15.24±2.40	31.75±13.03	21.60±9.14
ALT (µ/I)	21.43±1.20	24.86±1.00	30.67±2.06	32.43±2.09	32.34±1.90
ALP (µ/I)	33.17±2.80^{c}	36.86±2.06^{b}	38.32±2.01^{b}	40.04±3.01^{a}	41.51±2.00^{a}
AST (µ/I)	40.33±2.10^{c}	43.33±1.90^{b}	40.52±3.70 ^{c}	45.17±3.85^{b}	48.66±2.00^{a}

a, ab, b, c = Means within the same row with different superscripts are significantly ($p<0.05$) different. n= 3. ALT - Alanine aminotransferase, ALP - Alkaline phosphate, AST - Aspartate aminotransferase

Haematological parameters

The results of haematological indices of WAD goats fed Tomentosa nilotica seed meal diets were shown in Table 4. There were significant ($p<0.05$) differences among all the parameters determined. The observed PCV values (21.67% to 30.20%) fell within the normal range of 21% to 35% for healthy goats reported by Daramola et al. (2005). This implies that the goats did not suffer from anaemic condition throughout the experimental period. The values of red blood cell (RBC) that ranged from 8.55×106 µl (diet E) to 9.35×106 µl (diet B). These values were in agreement with the observation of Taiwo et al, (2002) that the normal range of RBC is 8 ×106 to 18×106 µl in a healthy goat. The haemoglobin values (7.20 g/d1 - 10.68g/dl) of goats fed experimental diets were within the ranged values of 8 - 12g/dl reported by Adebosin (2009) and Daramola et al. (2008). The observed increase in WBC values recorded in this study may be attributed to the protein content of the diets. The values of Lymphocytes (%) obtained in this study 59.33% to 62.05% fell within the range of 47- 82% reported by (Daramola et al., 2005) but lower than 51.60% reported by Tambuwal et al. (2002) for WAD goats. Thus, suggestive of a well- developed immune system in the WAD goats with

such number of immune cells to offer good health. The values of monocytes, eosinophils and basophils values obtained in this study for the experimental goat fell within the range of value obtained for WAD goats by (Opara et al., 2010; Waziri et al., 2010; Akinrinmade and Akinrinde, 2012).

Table 4. Haematological indices of WAD goats fed *Tomentosa nilotica* seed meal diets

Parameters	A	B	C	D	E
ESR (mm/hr)	0.83±0.17^{b}	2.05±0.5^{ab}	3.67±0.88^{a}	3.67±0.88^{a}	4.05±0.58^{a}
Packed cell vol.(%)	30.20±2.0^{a}	25.6±1.2^{ab}	22.68±2.0^{b}	22.33±1.4^{b}	21.6±1.45^{b}
Red blood cell (×10^{6})	9.06±0.20^{a}	9.35±0.6^{ab}	8.79±0.58^{b}	8.89±0.25^{b}	8.55±0.58^{b}
White blood cell (×10^{3}µl)	8.08±0.3^{c}	9.6±0.58^{bc}	10.73±0.5^{b}	11.05±0.2^{a}	11.6±0.30^{a}
Haemoglobin (g/100ml)	10.6±0.68^{a}	8.5±0.39^{ab}	7.2±0.67^{b}	7.4±0.47b	7.2±0.49^{b}
Lymphocyctes (%)	59.3±0.67^{b}	60.3±0.6^{ab}	61.05±0.3^{ab}	61.6±0.8^{a}	62.05±0.5^{a}
Neutrophils (%)	26.0±0.0^{bc}	29.05±0.5^{a}	28.33±0.3^{ab}	27.67±1.3^{ab}	25.05±0.2^{c}
Monocytes (%)	0.50±0.00^{c}	1.00±0.00^{c}	2.00±0.25^{b}	2.33±0.58^{b}	3.00±0.25^{a}
Eosinophils (%)	4.33±0.3^{ab}	3.00±0.00^{c}	4.67±0.33^{ab}	3.67±0.33^{b}	5.08±0.20^{a}
Basophils (%)	1.00±0.00^{a}	1.00±0.00^{a}	0.67±0.33^{b}	0.67±0.33^{b}	0.67±0.33^{b}

a, ab, b, c = Means within the same row with different superscripts are significantly ($p<0.05$) different. ESR= Erythrocyte Sedimentation Rate, n=3.

Growth performance

The final weight (kg), net weight gain (kg), average daily weight gain (g/day) and feed gain ratio were significantly ($p<0.05$) influenced (Table 5). It is evident that at 20% replacement levels, weight gain was best.

Table 5. Weight gain, feed gain ratio of WAD goats fed *Tomentosa nilotica* seed meal diets

Parameters (kg)	A	B	C	D	E
Initial weight	6.93±1.07	6.87±0.57	6.93±0.58	6.87±0.47	6.80±0.61
Final weight	9.28±1.74^{a}	9.61±0.61^{a}	8.47±0.57^{b}	8.04±0.40^{c}	8.03±0.78^{c}
Weight gain	2.35±0.94 ^{a}	2.74±0.18^{a}	1.54±0.29^{b}	1.17±0.12^{c}	1.23±0.45^{c}
DWG (g/d)	38.52±15.36^{b}	44.92±2.89^{a}	25.25±4.76^{c}	19.18±1.97^{d}	20.16±7.35^{d}
Feed gain ratio	9.97±0.58^{c}	8.79±0.20^{c}	14.33±0.96^{b}	18.69±2.83^{a}	16.37±0.10^{ab}

a, ab, b, c = Means within the same row with different superscripts are significantly ($p<0.05$) different. n=3. DWG - Daily weight gain

It could be said that despite the inherent protein in the seed meal, they are either bypass in the rumen or some intrinsic factors hinders their availability and utilization by the goats.

CONCLUSION

The cheaper the feed source without sacrificing the quality the better the return to the farmer. It was concluded that Tomentosa nilotica seed meal diets did not have any adverse effects on the haematological indices of WAD goats. Thus, the protein contents of the diets were well utilized and there was no

sign of ill health from the goats throughout the experimental period. Tomentosa nilotica seed could be included in WAD goat diets up to 20% based on the parameters studied. Thus, Tomentosa nilotica seed meal can be effectively harnessed to provide cheap and sustainable feed with good protein quality for ruminants, most especially West Africa Dwarf goats.

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