Nutrient Digestibility and Haematological Indices of West African Dwarf Goats Fed Cnidosculus Aconitifolius Multinutrient Blocks As Supplement

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ABSTRACT

The study involves twenty-four (12) yearling West African Dwarf Goats. The goats were assigned randomly to three treatments viz: Cnidoscolus-Poultry Manure-Multinutrient Blocks (CPMNB), Cnidoscolus-Urea-Multinutrient Blocks (CUMNB) and control consisting of Panicum maximum and cassava peels. Each treatment consists of eight goats as replicates. They were adequately fed and provided with fresh and clean water. The hematological parameters and nutrient digestibility as influenced by the three treatments were evaluated. The Packed Cell Volume (PCV) value for goats fed the experimental multinutrient blocks ranged from 25.25 ± 1.25% in CUMNB to 20.25 ± 2.25% in CPMNB and that of the control diet was 19.90 ± 1.59%. The red blood cell varied from 545 ± 116.0x10^6 mm^-1 in CUMNB to 335 ± 64.0 x 10^6 mm^-1 in CPMNB with control having the value 222.58 ± 25.61 x 10^6 mm^-1. The White Blood Cell (WBC) was highest in CUMNB (263.5 ± 1.65 x 10^3 mm^-1), followed by CPMNB (151.5 ± 10.8 x10^3 mm^-1) while the least value was recorded in the goat fed control diet (137.9 ± 7.5 x10^3 mm^-1). The haemoglobin concentration (Hbc) was lowest in goats fed the control diet (5.92 ± 0.18g 100 mm^-3). The Monocytes (%) value for CUMNB was the highest (6.4 ± 0.6), followed by CPMNB (5.0 ± 0.00) and the control treatment has the least value (4.90 ± 0.42) The Eosinophils (%) values varied from 2.0 ± 0.25 in CUMNB to 1.83 ± 0.17 in control treatment. The goats fed control diet showed the least values for the haematological variables. The percent digestible nutrient and coefficient of digestibility in the feed showed that goats fed supplemental Cnidoscolus-based multinutrient blocks had better nutrient utilization. Thus better rumen digestion and haematological performance than goats fed diet of Panicum- cassava peels ration.

Introduction

Goats have been hampered over the years primarily by the non-availability of good quality and quantity of feed (Onwuka, 1999). This is so for ruminant animals during dry season months when little forage available is low in quantity causing occasional weight losses, low birth weight, lowered resistance diseases and reduced animal performance (Onwuka et al., 1992).

Furthermore, the limited supply of raw materials for the livestock feed industry has resulted in a continuous increase in the cost of production, causing phenomenal rise in the unit cost of production of livestock (Onwuka et al., 1992). The shortage of good quality feed needed to sustain livestock growth especially during dry season months has been a perennial problem which can be reduced or eliminated by finding alternative source of protein and energy concentrate mixture given to animal.

In many under developed countries, malnutrition has been identified as the single most important public health problem (Adeyeye and Afolabi, 2004). The nutritional requirement of the human body reflects the nutritional intake necessary to maintain optimum body function to meet the body’s daily energy needs (F.A.O, 1999). Malnutrition which is defined as inadequate nutrition is been interpreted as under – nutrition or over-nutrition. The etiology of malnutrition includes factors such as poor food availability in good quality and quantity and preparation, recurrent infections etc. Consequently, the indices of nutritional disease and malnutrition are on the increase (F.A.O., 1999). The recommended total protein intake for normal growth and development in human is 85.99g per person per day, out of which approximately 39g should be from animal origin but an average Nigerian consumes about 33g (Adegbola 2002). This therefore calls for an increase in livestock production in order to improve the nutritional status of Nigerians through provision of high quality animal products such as meat, milk and eggs.

This therefore calls for a reasonable level of feed supplementation in small ruminant e.g. goats with particular emphasis on the energy, protein and minerals. Multinutrient blocks which is an alternative feed resource has been advocated as a panacea to protein and energy deficiencies in ruminant especially during dry season (Aye, 2005; Aye 2012). Multinutrient block provides primarily the needs of the rumen micro organism, it is a rich source of fermentable nitrogen, minerals, vitamins, amino acids and peptide.

Multinutrient blocks can be made from farm wastes such as Cnidoscolus aconitifolius leave residues, molasses, urea, cement and salt (Hassoun and Ba, 1991). Molasses and urea, which are components of multinutrient blocks, are known to respectively contain available energy and nitrogen and are used in feeding ruminant (Preston and Leng, 1990). Pickstock (1985) reported that in times of drought, when energy and protein reserves of animals fall to dangerously low levels, molasses – urea mixes fed in amount of up to 2kg a day, helped to satisfy both energy and protein needs for
maintenance of ruminant. These will upgrade the energy and ammonia levels in the ruminant’s rumen (Mancini et al., 1997).

The significance of determining hematological and biochemical indices of domestic animals has been well documented (Tambuwal et al., 2002; Orhuruata and Aikhunomohogbe, 2006). There is a great variation in the hematological and biochemical parameters as observed between breeds of goats (Meyer and Harvey, 1998). Normal blood values are defined as those of clinically healthy animals which are kept under normal housing conditions and fed balance ration. Meyer and Harvey (1998) noted that the ingestion of numerous dietary components have measurable effect on blood constituent.

This study is designed to evaluate nutrient utilization and hematological parameters of West African Dwarf goats fed Cnidoscolus aconitifolius – based multinutrient blocks.

Materials and Methods
Study Area: The experiment was carried out at the Small Ruminant unit of Teaching and Research Farms of the Ekiti State University, Ado Ekiti, Ekiti State.

The pens used were cleaned and disinfected with germicide, cleaning of feeder and water troughs were carried out before the arrival of the animals.

Procurement of the West African Dwarf (WAD) Goats: Twenty-four yearling WAD goats were purchased from the Otun market in Ekiti State of Nigeria. They were quarantined for 4 weeks during which routine treatment develop at NAPRI (1984) and modified by Aye (1998) was applied.

Experimental layout and Animal management: The pen was partitioned into twenty-four equi-dimensional unit with plants. The goats were weighed into their experimental units, efforts were made to ensure that all the treatments were balanced in body weight. The design of the experiment was a completely randomized designed. The animals were randomly assigned to three treatments and each treatment has four goats as replicates. The goats were fed basal diet consist of cassava peels and Panicum maximum and experimental multinutrient blocks.

The treatments were as follows;

Treatment 1- Panicum maximum + Cassava peels supplemented with Cnidoscolus–Poultry manure – based multi-nutrient blocks (CPMNB)

Treatment 2 - Panicum maximum + Cassava peels supplemented with Cnidoscolus-Urea-based multi-nutrient blocks (CUMNB).

Treatment 3 - Panicum maximum +Cassava peels only

Fresh cassava peels were obtained from gari-processing factory in Iworoko-Ekiti, the fresh cassava peels were sun-dried for about 5-7 days depending on weather condition.

Guinea grass was harvested 1m from the base of the plant with sickle. The stems and leaves were still succulent and had not lignified. It was chopped into small pieces with a cutlass so as to prevent wastage by the animals; the grass was wilted for about 2 days to prevent scouring in animals.

Leaves of Cnidoscolus aconitifolius were harvested in fresh condition from various locations in Ekiti State (Iworoko-Ekiti and Emure-Ekiti) and Ondo State (Akure).

The harvested leaves were pulped with leaf pulping machine, followed by processing with a screw-press as described by Fellow (1987) and modified by Aye (2007). The fibrous residues were thereafter separated from the leaf juice by filtering through Muslin cloth followed by pressing with screw press as described for gari making (Aleotor. 1993). The fibrous residues were then pulverized and spread in the sun to dry. The dried fibrous residues were ground with laboratory hammer mill and kept in airtight container prior to its use.

Preparation of Multinutrient Blocks :Two multinutrient blocks were produced as described by Aye (2012). The components were thoroughly mixed manually, cement was first mixed with water at the rate of (50/100) (w/w). Cnidoscolus residues, molasses, urea or poultry manure, salt was added in that order and the cement was added last. The mixture was poured into a cellophane-lined plastic mould. The cellophane paper was used to facilitate the removal of multinutrient blocks when formed. The molded multinutrient blocks were air dried under shade for about 7 days.

Feeding Trial: The feeding trial lasted for 12 weeks, when animals were fed on basal diets containing cassava peels and Panicum maximum supplemented with Cnidoscolus-based multi-nutrient blocks. The goats were adapted for 10 days to the experimental diets before actual data collection commenced. Measurements of haematological indices were done at the start and fortnightly.

Blood Collection: Blood was collected from the jugular vein of the goats at the start and fortnightly for analysis of blood indices. The blood was collected into a vial containing Ethylenediaminetetral acetic acid (EDTA), which prevents coagulation by complexing Ca$^{2+}$. The vials were immediately capped and content rocked gently for about a minute by repeated inversion.

Packed Cell Volume (Haematocrit): Packed cell volume (PCV) was determined by spinning about 7µl of each blood sample in heparinised capillary tubes in a haemocrit centrifuge for about 5 minutes. The PCV was then read on haemotocrit readers as described by Benson et al. (1989) and Jain (1993).

Erythocyte (Red blood count): Red blood count was determined using haemocytometer method as described by Lamb (1981). The blood sample collected in each replicate was diluted at a ratio of 1:200 and RBC were obtained using the pre-relationship Red Blood Cell/µL=Number of cell counted X 5X 200.

Haemoglobin estimation : The haemoglobin content in the blood of each goat was estimated using Cyanomethaemoglobin method. 0.02ml of blood from each goat was expelled into 4ml Drabkins solution. The mixture was allowed to stand for 5 minutes for full colour development. Also, standard hemoglobin was prepared by diluting blood of known haemoglobin concentration as in the test sample. The test samples and standard were read on the colourimeter at 624 nanometers using green filter.

Samples haemoglobin concentration was obtained using this relationship sample haemoglobin

\[ = \text{Reading of test} \times \text{Standard Haemoglobin Conc. (g/100ml)} \]

Reading of Standard

Haemoglobin indices also measured were erythrocyte sedimentation rate (ESR) Lymphocytes, Neutrophils, Monocytes, Eosinphils and Basophils.

Nutrient Utilization: This was carried out by transferring goats into wooden metabolic cage fitted with facilities to separately collect urine and faeces. Each goat was allocated individual metabolic cage for 14 days. The quantity of feed offered, feed refusal, faeces and urine were determined for 7 days after 7 days of adjustment to the cages.

Collection of Urine 20cm$^3$ of 10% concentrated H$_2$SO$_4$ was added to each bowl, which was used to collect the urine of animals to prevent Nitrogen loss, bacteria growth infestation. The volume of urine was measured and recorded daily each
morning. 10% of the urine collected from each animal was poured into a well-labeled urine collection bottle and stored in a refrigerator prior to laboratory analysis.

Collection of Faeces The faeces were collected from individual animal. 10% of the faeces collected daily over the 7-day period were bulked and weighed and used for moisture determination. The remaining faeces were oven dried at 70°C for 36 hours, milled and stored in air tight bottles.

Analytical Procedures: Samples of feeds and faeces were ground in a hammer mill to pass a 1mm mesh sieve for their proximate compositions according to the procedure described by AOAC (2005). Nitrogen contents of feed, faeces and urine were determined by the micro-kjeldahl technique using the Markham’s distillation apparatus. Results obtained were used for the calculation of digestibility of nutrients and Nitrogen balance for the experimental animals. Gross energy of feed was measured by bomb calorimetry using benzoic acid as a standard (26437J/g).

Statistical Analysis: Data obtained were subjected to one-way analysis of variance using ANOVA procedure of Minitab Statistical Package (Minitab USA) version 10.2. Means were separated using Duncan’s Multiple Range Test (Duncan, 1955). Results And Discussion

Diet Composition

Table 1 shows the proximate analysis of the Cnidoscolus residue, cassava peels, guinea grass and multinutrient blocks.

The Cnidoscolus residue contained 94.54 ± 0.02g 100g⁻¹ dry matter (DM), 15.54 ± 0.01g 100g⁻¹ Ash, 12.85 ± 0.01g 100g⁻¹ Ether extract (EE), 7.54 ± 0.01g 100g⁻¹ Crude Fibre (CF), 25.77± 1.14g 100g⁻¹ Crude Protein(CP), 32.93 ± 1.15g 100g⁻¹ Nitrogen Free Extract (NFE) and 14.71MJ kg⁻¹ Gross Energy (GE) while cassava peels contained 94.54 ± 0.01g 100g⁻¹ dry matter (DM), 6.89 ± 0.01g 100g⁻¹ Ash, 6.90± 0.37g 100g⁻¹ Ether extract (EE), 7.12± 0.01g 100g⁻¹ Crude Fibre (CF), 10.94±0.01g 100g⁻¹ Crude Protein (CP), 62.67± 0.41g100g⁻¹Nitrogen Free Extract (NFE) and 15.59MJ kg⁻¹ Gross Energy (GE).

The Panicum maximum contained 91.47± 0.01g 100g⁻¹ Dry Matter (DM), 7.21 ± 0.01g 100g⁻¹ Ash, 5.32 ± 0.01g 100g⁻¹ Ether extract (EE), 35.21± 0.03g 100g⁻¹ Crude fibre, 16.14±0.45g 100g⁻¹ Crude protein, 36.09±0.20g 100g⁻¹ Nitrogen Free Extract and 12.00MJ kg⁻¹ Gross Energy (GE).

The proximate composition of the experimental feed blocks were 69.93g 100g⁻¹ and 67.15g 100g⁻¹ dry matter (DM) in Cnidoscolus poultry manure Multinutrient block (CPMBN) and Cnidoscolus urea multinutrient block (CUMNB) respectively , 23.24 g 100g⁻¹ Ash in CPMBN and 22.81g 100g⁻¹ in CUMNB, 0.72 and 0.10g 100g⁻¹ Ether Extract (EE) in CPMBN and CUMNB respectively, Crude fibre were 5.51 and 3.51g 100g⁻¹ in CPMBN and CUMNB, Crude protein varied from 31.7g 100g⁻¹ in CPMBN to 34.83g 100g⁻¹ in CUMNB, Nitrogen free extract ranged from 35.73g 100g⁻¹ in CUMNB to 38.56 g100g⁻¹ in CPMBN and Gross Energy were 15.74 and 16.33 MJ kg⁻¹ in CUMNB and CPMBN respectively.

Table 2 shows the energy values as contributed by protein, fat and carbohydrate in the Cnidoscolus-based multinutrient blocks. The proportion of total energy due to protein (PEP) ranged from 70.72% in CPMBN to 90.33% in CUMNB. Proportion of total energy due to fat varied from 0.51% in CUMNB to 3.47% in CPMBN. Proportion of total energy due to carbohydrate (PEC) varied from 9.10% in CUMNB to 25.81% in CPMBN. Utilizable energy due to protein is higher in CPMBN (461.11) than CUMNB (437.05).

Table 3 presents the haematological parameters as influenced by the three treatments.

The packed cell volume (PCV) value for goats fed the experimental multinutrient blocks ranged from 20.25±±2.25% in CPMBN to 25.25±1.25% in CUMNB compared to PCV value of 19.90±1.59% in the control diet. The red blood cell varied from 8.45±1.16X10⁶mm⁻¹ in CUMNB to 9.35±0.40X10⁶mm⁻¹ in CPMBN with control treatment having the value 6.22±0.67X10⁶mm⁻¹. The white blood cell (WBC) was highest in the control treatment (13.9±1.05X10⁶mm⁻¹), followed by CPMBN (11.5±1.08X10⁶mm⁻¹) while the least value was recorded in the goats fed CUMNB (10.5±1.05X10⁶mm⁻¹). The haemoglobin concentration (HBC) was lowest in goats fed the control diet (5.92±0.18g 100mm⁻¹), and the highest value was recorded in goats fed CPMBN (8.8±0.89g 100mm⁻¹). The Erythrocyte sedimentation rate (mm/hr) varied between 1.33±0.34 in goats fed the control diet and 3.41±0.1 in goats fed supplemental CPMBN. The mean corpuscular volume (MCV) μm⁻³ was highest in goats fed supplemental CUMNB (28.9±0.08) and lowest in goat fed the control diet (24.6±0.6). The mean corpuscular Haemoglobin (MCH) (pg) was highest in goats fed supplemental CUMNB (2.66 ± 0.15) and lowest in goat fed the control diet (1.6 ± 0.55). The lymphocyte values were 63.0 ± 2.0%, 65.66 ± 1.34% and 60.25 ± 1.25% for CPMBN, CUMNB and control treatment respectively. Neutrophils (%) value for CUMNB was 29.25 ± 3.25, CPMBN was 28.25 ± 2.67 and that of the control treatment was 25.25 ± 1.75. The Monocytes (%) value for CUMNB was the highest (6.41 ± 0.6), followed by CPMBN (6.01 ± 0.00) and the control treatment has the least value (4.90 ± 0.42).

The Eosinophils and Basophils (%) values of the multinutrient blocks and control treatments were not significantly different (P<0.05).

The goats fed control diet showed the least values for the haematological variables. Thus the blood profiles of the goats were influenced by the dietary treatments.

Table 4 presents the digestibility coefficient of nutrients of West African Dwarf (WAD) goats fed Panicum-Cassava peels ration supplemented with or without Cnidoscolus aconitifolius – based multinutrient blocks.

Variation observed among the treatments reveal that all the nutrients measured were significantly (P<0.05) influenced by the treatments. The coefficient of digestibility of dry matter (68.66%), crude protein (70.58%), crude fibre (76.46%), ether extract (52.78%) and nitrogen free extract (71.99%) of the goats on the control ration were consistently lower(P<0.05) than those fed the Cnidoscolus – based multinutrient blocks supplemented rations (85.09-85.36% DM), (75.17-82.41% CP), (91.67-92.21% CF), (53.25-60.20% EE) and (91.88-92.87% NFE). Within the multinutrient blocks supplemented rations goats on CPMBN had higher coefficient of digestibility of all nutrients determined.

Table 5 presents the percent of digestible nutrients in the feed. The dry matter (DM) values was highest in CUMNB (42.24%), followed by CPMBN (42.05%) and the control treatment had the least value (33.99%). The Ether extract values were 1.25%, 1.41% and 1.07% for CPMBN, CUMNB and control treatment respectively. The % digestible crude fibre (CF) values was highest in CUMNB (6.72%), followed by CPMBN (6.32%) and the least value was obtained in control treatment (6.18%). The crude protein (CP) values were 4.26%, 7.73% and 4.21% for CPMBN, CUMNB and control treatment respectively. The Nitrogen Free Extract (NFE) values varied...
from 21.9 in control treatment to 27.34 in CPMNB. The %
digestible crude protein, crude fibre, ether extract and nitrogen
free extracts of the goats on the control ration were significantly
(P<0.05) lower than those fed on multinutrient blocks
supplemented rations. Within the feed blocks supplemented
rations, goats on CUMNB had higher % digestible crude
protein, dry matter, ether extract and crude fibre than those on
supplemental CPMNB. Goats on CPMNB had higher %
digestible nitrogen free extract.

Discussion
The proximate composition of Panicum maximum obtained
in this study was at variance with the result obtained by
Ogunsola (2005). The value recorded for crude protein was
6.72g100g⁻¹, which is lower than 16.14g 100g⁻¹ obtained in this
study. Also the Ash and Ether extract values obtained in this
study were at variance with the result reported by Ogunsola
(2005). However, crude fibre value obtained in this study agreed
with what has been reported in literature (Ogunsola, 2005; Aye,
2007).

The cassava peels used this study has dry matter value of
94.54g100g⁻¹ which is within the range of 86.5g 100g⁻¹ to
94.54g 100g⁻¹ as reported by Adegbola (1980), Aye and
Adegun(2010). The Ash content of 6.89g 100g⁻¹ was higher in
comparise to the value 5.95g100g⁻¹ obtained by Adegun et al.
(2011). The crude protein value of 10.94g100g⁻¹ was higher than
the value of 5.30g100g⁻¹ reported in literature (Adegun et al.,2011).
The value of crude fibre 10.94g100g⁻¹ fell within the
range of 10 - 31g100g⁻¹ reported in literature ( Devendra, 1977; Adegbola, 2002; Adegun et al., 2011).

The differences in these values obtained from this study
with those of other workers might be due to the stage harvesting
of the plant and processing methods adopted.

Cnidoscolus-urea multinutrient blocks had higher crude
protein value of 34.83g100g⁻¹ compared to Cnidoscolus-poultry
manure multinutrient block and this may be due to the presence
of urea with a very high content of nitrogen.

Report from literature showed blood indices are important
for the assessment of the nutritive component of a given ration
(Aletor and Egberongbe, 1992; Aghbede and Aletor, 2003).

The white blood cell (WBC) was significantly higher
(P<0.05) in the control group than in animals fed the MNBS, but
all the other haematological indices were significantly (P<0.05)
higher with supplemental diets. WBC obtained in animals fed
supplemental MNBS were within normal range of 4.0-12.0X10⁴
mm⁻¹ for goats (Byanet et al., 2008). The neutrophil counts,
PCV, RBC and other calculated haematological values were
within normal range for goats (Jain, 1993; Ikhimoya and
Imasuen, 2007). It has been reported that haematological indices
give insight into the production potential and help to monitor
and evaluate incidence of diseases in animals (Karesh and Cook,
1985; Orheruuta and Aikhuomohbeghe, 2006).

This tends to show that the feeding of the multinutrient
blocks did not have adverse effect on the health status of
animals. Therefore, the inclusion of urea or poultry manure at
10% in these block packages further confirmed the earlier report
of Habib et al. (1991) that urea at this level will not pose any
health hazard on the animals.

The significant higher nutrient digestibility in goats fed
Cnidoscolus- based multinutrient blocks as observed in this
study over the control treatment group was due to the non-
protein nitrogen used in the Multinutrient Blocks which appears
to favour proper functioning of rumen microorganisms. This
result shows that the West African Dwarf Goats fed
supplemental

Conclusion
This study demonstrates that goats fed Cnidoscolus–Based
Multinutrient Block had better performance than those fed
control diet of Panicum-cassava peels only. This shows that the
multinutrient blocks have enhanced performance of the goat by
efficiently improving rumen fermentation digestion, this
providing a better balance of nutrient to the animals for
absorption. Further, this study clearly demonstrates that
multinutrient blocks feeding is a useful strategy in overcoming
dry season weight losses or rather poor performance in goats fed
cut and carry fodder. The haematological studies showed that
the multinutrient blocks were not detrimental to animal health
and well-being and therefore could be used to supplement
Panicum-cassava peels in goats feeding.

References
metabolites in bulls fed rice straw with or without supplements.
Nig. J. Anim. Prod. 29(1) 40-46.
Adegun M. K; Aye P.A and Dairo F.A.S(2011) Evaluation of
Moringa oleifera, Gliricidia sepium and Leucaena leucocephala-
based multinutrient blocks as feed supplements for sheep in
South Western Nigeria. Agriculture and Biological Journal of
of three different types of land snails consumed in Nigeria. Food
replaced with leaf protein concentrate from Gliricidia in diets
for broiler-chicks. Effect on performance, muscle growth and
haematology and serum metabolites. International Journal of
aspects of the nutrition, biochemistry and haematology of the rat
fed gari containing varying residual cyanide levels. Inter. J.
Food Sci. 44: 289-295.
processed Soyabean. Part 2: An assessment of haemtalogical
responses in the characteristics, haematology and sepium
Official Methods of Analysis. 18th edn. (Association of Official
Analytical Chemists Gaithersburg USA) AOAC Press Pp 1250-
1255.
some physiological parameters and growth rate of the West
African Dwarf goats. M. Tech. Thesis. Federal University of
Technology Akure, Nigeria.
small ruminants in Nigeria. Proceedings 10th Annual ASAN
ruminants and alcohol from the waste products of Leucaena
leucocephala and Gliricidia sepium leaves using local
technologies. Ph.D Thesis. Federal University of Technology,
Akure.
Aye P. A and Adegun M.K (2010) Digestibility and growth in
West African dwarf sheep fed gliricidia-based multinutrient
block supplements. Agriculture and Biology Journal of North
America 1(6):1133-1139.
Table 1. Proximate Analysis of *Cnidoscolus* Residues, Cassava peels, Guinea grass and Experimental Multinutrient Blocks

<table>
<thead>
<tr>
<th>Composition</th>
<th>Cnidoscolus residues</th>
<th>Cassava peel</th>
<th>Guinea grass</th>
<th>CPMNB</th>
<th>CUMNB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry matter</td>
<td>94.54 ± 0.02</td>
<td>94.54 ± 0.01</td>
<td>91.47 ± 0.01</td>
<td>69.93</td>
<td>67.15</td>
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<tr>
<td>Ash</td>
<td>15.54 ± 0.001</td>
<td>6.89 ± 0.01</td>
<td>7.21 ± 0.01</td>
<td>23.24</td>
<td>22.81</td>
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<tr>
<td>Ether Extract</td>
<td>12.85 ± 0.01</td>
<td>6.90 ± 0.37</td>
<td>5.32 ± 0.01</td>
<td>0.72</td>
<td>0.1</td>
</tr>
<tr>
<td>Crude fibre</td>
<td>7.54 ± 0.01</td>
<td>7.12 ± 0.01</td>
<td>35.21 ± 0.02</td>
<td>5.51</td>
<td>3.51</td>
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<tr>
<td>Crude protein</td>
<td>25.77 ± 1.14</td>
<td>10.94 ± 0.01</td>
<td>16.14 ± 0.45</td>
<td>31.97</td>
<td>34.83</td>
</tr>
<tr>
<td>Nitrogen Free Extract</td>
<td>32.93 ± 1.15</td>
<td>62.67 ± 0.41</td>
<td>36.09 ± 0.20</td>
<td>38.56</td>
<td>35.73</td>
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<tr>
<td>Gross Energy (MJkg⁻¹)</td>
<td>14.71</td>
<td>15.99</td>
<td>12.00</td>
<td>16.33</td>
<td>15.74</td>
</tr>
</tbody>
</table>

CPMNB – *Cnidoscolus* + Poultry Manure Multinutrient Block
CUMNB – *Cnidoscolus* + Urea Multinutrient Block
Control – *Panicum maximum* + Cassava Peel

Table 2. Energy Values as Contributed by Protein, Fat, Carbohydrate in the *Cnidoscolus*-Based Multinutrient Blocks

<table>
<thead>
<tr>
<th>Parameters</th>
<th>CPMNB</th>
<th>CUMNB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Energy</td>
<td>768.52</td>
<td>728.42</td>
</tr>
<tr>
<td><em>Proportion of Energy due to Protein</em></td>
<td>70.72</td>
<td>90.33</td>
</tr>
<tr>
<td><em>Proportion of Energy due to Fat</em></td>
<td>3.47</td>
<td>0.51</td>
</tr>
<tr>
<td><em>Proportion of Energy due to Carbohydrate</em></td>
<td>25.81</td>
<td>9.10</td>
</tr>
<tr>
<td><em>Utilizable Energy due to Protein</em></td>
<td>461.11</td>
<td>437.05</td>
</tr>
</tbody>
</table>

*PEP,* *PEF,* *PEC,* *UEDP*
CPMNB – *Cnidoscolus* + Poultry Manure Multinutrient Block
CUMNB – *Cnidoscolus* + Urea Multinutrient Block
Control – *Panicum maximum* + Cassava Peel

Table 3. Haematological Variables of West African Dwarf Goat Fed *Cnidoscolus aconitifolius* –Based Multinutrient Block

<table>
<thead>
<tr>
<th>Parameters</th>
<th>CPMNB</th>
<th>CUMNB</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Packed Cell Volume (%)</td>
<td>20.25 ± 2.25</td>
<td>25.25 ± 1.25</td>
<td>19.90 ± 1.59</td>
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<tr>
<td>Red blood cell (x10⁶mm⁻³)</td>
<td>9.35 ± 0.40</td>
<td>8.45 ± 1.16</td>
<td>6.22 ± 0.67</td>
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<tr>
<td>White Blood Cell (x10⁶mm⁻³)</td>
<td>11.5 ± 1.08</td>
<td>10.5 ± 1.05</td>
<td>13.9 ± 1.05</td>
</tr>
<tr>
<td>Haemoglobin Conc. (g 100mm⁻¹)</td>
<td>7.1 ± 0.39</td>
<td>8.8 ± 0.89</td>
<td>5.92 ± 0.18</td>
</tr>
<tr>
<td>Erythrocyte Sedimentation Rate (mm/hr⁻¹)</td>
<td>3.41 ± 0.1</td>
<td>3.33 ± 0.39</td>
<td>1.33 ± 0.34</td>
</tr>
<tr>
<td>Mean Corpuscular Haemoglobin Conc. (%)</td>
<td>31.65 ± 1.64</td>
<td>34.85 ± 4.29</td>
<td>20.75 ± 3.37</td>
</tr>
<tr>
<td>Mean Corpuscular Haemoglobin (pg)</td>
<td>1.91 ± 0.33</td>
<td>2.06 ± 0.15</td>
<td>1.0 ± 0.55</td>
</tr>
<tr>
<td>Mean Corpuscular Volume (µm⁻²)</td>
<td>26.0 ± 1.14</td>
<td>28.9 ± 0.08</td>
<td>24.6 ± 0.6</td>
</tr>
<tr>
<td>Lymphocytes (%)</td>
<td>63.0 ± 2.0</td>
<td>65.66 ± 1.34</td>
<td>60.25 ± 1.25</td>
</tr>
<tr>
<td>Neutrophils (%)</td>
<td>28.66 ± 2.67</td>
<td>29.25 ± 3.25</td>
<td>25.25 ± 1.75</td>
</tr>
<tr>
<td>Monocytes (%)</td>
<td>6.01 ± 0.00</td>
<td>6.41 ± 0.6</td>
<td>4.90 ± 0.42</td>
</tr>
<tr>
<td>Eosinophils (%)</td>
<td>2.0 ± 0.00</td>
<td>2.0 ± 0.25</td>
<td>1.83 ± 0.17</td>
</tr>
<tr>
<td>Basophils (%)</td>
<td>1.08 ± 0.41</td>
<td>1.08 ± 0.09</td>
<td>1.0 ± 0.00</td>
</tr>
</tbody>
</table>

CPMNB – *Cnidoscolus* + Poultry Manure Multinutrient Block
CUMNB – *Cnidoscolus* + Urea Multinutrient Block
Control – *Panicum maximum* + Cassava Peel

Table 4. Digestibility Coefficient Values of West African Dwarf Goat Fed *Cnidoscolus aconitifolius* –Based Multinutrient Block

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>CPMNB</th>
<th>CUMNB</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter</td>
<td>85.36</td>
<td>85.09</td>
<td>68.66</td>
</tr>
<tr>
<td>Ash</td>
<td>79.10</td>
<td>71.20</td>
<td>59.21</td>
</tr>
<tr>
<td>Ether Extract</td>
<td>60.20</td>
<td>53.25</td>
<td>52.78</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>92.21</td>
<td>91.67</td>
<td>76.46</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>82.41</td>
<td>75.17</td>
<td>70.58</td>
</tr>
<tr>
<td>Nitrogen Free Extract</td>
<td>92.87</td>
<td>91.88</td>
<td>71.99</td>
</tr>
</tbody>
</table>

CPMNB – *Cnidoscolus* + Poultry Manure Multinutrient Block
CUMNB – *Cnidoscolus* + Urea Multinutrient Block
Control – *Panicum maximum* + Cassava Peel

Table 5. Percent Digestible Nutrient in the Feed

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>CPMNB</th>
<th>CUMNB</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Matter</td>
<td>42.05</td>
<td>42.24</td>
<td>33.99</td>
</tr>
<tr>
<td>Ash</td>
<td>5.9</td>
<td>5.01</td>
<td>2.07</td>
</tr>
<tr>
<td>Ether Extract</td>
<td>1.25</td>
<td>1.41</td>
<td>1.07</td>
</tr>
<tr>
<td>Crude Fibre</td>
<td>6.32</td>
<td>6.72</td>
<td>6.18</td>
</tr>
<tr>
<td>Crude Protein</td>
<td>4.26</td>
<td>7.73</td>
<td>4.21</td>
</tr>
<tr>
<td>Nitrogen Free Extract</td>
<td>27.34</td>
<td>22.10</td>
<td>21.9</td>
</tr>
</tbody>
</table>

CPMNB – *Cnidoscolus* + Poultry Manure Multinutrient Block
CUMNB – *Cnidoscolus* + Urea Multinutrient Block
Control – *Panicum maximum* + Cassava Peel


