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## BLOOD INDICES OF RABBITS FED WILD MELON (*Adenopus breviflorus*) - BASED DIETS

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### Abstract

This study investigated the haematological and the serum biochemical indices of rabbits fed different parts of wild melon (*Adenopus breviflorous*) meal. A total of twenty-four mixed breed weaned rabbits ( $1400 \pm 0.05$ g) of both sexes were used for the study. Three experimental diets were formulated comprising 0 % *Adenopus breviflorous* (ABM) meal for treatment (T1), 10 % of *Adenopus breviflorous* leaf meal (ABLM) for treatment (T2) and 10 % of *Adenopus breviflorous* pod meal (ABPM) for treatment (T3), respectively. The animals were randomized into three groups of 8 rabbits each using a completely randomized design on body weight and sex equalization basis. At the end of the feeding trial, blood samples were collected from four rabbits (2 females and 2 males) per treatment for hematological and serum biochemical assay, respectively. The result of the haematological analysis revealed that there were significant ( $p < 0.05$ ) differences between the treatment groups in red blood cell counts ( $6.09 - 7.26 \times 10^6/\text{mm}^3$ ), packed cell volume (42.67-48.00%), Haemoglobin (14.47-16.47g/dl), white blood cell ( $8.13 - 9.16 \times 10^3/\text{mm}^3$ ), mean corpuscular hemoglobin concentration (33.55-34.30g/dl), respectively which were all within the normal haematological ranges for healthy rabbits. For serum biochemical indices; total protein, albumin and total cholesterol were within the ranges 6.01-6.65g/dl, 3.08-4.07g/dl and 68.00-81.20mg/dl for T1, T2 and T3, respectively which were all within the normal ranges. The study concluded that rabbits fed up to 10% *Adenopus breviflorous* leaf and pod meal, respectively did not have adverse effects on haematological and serum biochemical indices.

**Key words:** Blood chemistry, nutrition, rabbits, wild melon

### Introduction

Nutrients fed to livestock can negatively impact on their well-being, especially if saturated with toxic substances (Evans *et al.*, 2020). The presence of these toxicants can be detected through the blood. Blood is a transport system of the body and its constituents change in relation to the physiological condition of the animal (Ihedioha *et al.*, 2004). Blood parameters of

animals can be influenced by certain factors such as nutrition (Evans *et al.*, 2023). Blood parameters, particularly haematological and serum biochemical indices are crucial indicators of an animal's health status and provide valuable insight into the physiological responses to dietary intervention.

Haematological parameters such as red blood cell counts, white blood cell counts, haemoglobin concentrate and platelet counts are essential for evaluating the oxygen-carrying capacity, immune function and overall health of an animal. Similarly, serum biochemical parameters, including liver enzymes, kidney function marker and lipid profile are vital for assessing the functional status of vital organs and metabolic processes (Ukpanah *et al.*, 2022; Salawu *et al.*, 2016). Monitoring these parameters are crucial when introducing new ingredients to ensure their safety and potential health benefits.

The scarcity of conventional feedstuffs such as maize, millet, soyabean meal is a significant challenge in livestock production. The incessant use of these conventional feed ingredients in the production of animal feeds and as food for humans makes these feedstuffs be highly sought after leading to rising cost and limited availability (Evans *et al.*, 2022).

The major constraint in the use of non-conventional feedstuffs is the anti-nutritional factors contain in them. Anti-nutritional factors are natural compounds in feedstuffs that interfere with the normal absorption and metabolism of nutrients as well as causing damage to red blood cells. They also caused decreased levels of haemoglobin and red blood cells in the blood leading to anaemia (Vikram *et al.*, 2020). Examples of some anti-nutritional factors include; saponin, tannins, oxalic acid and phytate. These anti-nutritional factors can be eliminated by processing methods

like toasting, soaking, boiling and fermenting (Evans *et al.*, 2025).

*Adenopus breviflorus* is a plant in the cucurbitaceae family, and widely distributed in tropical Africa (Oyedeji *et al.*, 2017). It is a tendril climber shrub and herb. The fruits are green with cream coloured narrowed blotch pepo found in the tropics and sub-tropical regions of the world (Ogunyele *et al.*, 2020). The fruits, seeds and leaves have been used in traditional medicine as herbal remedy for the treatment of measles, digestive disorder in man and very valuable to livestock farmers (Evans and Essien, 2021). *Adenopus breviflorus* is used in animal production due to its anti-microbial and anti-viral properties (Nworgu *et al.*, 2018). It can serve as protein supplement in rabbit diets. The proximate composition of the seed revealed 27% CP, 46% EE, 3.3% CF 2.02% ash (Evans and Essien, 2021). The richness of the seed of *Adenopus breviflorus* gives it a place as potential feed stuff to be looked out for. Rabbits are pseudo-ruminants with the ability to convert roughages with high fibre to meat efficiently without alteration in quality (Iyeghe-Erakpotobor and Adeyegun, 2012). The study therefore evaluated the blood chemistry of rabbits fed *Adenopus breviflorus*-based diets.

### Site of the experiment

The study was conducted at the Rabbitry Research Farm of the Department of Animal Science, Akwa Ibom State University, Obio Akpa Campus, Oruk Anam Local Government Area, Akwa Ibom State, Nigeria. Obio Akpa is located between latitude 5° 17' N/ 5° 27' N of the equator and

longitude 7° 27' N / 7° 58' E of the Greenwich meridian with an annual rainfall ranging from 350-500 mm and average monthly temperature of 25°C. Akwa Ibom State is a coastal state, lying between latitude 4° 28' N and 5° 3' N and between longitude 7° 25' E and 8° 20' E with a relative humidity between 60 and 90%. It is in the tropical rainforest zone of Nigeria (AKSG, 2022).

### Collection and processing of test materials

Mature *Adenopus breviflorus* whole pods and leaves were harvested from bushes around Obio Akpa in Oruk Anam local government area, Abak Local government area and Ukanafun local government area, Akwa Ibom State, respectively. The whole pods (i.e. the bark, seeds and pulp) were macerated into smaller particles and then sun dried for 10 to 12 days to reduce the

moisture content, until a constant weight was obtained. After drying, the pods. The leaves too were harvested, spread out in a room temperature overnight and then sun dried for 5 to 7 days. Each of the test ingredient was independently milled after which were stored in different sterile bag which was later used for inclusion in the experimental diets.

### Experimental diets

Three experimental diets were formulated with different forms of wild melon (*Adenopus breviflorus*), each of the dietary treatment was designated as T1, T2, and T3, respectively. T1 served as the control diet with 0% *Adenopus breviflorus*, T2 had 10% *Adenopus breviflorus* leaf meal and T3 had 10% *Adenopus breviflorus* whole pod meal, respectively.

**Table 1: Gross composition of experimental diets**

Ingredient	T <sub>1</sub> (0%AB)	T <sub>2</sub> (10% ALM)	T <sub>3</sub> (10% APM)
Yellow maize	55.00	55.00	55.00
Soybean meal	20.00	10.00	10.00
Groundnut cake	6.00	6.00	6.00
Palm kernel cake	10.	10.00	10.00
Wheat offal	5.00	5.00	5.00
Bone meal	3.00	3.00	3.00
Lysine	0.25	0.25	0.25
Methionine	0.25	0.25	0.25
Salt	0.25	0.25	0.25
Vitamin premix	0.25	0.25	0.25
<i>Adenopus breviflorus</i> leaf meal	0.00	10.00	0.00
<i>Adenopus breviflorus</i> pod meal	0.00	0.00	10.00
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>
Calculated values			
Crude protein (%)	17.11	17.52	17.62
Crude fibre (%)	10.00	11.56	11.55
ME (Kcal/kg)	2710.60	2600.50	2594.50

### Experimental animals and management

A total of 24 (twenty-four) cross bred (Chinchilla × New Zealand white) weaned rabbits, 14 bucks and 10 does of average body weight ( $1400 \pm 0.05\text{g}$ ), were purchased from a reputable rabbit farm at Uyo Local Government Area, Akwa Ibom State. Each rabbit was weighed individually and randomly distributed into three treatment groups after equalizing for weight and sex. Each treatment had eight replicates. The study was carried out in a completely randomized design (CRD). The rabbits were housed in well fitted cages with proper ventilation. The rabbits were fed daily and drinking water provided *ad-libitum* for 56 days.

### Haematological characteristics of rabbits

About 5 ml of blood sample was collected from each bottle in which half of it was poured into sample bottles containing ethylene diamine tetra-acetic acids (EDTA) as anti-coagulant and the bottles were gently shaken to guarantee homogenous mixture of the blood with EDTA thus preventing blood from coagulating and enabling haematological assay. Haematological parameters determined were haemoglobin count (HB), red blood cells (RBC), white blood cell (WBC) counts, packed cell volume (PCV), mean cell volume (MCV), mean corpuscular haemoglobin concentration (MCHC), lymphocytes, mean corpuscular haemoglobin (MCH), neutrophils, eosinophils, basophils and monocytes.

### Serum biochemical indices of rabbits

The remaining 2.5ml blood sample was kept in a pure sample bottle and allowed to coagulate for serum biochemical analysis. The serum biochemical indices that were determined include cholesterol, total protein and albumin levels using the routine Standard Clinical Chemistry Procedure as described by Magyar (2005); Merck (2012).

### Data analysis

All data obtained in this study were subjected to One-way analysis of variance (ANOVA) as described by Steel and Torrie (1980). Significant means were separated using Duncan's Multiple Range Test as described by Duncan (1955)

### Results and discussion

The result of haematological parameters of weaned rabbits fed *Adenopus breviflorous* meal – based diets is represented in Table 2. The haematological parameters obtained in the study revealed significant differences ( $p < 0.05$ ) across dietary treatments in most parameters such as red blood cell counts, packed cell volume, haemoglobin concentration, white blood cell counts, mean corpuscular haemoglobin, mean corpuscular haemoglobin concentration, neutrophils, lymphocytes and monocytes. for rabbit fed cassava peel meal as replacement for maize in the tropics. The values of red blood cell counts were 6.74, 6.09 and 7.26 for T1, T2 and T3, respectively.

The red blood cell counts of this study fell within the normal range haematological range ( $4.00 - 8.60 \times 10^6/\text{mm}^3$ ) for rabbits

reported by Medirabbit (2011). Red blood cell counts below the normal range indicates an anaemic condition and higher than the normal range indicates production of excess red blood cells, which could thicken blood flow, slow it and can cause blood clots. Red blood cells are the most common type of blood cells and the vertebrate's principal means of delivering oxygen to the blood tissues through blood flow in the circulatory system (Wikipedia, 2024), and to carry carbon dioxide as a waste product of metabolism to the lungs where it excreted. Normal range of red blood cell counts indicates that the vital physiological relationship of haemoglobin with oxygen is in the transport of gases to and from the tissues of the body (Njidda *et al.*, 2006). This implies that the feed did not have any adverse effect on the transport of oxygen. This is in tandem with the report of Etine *et al.* (2018).

Packed cell volume or haematocrit is a measurement of the proportion of blood that is made up of red cells. The value is expressed as a percentage or fraction of red cells in blood (Wikipedia 2013). According to Wikihow (2013), the packed cell volume (PCV) of animals can be determined to know their anaemic state; the haematocrit is used to screen animals to determine the extent of anaemia. A low haematocrit combined with other blood abnormal blood tests, confirms the diagnosis. The haematocrit is decreased in a variety of common conditions including liver and kidney diseases, malnutrition, vitamin B<sub>12</sub> and folic acid deficiencies and iron deficiency (DeMoranville and Best, 2013).

The values of PCV were 47.00, 42.67, 48.00 for T1, T2 and T3 respectively. The values fell within the recommended range (30-50 %) for healthy rabbits (Medirabbit, 2011). Packed cell volume is responsible for nutrient absorption and oxygen transportation (Evans *et al.*, 2020). Therefore, the result of this study shows that oxygen transportation and nutrient absorption were not affected by *Adenopus breviflorous* meal-based diets and there was no trace of anaemia. This supports the report of Solomon *et al.* (2024). The values of PCV were 47.00, 42.67, 48.00 for treatment 1, 2, 3 respectively. The values fell within the recommended range 30-50 (Medirabbit, 2011). There were significant differences ( $p < 0.05$ ) between treatment groups for PCV with treatment three having the highest value. Packed Cell Volume are responsible for nutrient absorption and oxygen transportation (Evans *et al.*, 2020). Therefore, the result of this study shows that oxygen transportation and nutrient absorption was not affected by *Adenopus breviflorous* meals and there was no trace of anemia. This corroborates the results of Solomon *et al.* (2024). Hemoglobin concentration is a measure of the oxygen carrying capacity of the blood, it conveys nutrients to different parts of the entire system; therefore, whatever affects the blood such as drugs, pathogenic organisms or nutrition will certainly affect the entire body in terms of health, growth and maintenance (Ajuonuma and Awodi, 2012). The values of haemoglobin concentration were 15.77, 14.47 and 16.47 g/dl for T1, T2 and T3, respectively. The result shows that *there* were significant differences ( $p < 0.05$ )

between treatment groups for haemoglobin concentration, with T3 (10 % APM) having the highest mean value. The haemoglobin values of this study fell within the normal range of haemoglobin concentration (9.30 - 19.30 g/dl). The normal range of haemoglobin indicates that the vital physiological relationship of haemoglobin with oxygen in the transport of gases to and from the tissues of the body was maintained and is normal (Njidda and Isidahomen, 2010). Low haemoglobin count indicates not enough oxygen and such animal will be respiratory stress). High haemoglobin count could lead to blood clotting. The result of this study revealed that the physiological relationship of haemoglobin with oxygen was maintained and the rabbit had the high oxygen capacity, meaning there was no respiratory stress as the values fell within the normal range of the healthy rabbits. This result corroborates the report of Evans *et al.* (2021) who fed rabbits with *Hibiscus sabdariffa* as residue. White blood cell (WBC) counts or leucocytes are cells of the immune system involved in defending the body against infections, disease and foreign materials (WebMD, 2012; Medline Plus, 2012; Wikipedia, 2013b). The values for white blood cell counts were 8.13, 9.16 and 8.95 ( $\times 10^3/\text{mm}^3$ ) for T1, T2 and T3, respectively. There were significant differences ( $p < 0.05$ ) between treatment groups, with T2 (10 % ALM) showing the highest mean value. Values for white blood cell counts in this study fell within the normal range (5-12  $\times 10^3/\text{mm}^3$ ) recommended by Medirabbit (2011). The white blood cell counts in this study fell within the normal range, indicating that the

rabbits had the ability to produce a defensive mechanism against infections. This is in collaboration with the report of Christopher *et al.* (2020), who had ranging from. Lower than normal white blood cell count is an indication of a fall in the production of defensive mechanism to combat infection and higher white blood cell count in an indication that the body could be fighting off infections (Evans *et al.*, 2023). The values for mean corpuscular volume were 69.87, 70.11, and 66.14 pg for T1, T2 and T3, respectively. The values fell below the normal range of 78-95 pg. reported by Medirabbit (2011). There was no significant difference ( $p > 0.05$ ) between treatment groups. Njidda *et al.* (2006) posited that MCV, MCH and MCHC are used in diagnosing anaemic conditions. Anaemia is a condition in which the body lacks enough healthy red blood cells to carry oxygen to the tissues. The values for mean corpuscular haemoglobin (MCH) were 3.35, 3.39 and 3.43 fl for T1, T2 and T3, respectively. The values fell below the normal range 19-22 FL reported by Medirabbit (2011). There were significant differences ( $p < 0.05$ ) between treatment groups. The values for mean corpuscular haemoglobin concentration (MCHC) were 33.55, 33.91 and 34.30 g/dl for T1, T2 and T3, respectively with T3 (10% APM) having the highest mean value. The values fell within the normal range 30-35 g/dl reported by Medirabbit (2011), indicating that the red blood cells carried the appropriate amount of haemoglobin.

The values for neutrophils were 47.67, 52.00 and 53.33 % for T1, T2 and T3, respectively, and were all within the normal

range of 20-75 % reported by (Medirabbit, 2011). Though, there were significant differences ( $p < 0.05$ ) between treatment groups. The values for lymphocytes were 44.33, 37.00 and 36.00 % for T1, T2 and T3, respectively, with T1 having the highest mean value. The values fell within the normal range 30-85 % reported by Medirabbit (2011). There were significant differences ( $p < 0.05$ ) between treatment groups. The values for monocytes were 5.33, 6.33 and 6.67 % for T1, T2 and T3 respectively, with T3 (10 % APM) having the highest mean value. The values were slightly above the normal range 1-4 % reported by Medirabbit (2011). There were significant differences ( $p < 0.05$ ) between treatment groups. The values for eosinophils

were 2.67, 3.67 and 3.33% for T1, T2 and T3, respectively with T2 (10 % APL) having the highest mean value. The values fell within the normal range recommended by Medirabbit (2011). The values for basophils were 0.67, 1.00 and 0.67 % for T1, T2 and T3, respectively with T2 slightly higher than the normal range 0.00-0.84 % reported by Medirabbit (2011). The values for T1 and T3 fell within the recommended range. There was no significant difference ( $p > 0.05$ ) between treatment groups (The results of all the components of leukocytes showed that the immune status of the rabbits was not compromised, thus the ability of *Adenopus breviflorous* meal to resist infections (Evans *et al.*, 2022; Evans, 2026).

**Table 2: Haematological parameters of weaned rabbits fed *Adenopus breviflorous* -based diets**

Parameter	T <sub>1</sub> (0% AB)	T <sub>2</sub>	T <sub>3</sub>	SEM	Ref. ranges*
RBC (x10 <sup>6</sup> /mm <sup>3</sup> )	6.70 <sup>a</sup>	6.09 <sup>b</sup>	7.20 <sup>a</sup>	0.20	4 - 8.6
PCV (%)	47.00 <sup>a</sup>	42.67 <sup>b</sup>	48.00 <sup>a</sup>	0.87	30 – 50
HB(g/dl)	15.77 <sup>a</sup>	14.47 <sup>b</sup>	16.47 <sup>a</sup>	0.31	9.3 - 19.3
WBC (x10 <sup>3</sup> /mm <sup>3</sup> )	8.13 <sup>b</sup>	9.16 <sup>a</sup>	8.95 <sup>a</sup>	0.16	5 – 12
MCV (pg)	69.87	70.11	66.14	0.15	78 – 95
MCH (fl)	3.35 <sup>b</sup>	3.39 <sup>b</sup>	3.43 <sup>a</sup>	0.01	19 – 22
MCHC (g/dl)	33.55 <sup>b</sup>	33.91 <sup>ab</sup>	34.30 <sup>a</sup>	0.14	30 – 35
NEU (%)	47.67 <sup>b</sup>	52.00 <sup>ab</sup>	53.33 <sup>a</sup>	0.13	20 – 75
LYM (%)	44.33 <sup>a</sup>	37.00 <sup>b</sup>	36.00 <sup>b</sup>	1.56	30 – 85
MONO (%)	5.33 <sup>b</sup>	6.33 <sup>ab</sup>	6.67 <sup>a</sup>	0.26	1 – 4
EOS (%)	2.67	3.67	3.33	0.22	0 – 5
BASO (%)	0.67	1.00	0.67	0.15	0.00 – 0.84

<sup>abc</sup>Means along the same row with different superscripts are significantly ( $p < 0.05$ ) different. T1 (0%) diet without *Adenopus breviflorous*, T2 - diet with 10% *Adenopus breviflorous* leaf meal, T3 diet with 10% *Adenopus breviflorous* pod meal. SEM Standard error of means, Ref. ranges - reference ranges (Medirabbit 2011).

RBC- Red blood cell count, PCV - Packed cell volume; HB- Haemoglobin, WBC- White blood cell counts; MCV- Mean corpuscular volume, MCH- Mean corpuscular haemoglobin; MCHC -Mean corpuscular haemoglobin concentration; NEU- Neutrophils; LYM -Lymphocytes; MONO -monocytes, EOS- Eosinophils; BASO - Basophils.

### Serum biochemical indices of weaned rabbits fed *Adenopus breviflorous* – based diets

Result of serum biochemical indices of rabbits fed *Adenopus breviflorous*-based diets is presented in Table 3. All the values obtained were within the normal ranges for healthy rabbits. The values for total protein were 6.01, 6.57 and 6.65 g/dl for T1, T2 and T3, respectively. Treatment 3 (10 % *Adenopus breviflorous* pod meal) had the highest mean value. The result corroborates that of Kennedy *et al.* (2022) who fed enzymes supplemented sorghum to monogastric animals. The values were within the normal range 5.0-7.0 g/dl reported by Medirabbit (2011). There were significant differences ( $p < 0.05$ ) between the treatment groups. The result of this study indicates sufficient protein intake from *Adenopus breviflorous* meals, meaning that the experimental diets improved the total protein values (Kennedy *et al.*, 2020). The values for albumin were 3.08, 3.72 and 4.07 g/dl for T1, T2 and T3, respectively. There were significant differences ( $p < 0.05$ ) between the treatment groups. These values

were slightly lower than those reported by Ukpanah *et al.* (2022) for monogastric animals fed probiotics. The values fell within the recommended range (2.7-5.00 g/dl) reported by Medirabbit 2011. Albumin helps in tissues synthesis and healing (Cumali *et al.*, 2012). The values for total cholesterol were 81.20, 73.80 and 68.00 (mg/dl) for T1, T2 and T3, respectively. The values were within the normal range reported by (Merck, 2012), except for T1 (0%) that was slightly above the normal range. The results are slightly lower than the results of Evans *et al.* (2020) for rabbits fed cassava peel meal diets. The results indicate there was no abnormal cholesterol in the blood which includes diabetes. The values for Alkaline phosphatase were 75.67, 71.67 and 70.67 (u/l) for T1, T2 and T3, respectively with T1 having the highest mean value. The values fell within the normal range 12 - 96 (u/l) reported by (Medirabbit, 2011). The values for urea were 17.00, 18.33 and 18.27 (mg/dl) for T1, T2 and T3, respectively. The values fell within the normal range 10 - 30 (mg/dl) reported by Medirabbit (2011).

**Table 3: Serum biochemical indices of weaned rabbits fed *Adenopus breviflorous*- based diets**

Parameter	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	SEM	Ref. ranges*
TP (g/dl)	6.01 <sup>b</sup>	6.50 <sup>a</sup>	6.65 <sup>a</sup>	0.11	5.4 – 7.5
ALBU (g/dl)	3.08 <sup>a</sup>	3.72 <sup>b</sup>	4.00 <sup>a</sup>	0.15	2.7 – 5.0
TCHOL (mg/dl)	81.20 <sup>a</sup>	73.80 <sup>b</sup>	68.00 <sup>b</sup>	1.99	10 – 80
ALP (u/l)	75.67	71.67	70.67	1.08	12 – 96
UREA (mg/dl)	17.00	18.33	18.27	0.29	10 – 30

(TP = Total protein; ALBU = Albumin; TCHOL = Total cholesterol; ALP = Alkaline phosphatase)

\*Ref. ranges (Merck, 2012))

## Conclusion

The haematological and serum biochemical indices of rabbits fed 10 % of *Adenopus breviflorous* leaf and whole pod meal were not adversely affected, as they were within the normal blood ranges for apparently healthy rabbits.

## Recommendation

The study recommends that rabbit farmers should be encouraged to utilize this readily available non-conventional feed stuff (10% of *Adenopus breviflorous* leaf and whole pod meal) in rabbit feeding without the fear of adverse effects on blood indices.

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