

## Haematology and Serum Indices of Weaner Pigs Fed Raw Pride of Barbados (*Caesalpinia pulcherrima*) Seed Meal

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**Target Audience:** Animal nutritionists, Livestock researchers, Pig farmers, Extension workers, Feed millers

### **Abstract**

*Sixteen (16) weaner pigs with an average weight of 3-6kg were used in an 8th weeks feeding trial to evaluate the haematological and serological response of the pigs to four levels of raw pride of barbados based diets. The animals were allotted into four treatments groups comprising four animals per group and two animals per replicate. Four isonitrogenous and isocaloric diets were formulated. Diet 1 which was the control diet, contained 0% of raw pride of barbados seed meal while diets 2, 3 and 4 contained 5%, 10% and 15% raw pride of barbados seed meal respectively. At the end of the experiment, blood samples were collected from two animals per treatment for haematological and serological study. The results obtained for the haematological indices revealed that the inclusion of raw pride of barbados seed meal had significant effect ( $P < 0.05$ ) on the packed cell volume (22.50-30.50%), haemoglobin (7.50-10.00g%), red blood cell ( $3.82-4.82 \times 10^6$ ), white blood cell ( $3825.00-7000.00 \times 10^3$ ), mean corpuscular volume (57.41-63.34fl), mean corpuscular haemoglobin (18.89-30.77pg), eosinophil (1.50-2.50%), lymphocyte (39.00-41.50%) and monocyte (1.00-3.00%) while mean corpuscular haemoglobin concentration (32.79-33.33g/dl) and neutrophil (55.50-56.50%) were not significant ( $P > 0.05$ ). For serum, significant difference ( $P < 0.05$ ) were obtained in the values recorded for total protein (7.35-8.90), albumin (3.65-4.55), globulin (3.70-4.35) and creatinine (38.50-77.75) respectively. The results of this study suggest that weaner pigs can be fed with raw pride of Barbados up to 5% inclusion level in their diets without any detrimental effects on the haematological and serum indices*

**Keywords:** Pride of barbados seed, haematology, serum, weaner pigs

### **Description of Problem**

Blood acts as a pathological reflector of the status of the exposed animals to toxicant and other condition. The examination of blood provide the opportunity to clinically investigate the presence of metabolites and other

constituents in the body of animals and it plays a vital role in the physiological, nutritional and pathological status of an animal (1). Haematological studies are useful in the diagnosis of many diseases as well as investigation of extent of damage to blood (2). The serum

biochemical variables of the blood of livestock are known to be positively correlated with protein quality and quantity of the diet (3) and (4). The impact of diet on serum chemistry cannot be overlooked because blood transport gases, nutrients, hormones and excretory products within the body. The high cost of animal protein and increase in population in Nigeria is among the major factors militating against the availability of much needed high quality protein food for low income people (5). To ensure speedy provision of animal protein, there is need to divert attention to those animal species that can multiply quickly. Pig production in particular represents one of the fastest ways of increasing animal protein; since pigs grow at faster rate than cattle, sheep and goats. Apart from their high rate of production, pigs and poultry are characterized by the best efficiency of nutrient transformation into high quality animal protein (6). They tolerate all kind of feed, considered as waste by man (7) some of which include cassava peels (8) and other agro industrial by products (9). However, commercial pig production rely on compounded feed (10). There is therefore need to evaluate energy and protein feedstuff which do not belong to the domain of human nutrition. Pride of barbados (*Caesalpinia pulcherrima*) is an alternative feedstuff which belongs to the family leguminosae and second largest family among the dicotyledonous plants (11). Its common names includes dwarf

poinciana, bird of paradise and they are good sources of essential amino acids and fats (12). The present trial aims at determining the effect of feeding raw pride of barbados seed meal on the haematology and serum biochemistry of weaner pigs.

## **Materials and Methods**

### ***Experimental location***

The experiment was carried out at the piggery unit of the Teaching and Research Farm of the Oyo State College of Agriculture and Technology, Igboora. The experimental areas lies in savanna forest zone on latitude 7° 43N and longitude 3° 28E in an elevation of 140m above the sea level. The average minimum temperature is above 21° 5 and maximum average temperature is 32.5°C (13)

### ***Experimental feed***

Ripened pod of pride of barbados were collected within Igboora metropolis. The dried and mature pods were worked to remove the seed in lateral arrangement. Over 100kg seed were collected and ground into pride of barbados seed meal using hammer mill. The meal produced was used to formulate four isocaloric and isonitrogenous experimental diet. A total of four diets were formulated to contain raw pride of barbados seed meal included at 5%, 10% and 15% respectively. The pigs were fed 4% of their body weight. The gross composition of the experimental diet is as shown in Table 1.

**Table 1: Gross Composition of Experimental Diet**

| Ingredients                 | T1(0%) | T2(5%) | T3(10%) | T4(15%) |
|-----------------------------|--------|--------|---------|---------|
| Maize                       | 30.00  | 28.00  | 25.00   | 20.00   |
| Maize Offal                 | 25.00  | 25.00  | 25.00   | 25.00   |
| Raw Pride of Barbados       |        |        |         |         |
| Seed meal                   | 0.00   | 5.00   | 10.00   | 15.00   |
| Soyabean Meal               | 20.00  | 17.00  | 15.00   | 15.00   |
| Palm Kernel Cake            | 20.00  | 19.00  | 19.00   | 19.00   |
| Local Fish Meal             | 1.25   | 2.25   | 2.25    | 2.25    |
| Bone Meal                   | 3.00   | 3.00   | 3.00    | 3.00    |
| Salt                        | 0.50   | 0.50   | 0.50    | 0.50    |
| *Vit. Min. Premix           | 0.25   | 0.25   | 0.25    | 0.25    |
| Total                       | 100.00 | 100.00 | 100.00  | 100.00  |
| <b>Determined Analysis</b>  |        |        |         |         |
| Dry Matter                  | 91.06  | 90.40  | 91.71   | 91.19   |
| Moisture (%)                | 8.94   | 9.60   | 8.29    | 8.81    |
| Crude Protein (%)           | 19.07  | 19.05  | 19.10   | 19.25   |
| Crude Fibre (%)             | 5.00   | 6.00   | 7.00    | 8.00    |
| Ash (%)                     | 5.20   | 5.01   | 5.30    | 5.10    |
| Ether Extract (%)           | 5.00   | 4.50   | 4.60    | 6.00    |
| Nitrogen Free Extract (%)   | 56.96  | 58.14  | 53.71   | 55.84   |
| Digestible Energy (kcal/kg) | 3.630  | 3.601  | 3.615   | 3.642   |

### ***Experimental Animals and Management***

A total of sixteen (16) crossbred weaner pigs in their 8<sup>th</sup> week of age were used for the study. The pigs were randomly assigned to four experimental groups in a completely randomized design. The pigs were grouped based on weight equalization and replicated twice with each replicate having two pigs respectively and housed together in naturally ventilated pen with floor size dimension of 3m x 2m. Fresh and clean water was supplied *ad libitum* throughout the duration of the experiment. The pigs were acclimatized for seven (7) days before the commencement of the experiment.

### ***Blood Collection***

At the 8<sup>th</sup> week, two pigs per treatment were sampled for blood analysis using 5mm syringe and needle. Blood was

drained into two different carefully labeled bottles for haematological and serum biochemistry investigation. The blood samples for haematological parameters were collected into the bottle pre-treated with Ethylene Diamine Tetra Acetate (EDTA), an anti coagulant. Blood samples for biochemical indices were collected into another sample bottle containing no anti coagulant. These samples were spurned in the centrifuge at 3000 rpm and the clearer portion (serum) decanted (after centrifugation) into small sample tubes and stored in a freezer. The haematological indices examined include Red Blood Cell (RBC), White Blood Cell (WBC), Packed Cell Volume (PCV), Differential count (monocyte, lymphocytes, eosinophil) Mean Cell Volume (MCV), Mean Cell Haemoglobin Concentration (MCHC),

Mean Cell Haemoglobin (MCH) and Haemoglobin Concentration (Hb). Serum indices investigated were total protein, globulin, albumin, albumin/globulin ratio, creatinine and cholesterol. The packed cell volume (PCV) was determined by spinning about 75ul of each blood samples in heparinised capillary tube in a haematocrit centrifuge for 5 minutes and read on haematocrit reader (14). Haemoglobin was estimated using cyanomethaemoglobin method. 0.02ml of blood was expelled into 4ml drakkins solution. The mixture was allowed to stand for 5 minutes for full colour development. Sample haemoglobin concentration was calculated using formula;

$$\text{Sample haemoglobin} = \frac{\text{Reading of test}}{\text{Standard haemoglobin concentration}} \times \text{g100ml}$$

The haemoglobin (Hb) concentration and the blood constants: mean cell haemoglobin (MCH), mean corpuscular

haemoglobin concentration (MCHC) and mean cell volume were determined using cyanomethaemoglobin method and appropriate formula respectively (15). The serum total protein was determined by the Biuret method using a commercial kit (Randox Laboratories Ltd, U.K) while albumin value was obtained by bromocresol green method (16). The globulin and albumin ratio were determined using (17) method. The serum creatinine were determined by deproteinisation using a commercial kit (Randox Laboratories Ltd. U.K). The cholesterol was determined by nonane extraction and enzymatic colorimetric methods using commercial kit (Quimica clinica Aplicada, S.A).

**Statistical Analysis**

All data obtained were subjected to Analysis of Variance using statistical package of (18). Significant mean were separated using Duncan Multiple Range Test of (19)

**Table 2: Haematological indices of weaner pigs fed raw pride of barbados seed meal Levels of Inclusions**

| Parameters                            | T <sub>1</sub> (0%)  | T <sub>2</sub> (5%)  | T <sub>3</sub> (10%) | T <sub>4</sub> (15%) | SEM (±) |
|---------------------------------------|----------------------|----------------------|----------------------|----------------------|---------|
| Packed cell volume (%)                | 24.00 <sup>bc</sup>  | 30.50 <sup>a</sup>   | 25.50 <sup>b</sup>   | 22.50 <sup>d</sup>   | 1.32    |
| Haemoglobin(g/l )                     | 7.90 <sup>bc</sup>   | 10.00 <sup>a</sup>   | 8.50 <sup>b</sup>    | 7.50 <sup>d</sup>    | 0.46    |
| White blood cell(10 <sup>3</sup> U/L) | 3825.00 <sup>d</sup> | 4025.00 <sup>c</sup> | 5050.00 <sup>b</sup> | 7000.00 <sup>a</sup> | 1108.50 |
| Red blood cell(10 <sup>6</sup> )      | 4.18                 | 4.82                 | 4.34                 | 3.82                 | 0.18    |
| MCHC(g/dl)                            | 32.92                | 32.79                | 33.33                | 33.33                | 2.98    |
| Mean Corpuscular Volume(fl)           | 57.41 <sup>c</sup>   | 63.34 <sup>a</sup>   | 58.82 <sup>b</sup>   | 58.97 <sup>b</sup>   | 3.10    |
| Mean Corpuscular Haemoglobin(pg)      | 18.89 <sup>c</sup>   | 30.77 <sup>a</sup>   | 19.61 <sup>b</sup>   | 19.66 <sup>b</sup>   | 2.85    |
| Lymphocytes(%)                        | 41.50 <sup>a</sup>   | 39.00 <sup>d</sup>   | 40.00 <sup>bc</sup>  | 41.00 <sup>ab</sup>  | 1.71    |
| Nuetrophils(%)                        | 55.00                | 56.50                | 55.50                | 55.50                | 1.70    |
| Monocyte(%)                           | 2.00 <sup>bc</sup>   | 3.00 <sup>a</sup>    | 2.50 <sup>ab</sup>   | 1.00 <sup>d</sup>    | 0.29    |
| Eosinophil(%)                         | 1.50 <sup>c</sup>    | 1.50 <sup>c</sup>    | 2.00 <sup>ab</sup>   | 2.50 <sup>a</sup>    | 0.22    |

a, b, c, d, means on the same row with differences superscript on the same row differ (p<0.05) significantly.

MCHC(Mean Corpuscular Haemoglobin Concentration)

**Table 3: Effect of feeding raw pride of barbados Seed meal on Serum indices of weaner pigs**

| Parameters             | T <sub>1</sub> (0%) | T <sub>2</sub> (5%) | T <sub>3</sub> (10%) | T <sub>4</sub> (15%) | SEM (±) |
|------------------------|---------------------|---------------------|----------------------|----------------------|---------|
| Total Protein (g/l)    | 8.90 <sup>a</sup>   | 7.35 <sup>bc</sup>  | 8.50 <sup>ab</sup>   | 8.50 <sup>ab</sup>   | 0.25    |
| Albumin (g/l)          | 4.55 <sup>a</sup>   | 3.65 <sup>bc</sup>  | 4.35 <sup>ab</sup>   | 3.70 <sup>bc</sup>   | 0.15    |
| Globulin (g/l)         | 4.35                | 3.70                | 4.25                 | 3.75                 | 0.13    |
| Albumin/Globulin Ratio | 1.00                | 0.95                | 1.06                 | 0.95                 | 0.02    |
| Creatinine (mg/dl)     | 38.50 <sup>d</sup>  | 77.75 <sup>a</sup>  | 74.95 <sup>ab</sup>  | 69.30 <sup>bc</sup>  | 0.39    |
| Cholesterol (mg/dl)    | 1.00                | 0.90                | 1.10                 | 0.90                 | 5.92    |

a, b, c, d, means on the same row with different superscript are significantly different (p<0.05) SEM = Standard Error of Mean

**Results and Discussion**

The results of haematological indices of weaner pigs fed raw pride of Barbados seedmeal is presented in Table 2. There were significant (P<0.05) difference in the values obtained for packed cell volume, haemoglobin, red blood cell, white blood cell and all blood constants (MCV, MCH, eosinophil, lymphocytes and monocyte) examined except for neutrophil and MCHC which showed no significant (P>0.05) difference across the treatments. Blood is an important index of physiological, pathological and nutritional status in the organism (20). Reports by (21) indicated that the blood variable most consistently affected by dietary influence include packed cell volume and plasma protein. Although packed cell volume were significantly influenced by dietary treatments, pack cell volume is involved in the transport of oxygen and absorbed nutrients. Pack cell volume decreased as the level of inclusion of raw pride of barbados seedmeal increase and this results in decreased primary and secondary polycythemia. Packed cell volume is an

index of toxicity and its distribution vary with breeds. Reduction in the concentration of packed cell volume in the blood usually suggests the presence of a toxic factor which had adverse effect on blood formation (22). The decreased in haemoglobin values as raw pride of Barbados seed meal inclusion increases suggested that the experimental animals had deteriorated oxygen supply and were predispose to anemia. The result of the study confirm the report of (23) who reported that haemoglobin concentration below that which is normally seen in healthy population best characterizes anaemia. There were significant (p<0.05) differences between the treatments groups for red blood cell, red blood cells counts, mean corpuscular volumes (MCV) and mean corpuscular hemoglobin (MCH) respectively Mean corpuscular haemoglobin values decrease as the level of inclusion of raw pride of Barbados seed meal increase. (24) reported that a low level of mean corpuscular haemoglobin is an indication of anaemia (25) opined that packed cell volume, haemoglobin and



mean corpuscular haemoglobin are major indices for evaluating circulatory erythrocytes and are significant in the diagnosis of anaemia and also serve as useful indices of the bone marrow capacity to produce red blood cells as in mammals. The serum biochemistry of weaner pigs fed raw pride of Barbados seed meal is shown in table 3. Among the parameters measured significant ( $p < 0.05$ ) difference was recorded in the mean values obtained for total protein, albumin and globulin. Serum albumin will increase when protein intake exceeds the amount required for growing and maintenance compared with the control diet (4.55g/dl). Serum albumin is a strong predictor of health, a low albumin concentration is a sign of poor health and predictor of bad outcome(26). The consequences of increased globulins are observed in chronic infections, liver damage and kidney dysfunction (27). (28) reported that low level of globulin affect the ability of the animal to fight diseases. The significant ( $P < 0.05$ ) difference in creatinine levels noticed in this study is a classical sign that the kidney was adversely affected by the exposure arising from intake of raw pride of Barbados based diets. Other factors that may be responsible for the increment among which are excess break down of blood protein catabolism. The result of blood changes is indicative of the effect of toxins in raw pride of Barbados seed meal (tannin, oxalate, phytate and saponin) on the animal. It has reported that abnormally high blood creatinine would indicate muscle wastage and implies that the animal was surviving at the expenses of body reserves which

also result in weight loss (29). The low cholesterol indicates the possibility of pigs having anorexia, liver dysfunction and malabsorption of fats which are some of the symptoms of abnormal cholesterol metabolism in the body as well as their level in the blood (30). The decreasing values of cholesterol as the levels of inclusion of raw pride of Barbados increasing contents of antinutritional factors as the levels of inclusion increased. This agrees with findings of (20, 21) that antinutritional factor asserts a physiological effect on lowering the level of plasma cholesterol concentration in experimental animals. The value obtained fluctuates across the treatments, other factors that may be responsible for the increment among which excess breakdown of blood protein catabolism. The result changes is indicative of the effect of toxins in raw pride of Barbados seed meal (tannin, oxalate, phytate, saponin) on the animal. The low cholesterol indicates the possibilities of pigs having anorexia, liver dysfunction and malabsorption of fats which are some of the symptoms of abnormal cholesterol metabolism in the body as well as their level in the blood (30)

### **Conclusion and Applications**

1. Inclusion of raw pride of Barbados seed meal in the ration of weaner pigs significantly affected the haematology and serum indices of pigs.
2. Raw pride of Barbados seed meal could be incorporated in the ration of weaner pigs at 5% level of inclusion without adverse effects in blood

formation.

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