# EFFECT OF DIETARY REPLACEMENT OF MAIZE WITH GRADED LEVELS OF SORGHUM WITH AND WITHOUT ENZYME (*ENZYBLEND®*) ON THE HAEMATOLOGICAL AND SERUM BIOCHEMICAL INDICES OF GROWING RABBITS

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**ABSTRACT**
*Maize is one of the major sources of energy in rabbits feed. The use of sorghum is to reduce prices in feeds and effect of replacing maize as energy source for rabbit demands research. A study lasting 84 days was conducted at the Teaching and Research Farm of the Department of Animal Health and Production Technology, Akperan Orshi Polytechnic Yandev, Gboko to determine the haematological and serum indices of replacing yellow maize with red sorghum in rabbit diets with or without enzyme. A total of 54 weaner rabbits of mixed strains and sexes with initial body weight of 690.84-794.83g were assigned to 9 dietary treatments containing 6 rabbits per treatment with 1 rabbit per replicate in a completely randomized design of 4×2+1 factorial arrangement having two levels of enzyblend supplementation (with & without). Dietary treatments included: D1: 0 %, D2 :25 %, D3: 50 %, D4 :75 % D5: 100 % red sorghum replacement. The results showed that, PCV, eosinophil and monocyte were Significantly (P>0.05) higher (39.75, 3.13 and 3.50 %) respectively, while WBC, HB and MCV had no significant (p<0.05) effects. Albumin, Globulin, Creatinine and Cholesterol were significantly (P<0.05) higher (4.20, 3.24, 0.93, and 118.96) respectively. Total protein and Uric acid had no significant (P>0.05) difference for serum biochemical parameters with or without enzymes supplementation. The study therefore recommends 100 % sorghum inclusion level without any deleterious effect.*
**Key words: Haematology, serum, maize, sorghum, enzyblend, rabbits**

## INTRODUCTION

Rabbit meat production has increased considerably in order to meet the increasing demand for animal protein, and to seek alternative to poultry meat, which has declined since the advent of avian influenza (Owen *etal*. 2008). Rabbit meat is also increasingly becoming popular due to the fact that it is nutritious, low in fat and cholesterol, compared with most other meats such as beef, chicken, mutton or pork. The meat is white fine grained, delicately flavoured, nutritious and appetizing (Cheeke, 1994). Sorghum (*Sorghum bicolor*) is the species of grasses within the genus Sorghum. These plants are used for grain, fibre and fodder. The plants are cultivated in warmer climates worldwide.

## MATERIALS AND METHODS

The study was conducted in the Teaching and Research Farm of the Department of Animal Health and Production Technology, Akperan Orshi Polytechnic Yandev, Gboko. Fifty-four (54) weaner rabbits of mixed breed and sexes were used for the study. The rabbits were randomly assigned to nine (9) dietary treatments with six (6) replicates each in a Completely Randomized Design (CRD) with one animal per replicate. Each experimental animal served as a replicate using a factorial arrangement. The rabbits were initially fed on respective experimental diets and water *ad libitum* during acclimatization period of seven (7) days while data collection commenced at the end of adjustment period. All health and management practices were strictly adhered to. Data collected were subjected to Analysis of Variance (ANOVA) (Steel and Torrie, 1980), and Duncan multiple Range Test was used to separate the means (Duncan, 1995).

**Experimental Diets:** Nine dietary treatments were formulated with diet 1 (control diet) containing 100% maize. In the other remaining diets maize was replaced 25, 50, 75 and

100% sorghum inclusion level with or without enzymes. Each of the diets (2, 3, 4 and 5) was formulated twice with $T_2$, $T_4$, $T_6$ and $T_8$ containing no enzyme while $T_3$, $T_5$, $T_7$ and $T_9$ were contained enzyme (*Enzyblend®*). The diets were formulated to meet the nutritional requirements of the rabbits as presented in Table 1.

**Haematological and Serum Determination:** At the end of 12th week of the experimental period, two (2) rabbits per treatment group of known approximate live weight to the average weight of the treatment mean were selected for the evaluation of blood profile indices. The parameters to determine included Packed Cell Volume (PCV), White Blood Cell (WBC), Haemoglobin (Hb), Red Blood Cell (RBC), Mean Cell Haemoglobin Concentration (MCHC), Mean Cell Haemoglobin (MCH) and Mean Cell Volume (MCV). The serum metabolite such as Serum Total Protein, Albumin, Globulin, Cholesterol, Creatinine, and Urea were also determined. A 10 ml sterilized disposable syringe was used to collect blood from the jugular vein (at the neck region) of the rabbit. The collection site was sterilized with methylated spirit before blood collection. 5 ml of blood was withdrawn from the jugular vein of each experimental animal by a 5 ml sterile needle and syringe guage and it was expelled gradually into labeled bijou bottle containing a speck of dried ethyldiamine tetracetic acid (EDTA) powder. The bottles were immediately capped and the contents were mixed gently for about a minute by repeated inversion.

**RESULTS**

The results of the main and interactive effects of feeding sorghum as a replacement for maize with or without enzyme supplementation on haematological parameters of rabbits is presented in Table 1. Packed cell volume PCV was higher ($P<0.05$) and comparable in 50 and 75% but reduced ($P<0.05$) in 0 (control) and 25 % sorghum levels of inclusion, sorghum levels. Values of RBC were higher ($P<0.05$) on control but comparable in 50 and 100 % sorghum levels of inclusion but reduced ($P<0.05$) in 50 and 75 % sorghum levels of inclusion. The values of MCH were higher ($P<0.05$) in the 25, 50 and 75 % sorghum levels compared to control. Neutrophil level in the blood was higher ($P<0.05$) and comparable in control and 75 %, but reduced in 25, 50 and 100 % sorghum levels. Eosinophil was higher ($P<0.05$) and comparable in 25 and 100 % sorghum levels, but reduced in control, 50 and 75 % sorghum levels. Monocyte levels were comparable in control, 25, 50 and 100 % sorghum levels with less values obtained in 75 % sorghum level compared 100 % sorghum. Table 3 presented main and interactive effects of feeding sorghum as a replacement for maize with or without enzyme supplementation on serum parameters of rabbits. All serum indices measured were not significantly ($P>0.05$) affected by enzyme supplementation

**Table 2: Effect of Feeding Sorghum and Sorghum with Enzyme on Haematological parameters on Rabbits**

| Parameter | Levels of Sorghum | | | | | | Levels of Enzyme | | |
|---|---|---|---|---|---|---|---|---|---|
| | Control | 25 | 50 | 75 | 100 | SEM | 0 | + | SEM |
| PCV (%) | $37.75^{b}$ | $37.50^{b}$ | $38.13^{ab}$ | $38.25^{ab}$ | $39.75^{a}$ | 0.29 | 38.10 | 38.45 | 0.29 |
| RBC ($x10^{12/lt}$) | $4.75^{a}$ | $4.43^{ab}$ | $4.24^{b}$ | $4.18^{b}$ | $4.59^{ab}$ | 0.07 | 4.36 | 4.52 | 0.07 |
| WBC ($x10^{9/lt}$) | 3.63 | 3.56 | 3.46 | 3.30 | 3.63 | 0.04 | 3.50 | 3.54 | 0.05 |
| HB (g/dlt) | 12.60 | 12.63 | 12.69 | 12.79 | 13.11 | 0.07 | 12.69 | 12.84 | 0.08 |
| MCV (fLt) | 80.23 | 86.08 | 83.61 | 84.84 | 82.89 | 1.05 | 83.44 | 83.62 | 1.04 |
| MCH (pg) | $26.58^{b}$ | $28.99^{a}$ | $28.54^{a}$ | $28.59^{a}$ | $28.16^{ab}$ | 0.29 | 28.24 | 28.11 | 0.28 |
| NEUTROPHIL (%) | $33.50^{ab}$ | $31.13^{bc}$ | $30.25^{c}$ | $34.25^{a}$ | $31.25^{bc}$ | 0.48 | 32.05 | 32.10 | 0.48 |
| EOSINOPHIL (%) | $1.75^{b}$ | $2.38^{ab}$ | $1.88^{b}$ | $1.16^{b}$ | $3.13^{a}$ | 0.20 | 1.90 | 2.20 | 0.20 |
| MONOCYTE (%) | $3.25^{ab}$ | $3.13^{ab}$ | $3.13^{ab}$ | $2.00^{b}$ | $3.50^{a}$ | 0.19 | 3.00 | 3.00 | 0.19 |

*$^{abcd}$=Means on the same row having different superscripts significantly ($P<0.05$) different. SEM= Standard error of mean. PCV=Pack cell volume; RBC=Red blood cell count; WBC=White blood cell count; MCV=Mean corpuscular volume; MCH= Mean corpuscular haemoglobin. Enzyme= Enzyblend ® 0.05g 0 = no enzyme mean value + = enzyme supplementation mean value.*

in experimental diets. For the levels of sorghum, albumin, globulin, creatinine and cholesterol were significant (P<0.05) across the different levels of sorghum replacement. Albumin was higher (P<0.05) in 75 % with least value observed in 0 % (control) sorghum inclusion. Comparable albumin concentration was observed in 25, 50 and 100 % sorghum replacement. Globulin was higher (P<0.05) in 100 % sorghum replacement and least (P<0.05) in 0 % sorghum replacement (control). Other levels of sorghum inclusion had comparable globulin values. Creatinine values were comparable in 0, 25 and 75 % sorghum levels. However, creatinine level was less (P<0.05) in 50 and 100 % sorghum levels compared to control. Cholesterol levels were also comparable in 0, 50 and 100 % sorghum inclusion. This was however less (P<0.05) in 25 and 75 % sorghum levels compared to 50 % sorghum replacement.

All serum indices measured were not significantly (P>0.05) affected by enzyme supplementation in experimental diets. For the levels of sorghum, albumin, globulin, creatinine and cholesterol were significant (P<0.05) across the different levels of sorghum replacement (Table 2). Albumin was higher (P<0.05) in 75 % with least value observed in 0 % (control) sorghum inclusion. Comparable albumin concentration was observed in 25, 50 and 100 % sorghum replacement. Globulin was higher (P<0.05) in 100 % sorghum replacement and least (P<0.05) in 0 % sorghum replacement (control). Other levels of sorghum inclusion had comparable globulin values. Creatinine values were comparable in 0, 25 and 75 % sorghum levels. However, creatinine level was less (P<0.05) in 50 and 100 % sorghum levels compared to control. Cholesterol levels were also comparable in 0, 50 and 100 % sorghum inclusion. This was however less (P<0.05) in 25 and 75 % sorghum levels compared to 50 % sorghum replacement.

**Table 3: Effect Between Feeding Sorghum and Enzyme on Serum Biochemical Indices**

| Parameter | Levels of Sorghum | | | | | | Levels of Enzyme | | |
|---|---|---|---|---|---|---|---|---|---|
| | Control | 25 | 50 | 75 | 100 | SEM | 0 | + | SEM |
| T. protein (g/dlt) | 5.68 | 6.51 | 6.69 | 6.81 | 6.89 | 0.17 | 6.63 | 6.41 | 0.11 |
| Albumin (g/dlt) | $3.85^{c}$ | $4.03^{b}$ | $4.02^{b}$ | $4.20^{a}$ | $4.01^{b}$ | 0.05 | 4.05 | 4.00 | 0.03 |
| Globulin (g/dlt) | $1.80^{c}$ | $2.53^{b}$ | $2.73^{b}$ | $2.78^{b}$ | $3.24^{a}$ | 0.16 | 2.64 | 2.59 | 0.10 |
| Uric acid (mg/dlt) | 5.98 | 5.19 | 5.46 | 5.69 | 5.66 | 0.29 | 5.50 | 5.69 | 0.18 |
| Creatinine (mg/dlt) | $0.93^{a}$ | $0.90^{ab}$ | $0.82^{bc}$ | $0.90^{ab}$ | $0.77^{b}$ | 0.03 | 0.86 | 0.87 | 0.02 |
| Cholesterol(mg/dlt) | $103.76^{ab}$ | $88.49^{b}$ | $118.96^{a}$ | $97.48^{b}$ | $105.13^{ab}$ | 6.67 | 103.41 | 102.13 | 4.22 |

*$^{abcd}$=Means on the same row having different superscripts significantly (P<0.05) different. SEM= Standard error of mean. Enzyme= Enzyblend ® 0.05 g. 0 =No enzyme mean value + = Enzyme supplementation mean value*

## DISCUSSION

There were significantly different values of PCV, RBC, WBC, Hb, neutrophil and eosinophil across the various replacement levels of sorghum and its interaction with enzymes, the values were within the normal range for a healthy growing rabbit agreed with the findings of (Ikhimioya *et al.,* 2000). According to Cary *et al.* (2002), PCV within normal values is a reflection of adequate protein and energy required for functioning by the animals for improved rabbit performance. Although not significantly different, addition of enzyme to dietary levels of sorghum further improved PCV levels in the rabbits. Contrary to higher PCV at 100 % sorghum, a lower PCV was reported for rabbits on sorghum offal based diets (Ogunsipe *et al*., 2017). The values recorded for PCV in this study were close to 31.93-41.90 % reported by Audu *et al.* (2018), and higher than 26.28 % reported by Oguntoye *et al.* (2012) fed sorghum based diets supplemented with enzymes. The normal values of Hb obtained in this study explains that dietary sorghum supported the relationship of haemoglobin with oxygen in the transport of gases (oxygen and carbon dioxide) to tissues of the body has been maintained and was normal (Njidda *et al.,* 2011). Significant differences

observed across treatment groups in the RBC and WBC (4.13 – 4.78 and 3.20 – 3.75×$10^{9/l}$) is in agreement with the normal ranged of 4.11 – 4.80 and 3.10-3.63 reported by Ojebiyi *et al.* (2013). Thus, the feeding of sorghum in place of maize produced adequate exchange of oxygen and carbon dioxide from tissue / lungs and providing defensive mechanism to combat infection. White blood cell (WBC) lower than the normal ranged indicates a greater challenge to the immune system and also suggests a decline in the production of defensive mechanism to combat infection (Eheba *et al*., 2008; Etim *et al*., 2014). The normal RBC values indicate that rabbits have normocytic and normochromic red cells (Aderemi and Wuraola, 2010). This explains that feeding sorghum in diets up to 100 % inclusion does not affect the utilization of iron. Non-significant values of MCV, MCH and monocytes across the treatment groups is in agreement with report of Audu *et al.* (2018) and also comparable to the values obtained by Campbell (2017).

Results of serum biochemical parameters were similar with the control diet which implied that, varying graded levels of sorghum replacement for maize with and without enzyme can be used with confidence in rabbit's diets to provide adequate nutrition. However improved albumin and globulin in sorghum based diets compared to control diet is proving of better nutritional quality, good amino acid balance and possibly a no case of muscle degeneration (Sola *et al.,* 2013). This implies the quality and higher amount of protein in sorghum compared to maize, as Ogbonna (1991) reported that a positive correlation exists between dietary protein and serum protein. Although significant differences were observed in albumin and globulin across the treatments, they were within the normal ranged of 5.00 – 8.00 g/dl report by Sola *et al.* (2013) which is not only indicative of high quality protein in the diets but also a reflection of protein reserved in the animal's bodies as reported by Anyaehie and Madubuike (2007). Urea level in the body is known to be a function of protein quality (Etim and Oguike, 2011). The range of 4.55 – 6.08 mg/dl for uric acid concentration in this study fell below the values for clinically healthy rabbits reported by Audu *et al.* (2018) fed rabbits with varying levels of *Ficussy comorus* and *Parkia biglobosa* leaf meals and Henry *et al.* (2017) fed weaned rabbits with pawpaw leaves as feed supplements, but similar to 4.00 – 7.05 mg/dl reported by Oguntoye *et al.* (2017) who fed grower rabbits with sorghum based diets supplemented with enzymes and environmental condition. Rabbits fed 100 % SGL diet without enzyme had a significantly ($P< 0.5$) higher value of 6.08 mg/dl for uric acid compared to other dietary groups as high level of urea is an indication of excess nitrogenous waste due to protein deamination (Oguntoye *et al.,* 2017). The normal values of total protein, albumin, globulin, uric acid and creatinine obtained in this study indicated that there was no negative interaction between the SGL and enzyme in the diets.

## CONCLUSION AND RECOMMENDATION

From the result obtained, it can be concluded that;

i. Sorghum is good alternate feedstuff in replacing maize as energy source in diet of growing rabbits
ii. Feeding sorghum to rabbits at 100 % did not adversely affect the physiological function of the rabbits as all blood profile values across the treatment groups were within the normal range. The interaction between sorghum and enzyme supplementation in the diet did not further improve the physiology of the animals.
iii. Based on the **CONCLUSION** drawn from the study, 100 % sorghum level replacement is therefore recommending 100 % sorghum inclusion level without any deleterious effect

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