# EFFECTS OF TIGER NUT OFFAL MEAL-BASED DIETS SUPPLEMENTED WITH KINGZYME® ENZYME ON HAEMATOLOGICAL INDICES OF GROWER RABBITS

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## ABSTRACT
A six week feeding trial was conducted to investigate the effect of tiger nut offal meal based diet supplemented with Kingzyme enzyme on haematological indices of grower rabbits. A total of 48 weaned composite rabbits of similar live weight were randomly allotted to the experimental diets in a 2x3–factorial arrangement fitted into Complete Randomized Design (CRD) which was replicated 4 times having 2 rabbits per replicate. Six experimental diets were formulated to be isocaloric (2500kcal/kg) and isonitrogenous (15% crude protein) with tiger nut offal meal levels of 0, 50 and 100% and two levels of Kingzyme 0ppm and 200ppm. The rabbits were reared in an open-sided hutches, fed with weighed amount of experimental diets and watered at all time. Other standard routine management practices were strictly observed throughout the experimental period. The result showed significant (P<0.05) increase in the red blood cell for rabbits fed on 50% TNO ($6.70x10^{9}$) than 0%TNO ($4.59\ x10^{9}$). Kingzyme supplementation significantly increased (P<0.05) white blood cell. Thus, indicated that rabbits fed on 200ppm enzyme supplementation had higher white blood cell ($10.63x10^{12}$) than 0ppm enzymes ($6.81\ x10^{12}$). The interactive effects of TNO and enzyme (T4) showed significant (P<0.05) increased in the level of red blood cell ($7.75\ x10^{9}$) and white blood cell ($13.90\ x10^{12}$) respectively. It is therefore, concluded from this experiment that rabbits could tolerate 50% tiger nut offal meal based diet supplemented with 200ppm Kingzyme enzyme in their diets. This suggest an increased immunity against disease by the grower rabbits.
**Keywords:** Haematology, Kingzyme®, Rabbits, Tigernut offal meal, Immunity

## INTRODUCTION
Rabbit as monogastric animal has several characteristics that qualify its production both at large and small scale levels. Among these features are small body size, rapid growth, high reproduction potential, short generation time, production of high quality meat, good potential for genetic improvement, ability to utilize non-competitive feeds among others (Oloruntola *et al*., 2015). Non-conventional feed resources from agro-industrial based are cheaply, easily and underutilized as feed (Tuleun *et al.,* 2005). These feed ingredients offer the best alternatives for reducing feed cost and therefore a reduction in the cost of meat thereby making animal protein available to Nigerian populace (Dafwang *et al.,* 2001). Among these feed ingredients is tiger nut offal. According to Sánchez-Zapata (2012) tiger nut (*Cyperus esculentus*) is an underutilized crop of the family Cyperceae, that produce rhizomes from the based and tubers which contain soluble glucose of about 21%. It has been reported by Bamishaiye (2009) that tiger nut was cultivated for its nutritive edible nuts and it is rich in vitamin E and C. The offal was believed to have gotten from local kunun aya (Tiger nut milk) processors. It has been underutilized and thrown waste causing environmental pollution within town and villages. Enzymes supplementation in livestock feed has positively improved feed intake, growth performance, reduction of anti-nutrients found in feed ingredient and total well-being of the animal (Alu *et al*., 2018). Therefore, the aim of this study was to investigate the effect of feeding Tiger nut offal meal based diets and Kingzyme on haematological indices of growing rabbits.

## MATERIALS AND METHODS
### Experimental site
This experiment was conducted at the Teaching and Research Farm of Animal Science Department of the Faculty of Agriculture, Nasarawa State University Keffi, Shabu-Lafia Campus.

**Source of feed ingredients**

Tiger nut offal was sourced from the local kunun Aya processors within Keffi and Lafia Local Government Area of Nasarawa State and sun- dried for 2-3 days under natural condition while other ingredients and enzymes were purchased from a registered dealer of animal feed ingredients.

**Experimental rabbits and management**

Forty eight (48) grower rabbits of the same age and similar live weight were purchased from National Animal Production Research institute NAPRI and reared in an open- sided mesh rabbit hutches at the rabbits unit. They were randomly assigned to a six dietary treatments with four replicates in each and 2 rabbits per replicate (incorporating Tiger nut offal meal and enzymes in a 3 x 2 factorial design). Each hutch was equipped with feeders and drinkers. Rabbit were fed with weighed amount of the experimental diets *ad-libitum* and drinking water supplied. Other routine management practices were observed.

**Proximate analysis of Tiger nut offal:** Proximate composition of the experimental test ingredient were determined using the procedure outlined by AOAC (2010) and the results are presented in Table 1.

**Table 1**: **Proximate composition and fibre fractions of Tiger nut offal**

| **Parameters** | **(%)** |
|---|---|
| Crude protein | 9.43 |
| Crude fibre | 6.77 |
| Ether extract | 3.54 |
| Ash | 2.88 |
| Moisture | 11.95 |
| *[2]Carbohydrate | 72.20 |
| *[2]Nitrogen free extract | 65.43 |
| *[2]Dry matter | 88.05 |
| *[1]Metabolizable energy (kcal/kg) | 2905.243 |

*[1]Pauzanga (1985) and *[2]AOAC (2010)

**Experimental diets and composition:** Six experimental diets were formulated to be isocaloric (2500kcal/kg) and isonitrogenous (15% crude protein) for the grower rabbits with three levels inclusion of the tiger nut offal meal (0, 50 and 100%) and two levels inclusion of exogenous enzymes (0, 200ppm Kingzyme) as presented in Table 2.

**Hematological Indices**

At the end of the experiment, blood samples were collected into bottles containing anti- coagulant: Ethylene diamine tetraacetic Acid (EDTA) as reported by Jain (1993) for hematological indices analysis.

**Statistical analysis**

All data collected were subjected to analysis of variance (ANOVA) for factorial experiment using (SPSS, 2007) Model. Significantly different means were separated using Duncan's Multiple Range Test (Duncan, 1955).

**RESULTS AND DISCUSSIONs**

The results for the main and interactive effect of tiger nut offal meal and enzymes on haematology were shown in Table 3. The result showed significant increased ($P<0.05$) level of red blood cell, for rabbits fed on 50% ($6.70 \times 10^9$) and 100% ($4.59 \times 10^9$) TNO than 0%TNO ($4.58 \times 10^9$) rabbits. This is an indication that TNO supplied more energy for normal physiological activities. This observation is at divergence with the previous report of Alagbe (2017) who investigated effects of feeding varying levels of Tiger nut seed meal on the performance and blood profile of weaner grass cutters and reported that PCV, Hb, WBC, RBC, MCHC, MCV and MCH were not significantly affected by the inclusion of Tiger nut meal. Kingzyme® supplementation on haematology showed significant ($P<0.05$) increase level of white blood cell ($10.63 \times 10^{12}$) for rabbits fed on 200ppm enzyme supplementation than rabbits fed on 0ppm enzymes ($6.81 \times 10^{12}$). This was an indication that rabbits fed 200ppm might develop immunity against diseases than 0ppm rabbits. Tiger nut offal meal and Kingzyme® supplementation interaction on haematology showed significant ($P<0.05$) increased in the level of red blood cell, white blood cell $7.75 \times 10^9$ and $13.90 \times 10^{12}$ for rabbits fed on 50%TNO and

200ppm enzyme respectively. This suggest an increased immunity against disease by the grower rabbits.

**Table 2**: **Ingredients composition of the experimental diets for grower rabbits**

| **Ingredients (%)** | **T1** (0%TNO +0ppm) | **T2** (0%TNO +200ppm) | **T3** (50%TNO +0ppm) | **T4** (50%TNO +200ppm) | **T5** (100%TNO +0ppm) | **T6** (100%TNO +200ppm) |
|---|---|---|---|---|---|---|
| Maize | 30.00 | 30.00 | 15.00 | 15.00 | 0.00 | 0.00 |
| TNO* | 0.00 | 0.00 | 15.00 | 15.00 | 30.00 | 30.00 |
| Maize offal | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 |
| GNC | 10.75 | 10.75 | 10.75 | 10.75 | 10.75 | 10.75 |
| Rice offal | 24.00 | 24.00 | 24.00 | 24.00 | 24.00 | 24.00 |
| Bone meal | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Full fat soya | 11.00 | 11.00 | 11.00 | 11.00 | 11.00 | 11.00 |
| palm oil | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Fish meal | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Common salt | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Premix | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Methionine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Lysine | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| Toxin binder | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| **Total** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** | **100.00** |
| Enzymes(ppm) | 0.00 | 200.00 | 0.00 | 200.00 | 0.00 | 200.00 |
| ***Calculated Analysis*** | | | | | | |
| ME Kcal/Kg | 2586.82 | 2586.82 | 2506.16 | 2506.16 | 2425.49 | 2425.49 |
| Crude Protein | 16.24 | 16.24 | 16.32 | 16.32 | 16.40 | 16.40 |
| Lysine | 1.01 | 1.01 | 1.13 | 1.13 | 1.25 | 1.25 |
| Methionine | 0.53 | 0.53 | 0.69 | 0.69 | 0.85 | 0.85 |
| Ether Extract | 8.75 | 8.75 | 8.71 | 8.71 | 8.67 | 8.67 |
| Crude Fibre | 12.83 | 12.83 | 13.54 | 13.54 | 14.26 | 14.26 |
| Calcium | 1.14 | 1.14 | 1.16 | 1.16 | 1.19 | 1.19 |
| Phosphorus | 0.54 | 0.54 | 0.56 | 0.56 | 0.59 | 0.59 |
| Ash | 5.76 | 5.76 | 5.99 | 5.99 | 6.23 | 6.23 |

*TNO tiger nut offal inclusion levels.

**Table 3. Main and interactive effect of Tiger nut offal meal and Kingzyme® supplementation on haematology of grower rabbits.**

| **Factors** | | **Parameters** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Paked cell volume (%) | Haemoglobin (g/dl) | Red blood cell ($x10^9$) | White blood cell ($x10^{12}$) | MCV (fl) | MCH (g/dl) | MCHC (g/dl) |
| ***TNO** | 0% | 34.00 | 11.08 | $4.58^b$ | 8.78 | 23.95 | 33.58 | 71.25 |
| | 50% | 37.25 | 12.35 | $6.70^a$ | 9.38 | 24.00 | 32.65 | 66.25 |
| | 100% | 33.75 | 11.03 | $4.59^b$ | 7.35 | 23.55 | 32.05 | 71.75 |
| | SEM | 2.85 | 0.88 | 0.41 | 0.84 | 1.33 | 0.87 | 1.95 |
| | LOS | NS | NS | ** | NS | NS | NS | NS |
| **Enzyme** | 0ppm | 36.25 | 11.91 | 5.11 | $6.81^b$ | 23.30 | 33.39 | 68.13 |
| | 200ppm | 34.88 | 11.49 | 6.17 | $10.63^a$ | 24.45 | 32.08 | 69.63 |
| | SEM | 2.47 | 0.77 | 0.35 | 0.73 | 1.15 | 0.75 | 1.69 |
| | LOS | NS | NS | NS | ** | NS | NS | NS |
| **Interactions** | T1 | 31.00 | 10.20 | $4.25^b$ | $8.60^b$ | 23.05 | 32.35 | 73.50 |
| | T2 | 37.00 | 11.95 | $4.90^b$ | $8.95^b$ | 24.85 | 34.80 | 69.00 |
| | T3 | 38.50 | 12.75 | $5.65^b$ | $4.85^c$ | 22.65 | 33.20 | 65.00 |
| | T4 | 36.00 | 11.95 | $7.75^a$ | $13.90^a$ | 25.35 | 32.10 | 67.50 |
| | T5 | 35.50 | 11.70 | $4.95^b$ | $7.20^b$ | 22.55 | 31.50 | 71.00 |
| | T6 | 32.00 | 10.35 | $4.24^b$ | $7.50^b$ | 24.55 | 32.60 | 72.50 |
| | SEM | 1.49 | 0.48 | 0.40 | 0.93 | 0.69 | 0.48 | 1.24 |
| | LOS | NS | NS | ** | ** | NS | NS | NS |

TNO= Tiger nut offal; SEM= Standard error means, NS= No significant (P>0.05), LOS= Level of significant, a, b c= Means on the same row bearing different superscript differ significantly (P<0.05).

This is in conformity with El-Kelawy *et al.* (2016) who investigated the impact of dietary supplementation with multi enzyme and/or probiotic on growth performance, nutrients digestibility and blood constituents of growing rabbits and reported that all blood biochemical and hematological parameters were within the normal physiological range and suggested that addition of Kemzyme and Actisaf are good growth stimulators to the growing rabbits and can be added together to the commercial diet to improve feed utilization and growth performance without any adverse effects on health status of rabbits.

## CONCLUSION AND RECOMMENDATION

This study has demonstrated that rabbits could tolerate 50% Tiger nut offal meals inclusion supplemented with 200ppm kingzyme in their diet without negatively affecting their haematological indices evaluated.

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