# HAEMATO-BIOCHEMICAL RESPONSE OF GROWING RABBITS FED BOILED AFRICAN STAR APPLE (*CHRYSOPHYLLUM ALBIDUM*) KERNEL MEAL AS REPLACEMENT FOR MAIZE IN THE DIET

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## ABSTRACT:

*The effect of dietary boiled African star apple kernel meal (BASAKM) as substitute for dietary maize on haemato-biochemical indices of growing rabbits were investigated. Seventy five 35-d old crossbreed (New Zealand x California white) rabbits weighing 591.00±0.15 g were allotted to 5 treatments (15 rabbits per treatment; 5 rabbits per replicate) in a completely randomized design. Five experimental diets (pelleted; 3 mm diameter and 6 mm in length) were formulated such that BASAKM replaced dietary maize at 0 %, 25 %, 50 %, 75 % and 100 % in rabbit diets (Diets 1, 2, 3, 4 and 5, respectively). A control diet (diet 1) had crude protein: 17 %, crude fibre: 10.35 %, metabolizable energy: 2647.50 kcal/kg. The study lasted for 56-d. At 91 d of age, the neutrophil level of rabbits fed diets 2, 3 and 4 decreased significantly compared to those fed the control diet (-5.20 %, -3.65 % and -9.69 %, respectively; P=0.0384. Results indicate that growing rabbits could tolerate BASAKM in their diets without adverse effect on haemato-biochemical indices of growing rabbits.*

**Key words:** African star apple, Kernels, Maize, Boiling, Rabbits, haemato-biochemical

## INTRODUCTION

The inclusion of alternative feedstuffs in animal diets might be interesting in some circumstances (relative price, feed quality), but it is limited because of the lack of information on their nutritive value. This is the case with African star apple (*Chrysophyllum albidum*) kernel meal, a by-product generated after the consumption of the fruits. African star apple (*Chrysophyllum albidum*) popularly called "Agbalumo" among the Yoruba tribe of Western Nigeria is also known as "Agwaluma" and "Udara" in Hausa and Igbo languages respectively. It is primarily cultivated for its sweet fleshy fruits which had been reported as an excellent source of vitamin C, iron, thickener or jam and flavours to diets, and raw materials to some manufacturing industries such as resin (Adisa and Fajola, 2000). Star apple belongs to the *Sapotacae* family and is believed to have originated from the low-lands of Central America and West Indian. It is common in both urban and rural centres in Nigeria especially during the months of December through April. The ripe fruit is highly perishable, and deteriorate within five days of harvest (Adisa and Fajola, 2000). Several researchers (Agbabiaka *et al.*, 2013; Makinde *et al*., 2017) have reported on the nutritional and medicinal importance of *Chrysophyllum albidum*. Apart from the report of Jimoh *et al.* (2014) on haematological changes in the blood of *Clarias gariepinus* fed *Chrysophyllum albidum* seed meal as energy source, there is dearth of information on the potential of African star apple seeds/kernels as alternative feed source. Therefore, this present paper reports experiment designed to investigate the haemato-biochemical indices of growing rabbits fed different levels of boiled African star apple kernel meal diets.

## MATERIALS AND METHODS

### Study site

The experiment was conducted from October to December, 2016 at the Rabbitry Unit of the Teaching and Research Farm of the School of Agriculture and Agricultural Technology, Federal University of Technology, Gidan Kwano Campus (Permanent site), Minna, Niger State.

**Experimental feed, design, animals and their management**

The African star apple kernels used for this study were sourced from African star apple fruit farmers in Osogbo, Osun State. African star apple seeds are always available between December and April. The seeds were gathered, washed with water to clean the dirts, allowed to dry under the shed for 7 d and carefully crushed with palm kernel machine so as to separate the kernel from the seed coat. Then, dried African star apple kernel was subjected to boiling at 100 °C for 15 minutes at the rate 1 kg kernel to 5 litre of water (Jimoh *et al*., 2014) after which water was drained off by means of 10 mm sieve and the boiled kernels were air dried under the shed for 7 d, milled using hammer mill with a sieve size of 3 mm and analysed in the laboratory.

Five experimental diets (diets 1, 2, 3, 4 and 5) were formulated to support optimal rabbit growth (de Blas and Mateos, 2010) as shown in Table 1. Diets 1 to 5 contained 0 %, 25 %, 50 %, 75 % and 100 % BASAKM, respectively as substitute for dietary maize. The diets were pelleted to 3 mm diameter and 6 mm in length and then analysed for chemical composition (Table 1). Seventy five 35-d old crossbred (New Zealand x California white) weaner rabbits of equal sexes weighing 591.00±0.15 g, certified healthy by a veterinarian, were allotted to 5 dietary treatments (15 rabbits per treatment; 5 rabbits per replicate) in a completely randomized design. The rabbits were housed in wire meshed cages, accommodated in a well-ventilated pen, supplied water and experimental diets *ad libitum* and the pen was cleaned and disinfected daily for 56 d which the study lasted.

**Table 1: Gross Composition of Experimental Diets (%)**

| | **Control** | **Replacement levels of boiled ASAKM** | | | |
|---|---|---|---|---|---|
| | Diet 1 | Diet 2 | Diet 3 | Diet 4 | Diet 5 |
| **Ingredients (%)** | 0% | 25% | 50% | 75% | 100% |
| **Maize** | 40.00 | 30.00 | 20.00 | 10.00 | 00.00 |
| ***Boiled ASAKM** | 00.00 | 10.00 | 20.00 | 30.00 | 40.00 |
| **Maize offal** | 25.00 | 25.00 | 25.00 | 25.00 | 25.00 |
| **Soyabean meal** | 12.00 | 12.00 | 12.00 | 12.00 | 12.00 |
| **Fish meal** | 1.20 | 1.20 | 1.20 | 1.20 | 1.20 |
| **Groundnut cake** | 18.00 | 18.00 | 18.00 | 18.00 | 18.00 |
| **Limestone** | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| **Bonemeal** | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| **Salt** | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| ****Premix** | 0.30 | 0.30 | 0.30 | 0.30 | 0.30 |
| **Methionine** | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| **Lysine** | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| **Total** | 100 | 100 | 100 | 100 | 100 |
| **Chemical composition (%)** | | | | | |
| **Dry matter** | 91.61 | 93.70 | 91.51 | 93.90 | 92.12 |
| **Crude protein** | 15.70 | 16.42 | 16.03 | 16.18 | 15.33 |
| **Ether extract** | 4.00 | 5.15 | 5.06 | 4.25 | 4.75 |
| **Ash** | 3.81 | 3.64 | 4.29 | 3.46 | 3.66 |
| **Digestible energy (Kcal/kg)** | 2701.44 | 2689.64 | 2687.65 | 2714.44 | 2691.17 |

*Boiled ASAKM=African star apple kernel meal. **Premix in diets provided per kg: Vit. A 10000 IU, Vit. B 2000 IU, Vit. E 13000 IU, Vit. K 1500mg, Vit. B12 10mg, Riboflavin 5000mg, Pyridoxine 1300mg, Thiamine 1300mg, Panthothenic acid 8000mg, Nicotinic acid 28000mg, Folic acid 500mg, Biotin 40mg, Copper 7000mg, Manganese 48000mg, Iron 58000mg, Zinc 58000mg, Selenium 120mg, Iodine 60mg, Cobalt 300mg, Choline 27500mg.

**Data collection**

Blood samples were collected from 9 rabbits per group at 91 d of age for determination of haemato-biochemical indices. The selected rabbits were fasted overnight before blood collection. About 5 mL of blood were collected from the prominent ear vein of the rabbits using a ten gauge hyposeranic needles. Two millilitres of blood sample was collected into labelled sterile bottles containing ethylenediamine tetraacetic acid (EDTA) as anti-coagulant for the determination of haematological parameters, while the remaining 3 mL blood sample for serum analysis was collected into anticoagulant-free bottles, allowed to clot at room temperature and centrifuged at 3000 rpm for 10 min. The supernatant sera were harvested and stored at 4 °C in a refrigerator for subsequent biochemical analysis (Coles,1986). The analyses were carried out at the General Hospital Laboratory, Minna.

**Statistical analysis**

Data were subjected to analysis of variance in a completely randomized design using SAS software (SAS Institute, 2015, Version 9.3). Significant difference between individual means was highlighted by Duncan's procedure of the same software. Mean differences were considered significant at $P<0.05$

**RESULTS**

The results of the effect of boiled African star apple kernel meal on haematological parameters of growing rabbits at 91 d of age are presented in Table 2. There were no significant differences ($P>0.05$) in all the parameters measured except neutrophil. The neutrophil level of rabbits fed diets 2, 3 and 4 decreased significantly compared to those fed the control diet (-5.20 %, -3.65 % and -9.69 %, respectively; *P=0.0384*).

Table 3 shows the results of the effect of boiled African star apple kernel meal on serum biochemistry of growing rabbits at 91 d of age. There were no significant differences ($P>0.05$) in all the serum parameters analysed. Albumin, globulin, total protein, glucose, cholesterol, triglyceride and urea were not influenced ($P>0.05$) by the dietary treatments.

**Table 2: Effect of Boiled African star apple kernel meal on haematological parameters of growing rabbits**

| Parameters | Diet 1 | Diet 2 | Diet 3 | Diet 4 | Diet 5 | SEM | *P-value* |
|---|---|---|---|---|---|---|---|
| No. of rabbits | 9 | 9 | 9 | 9 | 9 | | |
| White blood cell (x $10^3$/$mm^3$) | 9.24 | 10.67 | 8.75 | 7.61 | 9.37 | 0.39 | 0.0938 |
| Red blood cell, (x $10^6$/$mm^3$) | 5.41 | 5.27 | 4.93 | 5.46 | 5.62 | 0.25 | 0.8343 |
| Haemoglobin (g/dl) | 10.42 | 10.75 | 10.62 | 10.55 | 10.39 | 0.21 | 0.9515 |
| Packed cell volume (%) | 31.34 | 31.45 | 32.67 | 31.67 | 31.15 | 0.28 | 0.2828 |
| Basophil (pg) | 1.98 | 1.29 | 1.48 | 1.34 | 1.67 | 0.15 | 0.4088 |
| Neutrophil (%) | $46.93^a$ | $41.73^b$ | $43.28^b$ | $37.24^c$ | $48.72^a$ | 1.33 | 0.0384 |
| Monocyte (%) | 3.29 | 3.61 | 3.31 | 2.72 | 3.99 | 0.25 | 0.3599 |
| Lymphocyte (%) | 57.33 | 53.99 | 52.14 | 51.03 | 64.06 | 2.91 | 0.4187 |
| Mean corpuscular haemoglobin (pg) | 19.61 | 20.90 | 21.54 | 19.68 | 18.48 | 0.94 | 0.7117 |
| Mean corpuscular volume (fl) | 58.74 | 61.18 | 66.75 | 59.25 | 55.42 | 2.95 | 0.6295 |
| Mean corpuscular haemoglobin concentration (g/dl) | 33.25 | 34.21 | 32.58 | 33.32 | 33.38 | 0.76 | 0.9371 |

abc = means with different superscripts on the same row are significantly different ($P<0.05$), SEM= Standard error of mean, P = Probability value.

**Table 3: Effect of Boiled African star apple kernel meal on serum chemistry of growing rabbits**

| Parameters | Diet 1 | Diet 2 | Diet 3 | Diet 4 | Diet 5 | SEM | *P-value* |
|---|---|---|---|---|---|---|---|
| No. of rabbits | 9 | 9 | 9 | 9 | 9 | | |
| Albumin (g/dl) | 1.93 | 2.59 | 2.54 | 2.37 | 2.74 | 0.15 | 0.2946 |
| Globulin(g/dl) | 4.14 | 3.37 | 3.39 | 4.53 | 3.53 | 0.27 | 0.3552 |
| Total protein(g/dl) | 6.08 | 5.96 | 5.92 | 6.90 | 6.26 | 0.20 | 0.3136 |
| Glucose (mmol/L) | 3.06 | 2.44 | 3.01 | 2.54 | 1.95 | 0.32 | 0.6287 |
| Cholesterol (mmol/L) | 1.48 | 1.34 | 0.78 | 1.72 | 1.61 | 0.11 | 0.0514 |
| Triglyceride (mmol/L) | 1.31 | 2.20 | 1.32 | 1.97 | 1.21 | 0.19 | 0.1880 |
| Urea (mmol/L) | 2.20 | 3.21 | 3.02 | 2.85 | 2.79 | 0.24 | 0.5380 |

SEM= Standard error of mean, P = Probability value.

## DISCUSSION

The blood profiles have been used widely to establish the health status of animals particularly when they are subjected to dietary treatment that could affect their well being. Thus, Aro and Akinmoegun (2012) and Isaac *et al.* (2013) identified haemoglobin (Hb), PCV, WBC, RBC, MCH and MCHC among others as blood parameters that are useful in feed toxicity and feed quality monitoring and their effect on health status of the animals. In this study, only neutrophils was significant among the haematological parameters measured. The range of 37.24-48.72 % observed for neutrophil in this study is within the normal range reported by Mitruka and Rawnsley (1977) for growing rabbits. The non significant difference observed among most of the haematological parameters measured implies that the haematopoietic activity was enhanced identically by the dietary treatments and by extension the health status of the rabbit was not compromised by replacing maize with boiled African star apple kernel meal in the diets of growing rabbit. Thus, in most cases the blood parameters reported here falls within the ranges reported by Latimer *et al.* (2003) and Ibrahim *et al.* (2014).

## CONCLUSION

The result obtained from this study showed that boiled African star apple kernel meal can be considered as a high energy source in place of maize and growing rabbits could tolerate BASAKM in their diets without impairing the haemato-biochemical indices of the animals.

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