EFFECT OF FERMENTED AFRICAN STAR APPLE (*Chrysophyllum albidum*) KERNEL MEAL ON PERFORMANCE OF GROWING RABBITS

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ABSTRACT

The effect of fermented African star apple kernel meal (FASAKM) as substitute for maize on performance of growing rabbits was investigated. A total of forty eight weaner rabbits (mixed breed, average weight, and 590 g) were randomly allocated to four experimental diets containing 0, 5, 10 and 15 % FASAKM as substitute for dietary maize in a study that lasted for 12 weeks. The results showed that FASAKM influenced ($P<0.05$) average daily weight gain, feed conversion ratio, protein efficiency ratio, energy efficiency ratio and % mortality. Rabbits fed 0 % and 5 % FASAKM diets gained weight (16.24 g and 15.16 g) faster than those fed 10 % and 15 % FASAKM diets (11.42 g and 11.17 g). Feed conversion ratio was better for rabbits fed 0 % and 5 % FASAKM diets. It was concluded that FASAKM could be used up to 5 % to replace dietary maize in the diet of growing rabbits without compromising performance characteristics of the rabbits.
Key words: African star apple, kernels, nutrient, anti-nutrient, boiling, rabbits

INTRODUCTION

High cost feed ingredients for rabbit production in Nigeria has necessitated the search for alternative feedstuffs that are cheap and locally available. 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 (Edem and Miranda, 2011; Agbabiaka *et al*., 2013) 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 study was aimed at evaluating the effect of fermented African star apple (*Chrysophyllum albidum*) kernel meal on the performance of growing rabbits.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the Rabbitry Unit of the Teaching and Research Farm of the School of Agriculture and Agricultural Technology of the Federal University of Technology, Gidan Kwano Campus (Permanent site), Minna, Niger State. The area falls within the Southern Guinea Savannah Vegetation zone of Nigeria with annual rainfall of between 1100 and 1600 mm and temperature range between 21^0C to 36.5^0C (Climatemp, 2016). Minna experiences two distinct seasons (dry, from November to March and wet or rainy season, from April to October).

Experimental design and management of experimental animals

A total of forty eight (48) weaner rabbits of composite breeds and mixed sexes, aged between 5 and 6 weeks were procured from the rabbit section of National Animal Production Research Institute (NAPRI), Shika – Zaria, Kaduna State, Nigeria. They were randomly divided into four groups of twelve (12) rabbits per treatment with each treatment replicated thrice (4 rabbits per replicate) in a completely randomized design. The rabbits were housed according to treatments in a well-ventilated room in hutches. The hutches were fitted with drinkers and feeders. The rabbits were pre-conditioned for two weeks, during which they were treated twice (once a week) against parasitic infestation with Ivermectin (0.5 ml) subcutaneously. They were given feed and clean water *ad libitum* during the twelve (12) weeks experimental period.

Experimental diets

Four experimental diets were formulated and designated as T1, T2, T3 and T4. Diet T1 served as control diet while Diets T2, T3 and T4 contained 5, 10 and 15 % FASAKM as substitute for maize in rabbit diets as shown in Table 1. A known quantity of the diets was served twice daily at 8.00 am and 4.00 pm and supplemented with 10 g of *Tridax procumbens* per animal per day.

Table 1: Gross Composition of Experimental Diets

	Control	**Replacement levels of fermented ASAKM**		
Ingredients (%)	**0%**	**5%**	**10%**	**15%**
Maize	40.00	38.00	36.00	34.00
Fermented ASAKM	0.00	2.00	4.00	6.00
Maize offal	25.00	25.00	25.00	25.00
Rice offal	18.00	18.00	18.00	18.00
Soyabean meal	2.00	2.00	2.00	2.00
Fish meal	1.20	1.20	1.20	1.20
Groundnut cake	10.00	10.00	10.00	10.00
Limestone	1.00	1.00	1.00	1.00
Bonemeal	2.00	2.00	2.00	2.00
Salt	0.20	0.20	0.20	0.20
*Premix	0.30	0.30	0.30	0.30
Methionine	0.20	0.20	0.20	0.20
Lysine	0.10	0.10	0.10	0.10
Total	**100**	**100**	**100**	**100**
Calculated Nutrients				
Crude protein (%)	17.41	16.76	16.89	16.85
Energy (Kcal/kg ME)	2647.5	2600.0	2623.1	2604.0
Crude fibre (%)	10.35	10.01	10.18	10.05
Ether extract (%)	4.08	4.15	4.10	4.11

*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

Table 2: Nutrient and Anti-nutrient Compositions of Fermented African star apple kernels

Nutrients,%	Raw kernel	Fermented kernel
Dry matter	93.21	93.07
Crude Protein	12.03	8.08
Crude fibre	5.10	6.20
Ether extract	1.45	1.38
Ash	1.85	2.60
Nitrogen free extract	72.78	74.89
Gross energy (Kcal/100 g)	400.10	401.19
Metabolizable energy (Kcal/kg ME)	3147.23	3067.36
Saponin	5.00	2.02
Tannin	7.33	4.02
Oxalate	12.41	5.00
Phytate	10.06	3.33

Performance study

Rabbits were weighed individually at the beginning of the experiment and weekly thereafter for the duration of the experiment using weighing scale. Weighing was done before the morning feeding. The parameters determined for the evaluation of performance were initial weight (g), average feed intake (g), average weight gain (g) and feed conversion ratio. Weight gain for each animal was calculated by subtracting the initial weight (g) from the final weight (g), while the feed conversion ratio was calculated by dividing the average feed intake (g) by the average weight gain (g).

Chemical analysis

Proximate composition of roasted African star apple kernel and experimental diets were analysed using the methods described by AOAC (2006).

Statistical analysis

Data collected were subjected to analysis of Variance using SAS software (SAS, 2015) while significant means were separated with Duncan multiple range test at 5% level of significance.

RESULTS AND DISCUSSION

Table 2 shows the nutrient and anti-nutrient compositions of fermented African star apple kernels while Table 3 shows the result of the effect of fermented African star apple kernel meal on performance of growing rabbits. There were significant (P<0.05) differences in the daily weight gain, FCR, PER and EER of the rabbits. Daily weight gain and feed conversion ratio of rabbits fed 0 % and 5 % FASAKM diets were significantly (P<0.05) better than those fed 10 % and 15 % FASAKM diets. There was no significant (P>0.05) difference in the daily feed intake of rabbits. The depressed daily weight gain and poor FCR observed among rabbits fed 10 % and 15 % FASAKM could be due to the effect of anti-nutritional factors in the fermented kernels. Oxalates have been reported to form complexes with mineral particularly calcium thereby making them unavailable to the body, cause irritation of the gut and resulting in low feed intake, inhibit protein and energy utilisation in broilers (Okereke, 2012). Phytate impairs the utilization of protein and some minerals resulting in poor performance while tannins inhibits digestive enzymes and causes irritation of the gut. Not only does oxalate interfere with calcium absorption in the digestive tract, it also limits nitrogen retention (Hang and Binh, 2013). Rabbits fed 5 % FASAKM diet gained weight similar to those fed control diet. This is an indication that rabbits will tolerate up to 5 % FASAKM in their diets without adverse effect on the growth performance. Makinde *et al*. (2017) however reported that growing rabbits could tolerate up to 15 % boiled ASAKM in their diets without adverse effect on growth performance. The similarity observed in the average feed intake of rabbits across the treatment groups could be probably due to lack of variation in the nutrient content of the various diets fed. The results of this study revealed that 5 % FASAKM can be substituted for dietary maize in rabbit diet. Above this level, there appears to be a decrease in performance characteristics of the growing rabbits.

Table 3: Effect of fermented African star apple kernel meal on growth performance of growing rabbits

Levels, %	Initial weight, g	Final weight, g	Total weight gain, g	Daily weight gain, g	Daily feed intake, g	FCR	PER	EER
0	584.39	1948.60^{a}	1364.21^{a}	16.24^{a}	59.93	3.69^{a}	1.84^{a}	1.89^{a}
5	591.15	1864.25^{a}	1273.10^{a}	15.16^{a}	60.48	3.99^{a}	1.73^{a}	1.65^{b}
10	585.82	1545.28^{b}	959.46^{b}	11.42^{b}	62.05	5.50^{b}	1.35^{b}	1.47^{b}
15	592.46	1530.72^{b}	938.26^{b}	11.17^{b}	62.52	5.59^{b}	1.36^{b}	1.55^{b}
SEM	7.05	38.93	36.05	1.66	1.53	0.20	0.11	0.21
P-val	0.229	0.001	0.001	0.001	0.699	0.001	0.001	0.101
LOS	NS	**	**	**	NS	**	**	**

abc= means with different superscripts on the same column are significantly different (P<0.05*, P<0.01**), SEM= Standard error of mean, P = Probability value. LOS = Level of significant. NS = Not significant. FCR= feed conversion ratio. PER = Protein efficiency ratio. EER = Energy efficiency ratio

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