PERFORMANCE AND NUTRIENT DIGESTIBILITY OF FUNAAB ALPHA BROILER CHICKENS TO DIETS CONTAINING VARYING LEVELS OF ALLIGATOR PEPPER (*Aframomum melegueta*) SEED MEAL

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ABSTRACT
Alligator pepper (Aframomum melegueta) seed meal (APSM) was included in the diets of FUNAAB Alpha broiler chickens as a phytogenic feed additive to enhance performance and nutrient digestibility. One hundred and fifty (150) 1-day-old chicks were arranged in a Completely Randomized Design into five treatment groups, three replicates per treatment with ten birds per replicate. The birds were fed basal diet containing APSM at 0, 0.5, 1.0, 1.5 and 2.0 g/kg for 8 weeks. Data collected on feed intake (FI) and weight gain (WG) were used to calculate the feed conversion ratios (FCR). Data generated from the experiment were subjected to Analysis of Variance for a Completely Randomized Design using general linear model of SPSS, (2021). Significant means were separated using the Duncan's Multiple Range Test of SPSS software. The results showed that FI, WG, FCR and mortality record had no significant difference across the treatments, however, APSM significantly ($p<0.05$) influenced crude protein, crude fibre and ether extract digestibility. Dry matter digestibility was not significantly affected, but the values range from 83.11% to 84.07% in all APSM based diet and 80.38% in the control diets, ash availability was numerically affected by APSM with control group (T1) having the second least value (60.79%) while T5 diets had the least (52.81%). Gross energy was not significantly affected but the values were comparable across all treatment groups with the highest (89.96%) in T4 and the least (86.66%) in T3. The dietary inclusion of APSM at 1.0g/kg and 2.0g/kg (T3 and T5), was found to enhanced nutrient digestibility and therefore concluded most suitable for finisher FUNAAB Alpha broiler chicken.
Keywords: Alligator pepper, Broiler chickens, Performance, Nutrient digestibility, Seed meal.

INTRODUCTION

Digestibility is the fraction of feed that is not excreted in faeces and is assumed to be absorbed by an animal McDonald *et al*. (2011). In broiler chicken, nutrient digestibility is a measure of how effective a birds digestive system can breakdown feed and absorb its nutrients. It is influenced by multiple factors including feed composition, processing, environmental condition and bird physiology. Digestibility is an important factor in evaluating the nutritional value of animal feed as it measures the efficiency with which feed ingredients are broken down into absorbable forms.

The use of antibiotics in poultry production has been effective for improving growth performance and nutrient digestibility. However, concerns about antimicrobial resistance and regulatory restrictions have driven the search for natural alternatives like APSM, a phytogenic feed additive derived from the seeds of *Afromomum melegueta* which are rich in essential oils, alkaloids, flavonoids, tannins, saponins and phenolics. These bioactive compounds contribute to its antimicrobial, antioxidant, and anti-inflamatory properties (Adeola and Awesu, 2020) that enhance performance. APSM is a naturally occurring substance and it is unlikely to have any negative lingering effects, but can stimulate the secretion of digestive enzymes like amylase, lipase, and protease which can improve nutrient digestibility. Several studies have revealed the health benefits of spices such as APSM in the diets of broiler chickens, however its application in enhancing digestion is quite limited. Hence, the study aims to evaluate the performance and the nutrient digestibility of finisher FUNAAB alpha broiler chickens to diets containing varying levels of APSM.

MATERIALS AND METHODS

The study was carried out at the Poultry Unit of the Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta (FUNAAB), Ogun State, Nigeria. The area lies on latitude 7° 13'49.46N and longitude 3°26'11.98E, at 76m above sea level in a tropical rain forest vegetation zone with an average temperature of 27.57°C (Google Earth, 2022). Dried Alligator pepper was purchased from open market within Abeokuta metropolis; the seeds were removed from its pods and blended using a kitchen blender to achieve a very fine particle size, the alligator seed powder was then included in the basal diets of broiler chicken at 0.0, 0.5, 1.0, 1.5 and 2.0 g/kg basal diets to form five dietary treatments, T1, T2, T3, T4 and T5 respectively. One hundred and fifty (150) day-old FUNAAB Alpha broiler chicks were purchased from a FUNAAB Hatchery at DUFARMS, FUNAAB and randomly allotted to the five dietary treatments (T_1, T_2, T_3, T_4 and T_5) in a completely randomized designed of three replicates with ten chicks per replicate. Experimental diets and water were provided *ad libitum*

throughout the 56 days feeding trial. At the end of the feeding trial, two broilers from each replicate (making a total of 6 birds per treatment) were selected and arranged separately in a clean and disinfected metabolic cage. They were acclimatized for three days before the commencement of the digestibility study. A known weight of feed was fed during the digestibility trial. The daily dropping from each bird was collected for 3 days and oven dried at 55°C until a constant weight was attained. The dried faecal samples were used to determine the proximate compositions according to procedure of Association of Official Analytical Chemists (AOAC, 1995).
Records of live weight and feed intake for each replicate were used to calculate the average live weight per bird while feed conversion ratio was calculated as total feed consumed per weight gain. Data generated from the experiment were subjected to Analysis of Variance for a Completely Randomized Design using general linear model of SPSS, (2021). Significant means were separated using the Duncans Multiple Range Test of SPSS software.

Table 1: Gross composition of basal diet

Ingredients (%)	Broiler Starter (0-4 weeks)	Broiler Finisher (5-8 weeks)
Maize	52.00	56.00
Soybean meal	22.00	8.00
Groundnut cake	10.00	16.00
Wheat offal	6.30	3.00
Palm kernel cake	2.00	9.30
Fish meal (72%)	3.00	3.00
Bone meal	2.00	2.00
Limestone	2.00	2.00
*Broiler Premix	0.25	0.25
Salt (NaCl)	0.25	0.25
Lysine	0.10	0.10
Methionine	0.10	0.10
Total	**100.00**	**100.00**
Determine Nutrients (%)		
ME Kcal/kg)	2933.80	2875.60
Crude Protein	23.22	20.18
Crude Fibre	4.26	5.12
Fat	2.19	4.12
Calcium	1.40	1.65
Phosphorus	0.44	0.82

**Premix provided the following: Vitamin A 12,000,000 I.U; Vitamin D 3,000,000 I.U; Vitamin E 30,000,000; Vitamin K 2,500mg; Folic acids 1,000mg; Niacin 40,000mg; Panthothenic acid 10,000mg; Vitamin B_{12} 20mg; Selenium 250mg; Iodine 200mg; Iron 40,000mg; Manganese 70,000mg; Copper 8,000mg; Zinc 60,000mg; Chlorine 200,000mg*
ME (Kcal/kg) = 37 x % CP + 81.8 x % EE + 35.5 x % NFE (Pauzenga, 1985)

Table 2: Nutrient digestibility of FUNAAB-Alpha broiler chicken fed diets containing varying levels of APSM at the finisher phase

Parameters/Inclusion level	0	0.5	1.0	1.5	2.0	SEM	P-value
Dry Matter (%)	80.38	83.11	83.39	84.07	83.82	0.91	0.792
Crude protein (%)	81.41^{b}	91.49^{a}	92.99^{a}	89.69^{ab}	90.83^{a}	1.48	0.023
Crude Fibre (%)	45.76^{cd}	53.83^{bc}	63.04^{ab}	36.58^{d}	73.82^{a}	3.81	0.001
Ash (%)	60.79	67.45	64.93	71.27	52.81	4.27	0.761
Ether extract (%)	76.96^{ab}	81.91^{a}	81.69^{a}	67.58^{b}	74.39^{ab}	2.10	0.033
NFE (%)	88.28	88.87	86.66	89.96	88.89	0.74	0.770

$^{a, b, c}$ Means with different superscripts on the same row are significantly different ($P < 0.05$)

RESULT AND DISCUSSION

The significantly higher crude protein, ether extract and crude fibre digestibility observed in birds fed APSM might be due to the enhanced enzymatic activity stimulated by APSM. Oyedeji *et al* (2022) reported that birds fed diets supplemented with alligator pepper seed meal exhibited better nutrient absorption due to improved enzymatic activity. The significantly lower crude protein obtained in the control diet could be due to the presences of gingerol (a bioactive component of alligator pepper) which inhibits the growth of harmful bacterial, contributing to the

antimicrobial effects of alligator and facilitating a healthier gut environment and the breakdown and absorption of dietary proteins in the birds on APSM based diet. Reaffirming the findings of Ogunwole *et al*., (2019), who reported that broiler chickens fed with alligator extract exhibited significantly higher crude protein digestibility compared to the control group.

The significant increase ether extract digestion observed at 0.5g/kg and 1.0g/kg inclusion levels of APSM could be due to the anti-inflammatory and antioxidant properties of 6-paradol constituent found in the essential oils of APSM which could potentially reduce inflammation of the gut, enhancing fat digestion and absorption by the birds for that group, this finding is in agreements with Liu *et al*. (2017) which indicated that 6-paradol significantly reduced inflammation and improves intestinal barrier function. In addition, oxidative stress in the gut could lead to lipid peroxidation, which could impair fat digestion and absorption. The antioxidant nature of 6-paradol might help counteract oxidative damages, promoting better fat digestibility and absorption.

The significantly increased in crude fibre digestibility observed for all the groups on APSM could be due to the presence of fibre modifying bioactive compounds such as flavonoids and alkaloids in the test ingredient which are associated with improved digestion and nutrient absorption. According to a study by Dhama *et al*. (2015), flavonoids have the potential to enhance the production of cellulose enzymes, which are responsible for the breakdown of crude fibre. This is suggestive of the positive roles of flavonoids on crude fibre digestibility in broiler chickens.

APSM did not significantly ($P > 0.05$) affect the growth performance of FUNAAB Alpha broiler chickens, but numerically increased the weight gain of birds on dietary inclusion of APSM at 1.5 and 2.0 g/kg and also numerically decreased the FCR of the birds on the same dietary treatments (Table 3). The non-significant values obtained in performance record indicates that despite the decreasing initial weight with increase in the level of APSM across the treatment except for the birds in T5, the chickens were able to utilize the phytonutrients in alligator pepper which suggest a superior performance, supporting the non-significant value obtained across all treatments.

C Table 3: Growth performance of FUNAAB Alpha broiler chickens fed diets containing varying levels of APSM at finisher phases

Parameter/Inclusion Levels	0	0.5	1.0	1.5	2.0	SEM	P-Value
Initial weight (g/bird)	506.67^{a}	452.20^{ab}	385.20^{bc}	315.70^{c}	346.67^{bc}	23.21	0.02
Final weight (g/bird)	1426.67	1513.71	1482.43	1538.13	1363.33	33.05	0.51
Weight gain (g/bird)	920.00	1061.51	1097.23	1222.43	1016.67	45.32	0.33
Weight gain (g/bird/day)	32.86	37.91	39.19	43.66	36.31	1.62	0.33
Feed intake (g/bird)	3367.39	3603.72	3097.29	3347.26	3325.36	72.46	0.32
Feed intake (g/bird/day)	120.26	128.70	110.62	119.54	118.76	2.59	0.32
FCR	3.69	3.58	2.87	2.74	3.34	0.18	0.38
Mortality	0.00	7.41	3.70	7.41	3.70	1.45	0.51

a, b, c Means with different superscripts on the same row are significantly different ($P < 0.05$)
SEM: Standard error of means, FCR: Feed conversation ratio

ONCLUSION

The study demonstrated that APSM can be included in the diets of FUNAAB Alpha broiler chicken at $1.0gkg^{-1}$ and $2.0gkg^{-1}$ (T3 and T5) without any adverse effect on their performance. Hence, it can be adopted as management tool to enhance the performance and digestibility of broiler chickens at finisher phase.

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