CARCASS CHARACTERISTICS OF FUNAAB ALPHA BROILER CHICKENS TO GRADED LEVELS OF ALLIGATOR PEPPER (*Aframomum melegueta*) SEED MEAL

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Abstract

Alligator pepper (*Aframomum melegueta*) seed meal (APSM) was included in the basal diets of 150 day old FUNAAB Alpha broiler chickens as phytogenic feed additives at 0.0, 0.5, 1.0, 1.5 and 2.0g/kg allotted as T1, T2, T3, T4 and T5 diet respectively in a 56 day feeding trial. Results revealed significant ($P < 0.05$) differences in kidney, empty gizzard, liver, spleen, abdominal fat, and gall bladder weights, while the heart, lungs, and proventriculus were not affected. Carcass characteristics such as live weight, eviscerated weight and dressed yield were not significantly affected, but numerically higher eviscerated weight was observed in birds fed 0.5g/kg and 1.0g/kg APSM based diet. Prime cuts (head, neck, breast, back, wings, thigh, drumstick and shank) were also not significantly affected. Birds fed 1.5 g/kg APSM had the lowest gizzard (51.60 g) and liver (22.57 g) weights, whereas the highest values were obtained in the control (60.99 g and 30.91 g, respectively). Kidney weight was significantly higher (10.25 g) at 1.5 g/kg APSM compared with the least value (6.25 g) at 0.5 g/kg. Spleen weight was highest in the control group (2.74 g) but reduced across APSM-fed groups. Abdominal fat was markedly decreased at 1.5 g/kg (12.24 g) compared to control (30.01 g), suggesting fat-sparing effects of APSM. Gall bladder weight peaked at 2.0 g/kg (3.24 g) but was lowest at 1.5 g/kg (1.77 g). In conclusion, APSM at 0.5g/kg and 1.0g/kg dietary inclusion supported balanced organ development, while higher levels (1.5 g/kg and 2.0 g/kg) reduced abdominal fat and organ weights, indicating physiological adaptations to the bioactive compounds present in alligator pepper.

Keywords: Alligator pepper seed meal, FUNAAB Alpha broiler chickens, Carcass characteristics, Internal organ weight.

Description of Problem

The search for safe, natural alternatives to antibiotic growth promoters has led to increasing attention on phytogenic feed additives derived from medicinal plants and spices [1]. Alligator pepper (*Aframomum melegueta*) contains bioactive compounds such as alkaloids, flavonoids, tannins, saponins, and essential oils with strong antimicrobial, antioxidant, and digestive enhancing properties [2]. Its seed meal, when incorporated into poultry diets, has the potential to influence carcass yield and organ development by improving nutrient utilization and metabolic efficiency.

Carcass and organ characteristics are important indicators of feed efficiency and overall bird health. Abnormal enlargement of internal organs such as the liver or gizzard often reflects metabolic stress, while optimal organ development suggests improved nutrient assimilation [3]. Studies have shown that phytogenic feed additives can reduce abdominal fat deposition while improving dressing percentage and lean muscle yield [4]. Specifically, the bioactive compounds in alligator pepper stimulate digestive enzymes and improve lipid metabolism, thereby reducing fat accumulation and supporting higher carcass yield [5]. The antioxidant constituents of alligator pepper protect metabolically active organs such as the liver, heart, and kidney against oxidative damage, maintaining their physiological function [6]

APSM with its antioxidative and antimicrobial properties, could influence organ weights and fat deposition in broilers by modulating metabolism and digestive efficiency. Hence this study provides valuable insights into the safe inclusion levels of APSM in broiler diets.

Materials and Methods

Experimental Site

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 [7].

Test Ingredients and processing

Dried Alligator pepper was purchased from an open market within Abeokuta metropolis; the seeds were removed from its pods and ground using a kitchen blender to achieve a fine particle size prior to dietary inclusion at 0.0, 0.5, 1.0, 1.5 and 2.0 g/kg in T1, T2, T3, T4 and T5 respectively.

Table 1: Gross composition of basal diets

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
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)

Experimental Birds and Management

One hundred and fifty (150) day-old FUNAAB Alpha broiler chicks were purchased from a FUNAAB Hatchery at DUFARMS, FUNAAB and randomly allotted to 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^{th} day feeding trial.

At the end of the feeding trial, 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.

On the 56^{th} day of the feeding trial, two bird from each replicate whose weight is close to average weight of the replicate was randomly selected, weighed, slaughtered by severing the jugular vein for carcass analysis. The slaughtered birds were dressed and eviscerated according to standard commercial procedures [8]. Carcass parameters, such as dressing yield, breast meat yield, abdominal fat and weight of visceral organs (heart, gizzard, kidney and liver) and cut parts such as head, neck, wings, thigh, shank, drumstick, back and breast were carefully removed, weighed and recorded using a sensitive scale. The weight of the cut parts was expressed as a percentage of live weight according to 'Modified Kosher' method as described by [9], while the yield for each part was expressed as a percentage of live weight of the birds.

Data generated were subjected to Analysis of Variance for a Completely Randomized Design using general linear model [9]. Significant means were separated using the Duncans Multiple Range Test of SPSS software.

Results and Discussion

Carcass yield in broiler chicken is strongly influenced by adequate feeding and nutrition. The numerically higher eviscerated weight observed in birds fed APSM based diets except those on T5 diets indicate enhance carcass yield at 0.5, 1.0 and 1.5g/kg dietary inclusion of APSM. However, 2.0g/kg dietary inclusion level tend to compromise the growth and carcass yield of FUNAAB Alpha broiler chicken. Most of the internal organ were influenced by the inclusion of APSM, except for the heart, liver and proventriculus which had no significant (P > 0.05) differences across dietary treatment. Phytogenic feed additives generally exert little or no negative impact on the development of vital organs such as the heart and lungs of broiler chicken at safe levels dietary inclusion [1]. Increased kidney weights in broilers are often associated with higher metabolic activity and detoxification processes triggered by phytochemicals present in herbal feed additives [3], corroborating the significantly (p < 0.05) elevated kidney weights observed in birds fed T4. However, the kidney weight of birds fed T3 and T5 did not differ significantly from T1 (control), suggesting that the kidney responses are not dose linear but may be influenced by adaptive metabolic adjustments.

Table 2: Effect of dietary inclusion of APSM on carcass parameters of FUNAAB-Alpha strain of broiler chickens

	APSM Inclusion Levels						
Parameters (kg)	**0 g/kg**	**0.5 g/kg**	**1.0 g/kg**	**1.5 g/kg**	**2.0 g/kg**	**SEM**	**P-Value**
Live weight	1.42	1.51	1.48	1.53	1.36	0.33	0.511
Eviscerated W.	0.98	1.05	1.05	1.00	0.83	0.38	0.392
Dressed yield	0.88	0.83	0.81	0.82	0.66	0.35	0.408
Prime cut (g)							
Head	48.15	49.48	46.86	51.62	42.24	1.54	0.404
Neck	54.60	50.64	47.83	50.80	52.58	1.45	0.692
Breast	207.44	205.44	246.23	227.55	232.74	9.12	0.603
Back	149.93	157.61	166.71	159.68	153.87	4.60	0.846
Wings	94.82	92.22	83.01	88.10	89.34	2.58	0.693
Thigh	131.20	150.97	142.41	143.59	136.54	4.10	0.644
Drumstick	131.48	137.36	134.54	129.39	130.48	3.60	0.964
Shank	68.48	71.77	59.18	62.58	61.75	2.83	0.637
Organs (g)							
Heart	7.21	6.27	7.67	8.16	6.98	0.31	0.390
Kidney	7.37^{ab}	6.25^{b}	7.78^{ab}	10.25^{a}	8.60^{ab}	0.48	0.008
Lungs	8.50	7.53	7.02	7.77	7.560	0.31	0.700
Empty gizzard	60.99^{a}	61.39^{a}	56.77^{ab}	51.60^{b}	55.90^{ab}	1.25	0.015
Liver	30.91^{a}	26.71^{ab}	24.68^{ab}	22.57^{b}	31.16^{a}	1.15	0.018
Offals (g)							
Spleen	2.74^{a}	2.32^{ab}	1.58^{b}	1.61^{b}	1.59^{b}	0.13	0.005
Abdominal fat	30.01^{a}	25.50^{a}	16.02^{bc}	12.24^{c}	22.84^{b}	1.72	0.002
Gall bladder	2.96^{ab}	2.85^{ab}	1.85^{b}	1.77^{b}	3.24^{a}	0.21	0.033
Proventriculus	7.38	5.38	7.21	5.68	7.08	0.37	0.271

$^{a, b, c}$ Means with different superscripts on the same row are significantly different (P < 0.05)
SEM: Standard error or means.

The significantly (P > 0.05) lower gizzard observed in T4 may be attributed to the pungent and digestive stimulant properties of APSM, which enhance feed breakdown efficiency, reducing the need for gizzard hypertrophy. This is in line with the report of [4] who stated that essential oils and pungent spices enhance digestive efficiency by stimulating enzyme secretion, thereby reducing the workload on gizzard and consequently lowering gizzard weight.

The spleen weight is a reflection of immune activation; reduced spleen size in birds fed phytogenic additives suggests a lower pathogenic challenge and reduced immune burden due to antimicrobial properties. [10]. The lower spleen weights across the treatment, except for birds on T1 and T2 diets, reduced spleen size may indicate reduced immune organ burden due to the antimicrobial properties of APSM, which lower pathogenic load and minimize over-activation of the immune system.

APSM significantly ($P > 0.05$) decreased abdominal fat of FUNAAB Alpha broiler chicken on T4 diets as compared with the T1 (30.01 g). This fat-sparing effect highlights the ability of APSM to improve lipid metabolism and redirect energy towards lean tissue accretion, is consistent with reports of reduced fat deposition in broilers fed phytogenic additives [4]

The significantly variation in gall bladder weight suggests that APSM bioactive compounds may influence bile secretion and lipid digestion differently across inclusion levels. This indicates that APSM inclusion did not interfere with gastric secretory function or upper digestive organ development, hence no significant difference in proventriculus weight. [11] reported that the weights of upper digestive organs such as the proventriculus are usually not significantly influenced by dietary phytogenic additives, indicating their minimal impact on gastric development.

Conclusion and Application

The inclusion of APSM at 1.0 g/kg and 1.5 g/kg offered a better result; improve fat metabolism and reduce organ hypertrophy without compromising carcass yield.

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