PERFORMANCE, CARCASS AND ORGAN CHARACTERISTICS OF FINISHER BROILERS FED VARYING LEVELS OF RAW *Adenanthera pavonina (L)* SEED MEAL.

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ABSTRACT
The effect of graded levels of raw *Adenanthera pavonina* seed meal (RAPSM) on the performance, carcass and organ characteristics of finisher broilers was investigated in a five week feeding trial. One hundred and five, 4- week old Anak broilers were divided into five groups of 21 birds per group. Each group was further divided into three replicates of 7 birds. Five experimental diets were formulated to contain 0, 5, 10, 15 and 20 % RAPSM, for T_1, T_2, T_3, T_4 and T_5 respectively. Each of the five groups of broilers were allocated to one dietary treatment in a completely randomized design (CRD). Values for average daily feed intake (57.14, 33.67, 26.12, 13.20 and 11.53g), average daily weight gain (34.67, 13.30, 8.21, 3.76 and 3.20g)), feed conversion ratio (1.65, 2.51, 3.18, 3.51 and 3.60) and the final weights 2500.00, 1650.00, 1400.00, 948.00 and 875.00g) for T_1, T_2, T_3, T4 and T_5 respectively were significantly highest in the birds on the control diet than the other treatments. The birds fed 5% raw *Adenanthera pavonina* seed meal (RAPSM) had values comparable to those on the control diet. Birds on 20% RAPSM diet had the lowest percentage of dressed weight, drumstick, breast muscle and thigh weights. The visceral organ weights increased as the level of RAPSM in the diets increased from 0 to 20%. The raw Adenanthera pavonina seed meal (RAPSM) should not exceed 5% level of inclusion in the broiler ration, except when it had been processed to eliminate the anti-nutrients in the raw seeds.

Keywords: *Adenanthera pavonina*, Broilers, Performance, Carcass, Organs

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INTRODUCTION

Broilers play a significant role in the livelihood of both rural and urban populace in most developing and developed countries. Apart from serving as a vital protein source, it also provides income for satisfying urgent household needs. Poultry production has been suggested as a means of massively producing animal protein because of its short generation interval and high growth rate (Essen *et al*., 2005). Shortages of animal protein still remain a major problem in the developing countries. Poultry production has great potential for improving the animal protein intake of the populace. However, the availability of high quality poultry feed is constrained by the phenomenal rise in the cost of the major conventional feed ingredients, due mostly, to competition from the consumption of these materials by human beings (Tuleun *et al*., 2008). For example a 25kg bag of broiler finisher feed that was sold for ₦2,700.00 in December, 2015 is now (July, 2016) sold for ₦3,800.00 which represents an increase of 40.74% within a year and six months. For layers mash the difference is as high as 75.00% (from ₦2,000.00 to ₦3,500.00). The rise in prices of livestock feed and conventional feed ingredients has necessitated the need to investigate the potentials of some lesser-known energy and protein feedstuffs that are cheap and readily available with less competition with humans and beer-brewing industries compared to soya bean and maize in poultry nutrition. This will reduce the cost of feed and animal products such as meat and eggs among others for Nigerian populace (Agbabiaka *et al*., 2013). In order to remain competitive in the global market, the poultry sector must seek sustainable and viable solutions to the sourcing and level of dietary energy and nutrient inputs, whilst maintaining an acceptable level of output and animal performance (White *et al*., 2015). Some leaf meals have been evaluated and incorporated into poultry diets as sources of protein. Among them were *Microdermis puberula* (Esonu *et al*., 2002), *Ipomea asarifolia* (Madubuike and Ekenyem, 2006) and *Gomphrena celosioides* (Ukpabi *et al*., 2009). The seeds of *Napoleona imperials* (Ukpabi and Ukpabi, 2003; Uchegbu *et al*. 2004) and *Anthonotha macrophylla* (Ekpo, 2012; Ukpabi *et al*., 2015a, 2015b) have also been recently incorporated into poultry diets with very promising results. One other cheaper and readily available nonconventional protein and energy source is *Adenanthera pavonina.* This useful tree, commonly referred to as *red sandal wood* under the family *Leguminaceae* contains reasonable amounts of protein, fat and minerals compared to commonly consumed staples (Ezeagu *et al*., 2004).This study was therefore aimed at evaluating the effect of raw *Adenanthera pavonina* seed meal on performance, carcass and organ characteristics of finisher broilers.

MATERIAL AND METHODS

Experimental site

The experiment was conducted at the Livestock Unit of Faculty of Agriculture Teaching and Research Farm, Umudike. Umudike bears a coordinate of $7^0 31^1$ East and $5^0 28^1$ North and lies at an altitude of 122meters above sea level.

Procurement of Feed Ingredients

The *Adenanthera pavonina* seeds were gathered from the University premises in Umudike, other feed

ingredients were purchased from a commercial feed shop in Umuahia.

Processing of Adenanthera pavonina seeds.
The seeds were sorted, sundried for one week, before being milled using a hammer mill to produce the raw *Adenanthera pavonina* seed meal (RAPSM).

Experimental Design
A total of one hundred and five, 4-weeks old Anak broilers were used for the experiment. The birds were divided into five groups of twenty one birds each and allotted to five treatment diets in a completely randomized design (CRD). Each group was further sub-divided into three replicates of seven birds each, feed and water were offered *ad libitum* and the feeding trial lasted for 5 weeks.

Experimental Diets
Five experimental diets were formulated by incorporating RAPSM at 0, 5, 10, 15 and 20 % levels and designated T_1, T_2, T_3, T_4 and T_5 respectively. The composition of the experimental diets is shown in Table 1. The determined proximate composition of the diets and RAPSM are presented in Table 2.

Table 1: **Composition of Experimental Diets**

Ingredient	**RAPSM Inclusion Level in Diets (%)**				
	T_1(0)	**T_2 (5)**	**T_3 (10)**	**T_4 (15)**	**T_5 (20)**
Maize	50.00	50.00	50.00	50.00	50.00
Soybean meal	30.00	25.00	20.00	15.00	10.00
RAPSM	0.00	5.00	10.00	15.00	20.00
Blood meal	2.00	2.00	2.00	2.00	2.00
Palm kernel cake	10.00	10.00	10.00	10.00	10.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Palm oil	1.00	1.00	1.00	1.00	1.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Premix*	0.30	0.30	0.30	0.30	0.30
Salt	0.50	0.50	0.50	0.50	0.50
Methionine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated composition					
Crude protein	22.33	23.33	22.43	21.53	20.63
ME (MJ/kg)	12.78	12.73	12.67	12.62	12.57

*Vitamin mineral premix provides per kg diet: Vit. A, 13.340 iu, Vit D_3 2680 iu, Vit. E 10.00 iu, Vit. K, 2.68 iu, Calcium panthonate, 10.68mg, Vit. B_{12} 0.022mg; Folic acid, 0.668mg; Choline chloride 400mg; Chlorotetracycline, 26-28mg; Manganese, 133.34mg; Iron, 66.68mg;Zinc, 53.34mg Copper, 3.2mg; Iodine, 1.86mg; Cobalt,0.268mg; Selenium, 0.108mg. ME = Metabolizable Energy (MJ/kg), RAPSM = Raw *Adenanthera pavonina* seed meal.

Table 2. Proximate composition of experimental diets and raw *Adenanthera pavonina* (L) seed meal (RAPSM)

Parameter	**RAPSM inclusion levels in diets (%)**					**RAPSM**
	T_1(0)	**T_2 (5)**	**T_3 (10)**	**T_4 (15)**	**T_5 (20)**	
Dry matter (%)	84.68	79.16	89.80	85.44	88.55	86.62
Crude protein (%)	20.91	20.22	20.00	20.01	20.65	27.00
Crude fibre (%)	3.43	3.01	2.85	2.34	2.10	9.05
Ether extract (%)	4.80	4.02	3.95	3.40	3.51	5.54
Ash (%)	5.37	4.91	4.92	4.29	4.17	5.23
NFE (%)	50.17	47.00	58.08	54.50	58.12	40.80
ME (MJ/kg)*	12.32	11.47	13.06	12.35	13.02	11.78

RAPSM – Raw *Adenanthera pavonina* seed meal, NFE – Nitrogen free extract
*ME: Metabolizable Energy calculated according to Pauzenga (1985) as ME (MJ/kg) = 37 × % CP + 81 × % EE + 35.5 × % NFE (Folorunso et al., 2016)

Data Collection
The birds were weighed at the beginning of the experiment to obtain their initial body weights and then weekly, thereafter. Daily feed intake was determined by subtracting the weight of left over feed from the weight of the feed fed the previous day. Data collected included initial and final body weights, average daily feed intake, daily weight gain and feed conversion ratio. **Carcass Evaluation**
At the end of the experiment, nine birds were randomly selected from each treatment (3 per replicate) and used for evaluation of carcass and

internal organ weights. They were starved of feed for 12 hours, weighed and slaughtered by severing the jugular vein with sharp knife. They were de-feathered, using hot water (below 72°C) and separated into head, neck, feet and visceral organs. The wings were removed by cutting anteriorly severing at the humero-scapular joint. The cuts were made through the rib head intact by pulling anteriorly. Thighs and drumstick were dissected from each carcass and weighed separately.

Statistical Analysis

All data obtained were subjected to statistical analysis using one way analysis of variance (ANOVA) as outlined in (Steel and Torrie, 1980). Duncan multiple range test was used to separate significant treatment means where they occurred (Obi, 1990).

RESULTS

The performance of broilers fed diets containing different levels of raw *Adenanthera pavonina* seed meal is presented in Table 3. The results showed significant differences (P<0.05) among the treatments in all parameters measured except in initial body weight of the birds. The control group (T_1) had the highest final weight of 2500g which was significantly different from treatments T_2, T_3, T_4 and T_5.

Average daily weight gains obtained in this study were 34.63, 13.30, 8.21, 3.76 and 3.20 for T_1, T_2, T_3, T_4 and T_5 respectively. Birds on the control diet had the highest daily weight gain of 34.67g which differed significantly (P<0.05) from treatments 2, 3, 4 and 5. Average daily feed intake values obtained were 57.14g, 33.67g, 26.12g, 13.20g and 11.53g for birds fed diets T_1, T_2, T_3, T_4 and T_5 respectively. There was a significant decrease (P<0.05) across the treatments with birds on T_1 having the highest intake which was statistically different (P<0.05) from other treatments. Feed conversion ratio (FCR) ranged from 3.60 in birds on T_5 to 1.65 in birds on T_1. There was a significant increase across the treatment means with birds on T_5 having the highest value of 3.60, while the lowest value was recorded in birds placed on T_1. The FCR for birds on the control diet differed significantly (P<0.05) from those on RAPSM. Birds in T_3, T_4 and T_5 were similar (P>0.05) while T_3 did not differ significantly (P>0.05) from T_2.

Table 3. Performance of finisher broilers fed graded levels of raw *Adenanthera pavonina* seed meal (RAPSM)

	RAPSM inclusion levels (%)					
Parameter	**T_1(0)**	**T_2 (5)**	**T_3 (10)**	**T_4 (15)**	**T_5 (20)**	**SEM**
Initial body weight (g)	500.00	471.42	485.71	485.71	471.42	73.08
Final body weight (g)	2500.00^a	1650.00^b	1400.00^b	948.00^c	875.00^c	99.91
Average daily weight gain (g)	34.67^a	13.30^b	8.21^c	3.76^d	3.20^d	0.73
Average daily feed intake (g)	57.14^a	33.67^b	26.12^c	13.20^d	11.53^d	3.83
Feed conversion ratio	1.65^c	2.51^b	3.18^{ab}	3.51^a	3.60^a	0.36

^{abcd} Means in the same row with different superscripts differed significantly (p<0.05).
RAPSM - Raw *Adenanthera pavonina* seed meal. SEM-Standard error of the means

The results of carcass characteristics of finisher broilers fed graded levels of raw *Adenanthera pavonina* seed meal are presented in Table 4. There were significant differences (P<0.05) in all carcass parameters measured. Live weight values ranged from 2233.33g in T_1 to 456.67g in T_5. The values obtained decreased significantly (P<0.05) among the treatment groups, with birds on T_1 having the highest live weight followed by birds on T_2.

The dressed weight also followed the same trend, the values ranged from 1866.66g in T_1 to 303.33g in T_5. There were significant (P<0.05) decrease in dressed weights among the treatment groups, as the level of *A. pavonina* in the diet increased. The values for dressing percentage obtained in this study revealed non-significant differences (P>0.05) among treatment groups T_1, T_2, T_3 and T_4. The difference between T_4 and T_5 was not significant (P>0.05). The values declined significantly as the level of RAPSM increased in the diet. It ranged from 83.53% in T_1 to 66.83% in T_5.

Breast muscle values ranged from 15.55% in T_5 to 22.58% in T_1. The values obtained in T_1, T_2, T_3 and T_4 did not differ significantly (P>0.05) but differed significantly (P<0.05) from T_5.

Thigh weights ranged from 13.11% in T_1 to 10.00% in T_5. The difference between T_1 and T_2 was not significant (P>0.05) but they differed significantly (P<0.05) from T_3, T_4 and T_5 which were similar (P>0.05) to each other.

The drumstick revealed significant differences (P<0.05) among the treatment groups with the highest value of 15.23% recorded in T_1, and the lowest (11.00%) in T_4. The difference between T_1 and T_2 was not significant (P>0.05) but they differed significantly (P<0.05) from T_3, T_4 and T_5. Treatment T_3 differed significantly (P<0.05) from T_4 and T_5.

Percentage values of back weights were 20.92, 18.21, 18.10, 17.99 and 15.66% for T_1, T_2, T_3, T_4 and T_5 respectively. Birds on T_1 differed significantly (P<0.05) from those on different levels of RAPSM, while those on T_2, T_3 and T_4 were significantly (P<0.05) different from those on T_5. The values also declined as the level of RAPSM in the diets increased from 0 – 20%.

Table 4: Cut parts of finisher broilers expressed as percentage of dressed weight

	Level of inclusion of RAPSM (%)					
Parameters	**T_1 (0)**	**T_2 (5)**	**T_3 (10)**	**T_4 (15)**	**T_5 (20)**	**SEM**
Live weight (g)	2233.33[a]	1350.00[b]	1066.67[b]	550.00[c]	456.67[c]	201.76
Dressed weight (g)	1866.66[a]	966.66[b]	750.00[c]	383.33[d]	303.33[d]	12.65
Dressing (%)	88.53[a]	74.00[a]	73.13[a]	70.06[ab]	66.83[b]	10.79
Breast muscle (%)	22.58[a]	21.74[a]	21.76[a]	21.29[a]	15.66[b]	4.36
Thigh (%)	13.11[a]	12.54[a]	10.13[b]	10.53[b]	10.00[b]	1.25
Drumstick (%)	15.23[a]	14.68[a]	13.66[b]	11.00[c]	11.01[c]	1.08
Back (%)	20.92[a]	18.21[b]	18.10[b]	17.99[b]	15.66[c]	2.01

[abcd] Means in the same row with different superscripts differed significantly ($p<0.05$).
RAPSM - Raw *Adenanthera pavonina* seed meal. SEM-Standard error of the means

The effect of RAPSM on organ weights of finisher broilers expressed as percentage of dressed weight are presented in Table 5. The dietary treatment showed significant ($P<0.05$) effects on the weights of the liver, heart, kidney and gizzard. The values obtained for internal organs followed a consistent trend by increasing as the level of RAPSM increased from 0 – 20% in the diets.

Table 5. Organ weights expressed as percentage of dressed weights of finisher broilers fed graded levels of raw *Adenanthera pavonina* seed meal

	Level of inclusion of RAPSM (%)					
Organ as % of dressed weight	**T_1 (0)**	**T_2 (5)**	**T_3 (10)**	**T_4 (15)**	**T_5 (20)**	**SEM**
Liver	2.42[b]	2.98[b]	3.21[b]	4.31[a]	5.40[a]	0.97
Heart	0.56[b]	0.77[b]	0.59[b]	1.34[a]	1.25[a]	0.19
Kidney	1.26[b]	1.33[b]	1.86[a]	1.88[a]	1.90[a]	0.72
Gizzard	3.03[b]	4.18[b]	4.11[b]	6.41[a]	6.81[a]	1.24

[a b c d] Means in the same row with different superscripts differed significantly ($P<0.05$)
RAPSM – Raw *Adenanthera pavonina seed* meal. SEM-Standard error of the means

DISCUSSION

The decreased final weight could be attributed to the presence of anti-nutrients in *A. pavonina*. The results obtained agreed with the findings of Amaefule *et al.* (2006) who reported a significant reduction in final body weight of finisher broilers fed treated rice milling waste.

The weight gain of birds in this study were significantly reduced as the level of RAPSM increased in the diet. Tuleun *et al.* (2008) reported similar adverse effect of raw *Mucuna* on weight gain in broiler chickens. Depressed weight gain was also reported in broilers fed graded levels of raw African pear (*Dacryodes edulis*) seed meal (Onigemo *et al.*, 2016).

The reduction in feed intake could account for the reduction in the weight gain of birds. The significant decline in feed intake at 15% and 20% dietary inclusion of the seed meal could perhaps be attributed to the presence of some anti-nutritional factors, which are thought to be prevalent in most unconventional feedstuffs (D'Mello, 1982) or acceptability of the diets by the birds. This report agreed with the reports of Uchegbu *et al.* (2004) who reported significant decrease in feed intake at 15% dietary inclusion of raw *Napoleona imperialis* seed meal in finisher broiler rations.

The trend in FCR obtained in this study was similar to the observation of Kwari *et al.* (2011) who observed an increase in FCR when broilers were fed differently processed Sorrel seed meal diets. Feed conversion ratio also increased as the level of raw kenaf (*Hibiscus cannabinus*) seed meal in broiler diets increased from 0 to 30% (Odetola *et al.*, 2015) This implied that birds on T_1 converted their feed more efficiently than those on T_2, T_3, T_4 and T_5.

The decrease in dressing percentage could be attributed to the live weight of the birds. It was observed that dressing percentage declined as the efficiency of feed conversion declined. Values (66.83-88.53%) obtained in this study were higher than the values (63.65-70.21%) reported by Ugwuene (2011).

Breast weight of birds fed graded levels of RAPSM declined and the values were lower compared to 29.68-31.64% reported in turkey fed different levels of palm kernel meal (Ugwuene, 2011). The reduction in breast weight as the level of RAPSM increased in the diet particularly in T_5 is a pointer to reduced efficiency of feed utilization. Thigh weights of birds decreased significantly ($P<0.05$) from T_3 as the level of RAPSM increased in the diet. The values obtained in this study were comparable with 11-12.03% reported by Omojola and Adesehinwa (2007).

The consistent reduction in the percentage of the drumstick as the level of inclusion of RAPSM in the diet increased from 0% to 20% is a further reflection of lowered efficiency of nutrient utilization by the

birds. These values were comparable with 12.01-15.32% reported by Ugwuene (2011) but higher than 10.23-10.70% reported by Omojola and Adesehinwa (2007) and 10.40 to 12.04% reported by Odetola *et al*. (2015). Like all other parameters measured, the values for the back also declined significantly. The decrease observed in the cut parts parameters in this study could be attributed to the corresponding decrease in live weight of the experimental birds.

Observed significant increases in the internal organs of finisher broilers obtained in this study were similar to the trend reported by Onigemo *et al*. (2015) when 0 to 20% raw Loofa gourd *(Luffa cylindrica*) was fed to chicken. This may be attributed to the presence of anti-nutrients in the test ingredients and the increased rate of metabolism in these organs aimed at detoxification (D'Mello, 1982; Ukpabi and Ukpabi, 2003).

CONCLUSION

Increasing the content of RAPSM in the diet from 0 to 20% resulted in corresponding decreases in growth performance and carcass characteristics of broilers which also impacted negatively on nutrient utilization as reflected in the feed conversion ratio. The results obtained in this study indicated that finisher broilers could barely tolerate RAPSM at 5% inclusion level in the ration. Since the test ingredient (*Adenanthera pavonina*) was included in a raw form, there is the need to subject the seed to various processing methods that would increase its digestibility and palatability to suit the nutritional needs of the birds, and also to enable its utilization in broiler feeds at levels exceeding 5% inclusion.

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