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Nutritional Evaluation of Rubber Seed Meal with Blood Meal in Broiler Rations

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Abstract

A trail was carried out to investigate the effects of the incorporation of rubber seed meal as sources of plant protein on the performance, feed intake and the carcass of poultry birds from day-old chicks to 12 weeks under traditional system of management. Unsexed 300 Jupiter chickens were randomly divided into 4 groups each of 75 birds. Four diets representing different levels of Rubber Seed Meal (RSM) and Blood Meal (BM):- R_0 with 0% RSM and 0% BM; R_{10} with 10% RSM and 8% BM; R_{20} with 20% RSM and 6% BM and R_{30} with 30% RSM and 4% BM were fed *ad libitum* throughout the experimental period. Results showed significant differences between treatments indicating the superiority of the diet supplemented with 30% RSM and 4% BM.

Introduction

The poultry industry is one of the fast means of providing the much needed animal protein to the teeming populace. It has been suggested that the expansion of the Nigeria poultry holds the greatest promise of bridging the animal protein gap in the country within the shortest possible time [1,2]. Some agro-industrial by-products like Bambara nut, feather meal, rice offal, brewer's dried grain have been used in poultry diets to replace cereals [3].

Broiler birds are probably the most universal and important of all poultry as producers of meat for human consumption. It has been reported that rubber seed (*Hevea brasiliensis*) meal obtained from ground sun dried seeds can supplement blood meal in broiler chicken diet at 30% level without any adverse effect on performance [4,5]. Feed processing helps to enhance the feeding quality of agro-industrial by-products by reducing the level of toxicants where present, improving their nutrient value, acceptability of feed, and utilization by animals [6,7]. The shortage of good quality feeds needed to sustain live stock growth, especially during the dry season has been a major challenge to the industry in the developing countries. Thus crop residues, agro-industrial by products and non-conventional feed resources which abound duringthe dry season are being evaluated to access their nutritive potential to support livestock productivity [8].

Several factors have been generally identified as limiting to the utilization or high incorporation of non-conventional feed stuffs in livestock feed. These include low protein content, high fiber, amino acid imbalance and presence of anti-nutritional factors [9]. Anti-nutritional factors have significant negative effects on livestock production. These effects include reduction in palatability, digestibility and utilization of ration, intoxication of different classes of livestock, resulting in mortality or decreased production of animal and reduction in the quality of meat, egg, and milk products due to the presence of hazardous residues [10]. Alternative sources of feed ingredients should be found which are not utilized by the human population and which, at present, might not have been found wider use in animal feeding.

The objective of this study was to investigate the effects of the incorporation of rubber seed meal supplemented with blood meal as source of protein in broiler rations in replacement of cottonseed cake and groundnut cake under stimulated traditional management conditions on chicken growth, feed consumption, and efficiency of feed utilization, morality rates and the characteristics of the carcass often slaughtered.

Materials and Method

The experiment was carried out at the Imo State Polytechnic Teaching and Research Farm Umuagwo, Owerri, Imo State, Nigeria. The site is situated between longitudes 7^{o} 0^{1} 06^{11}E and 7^{o} 03^{1} 00^{11} and latitudes 5^{o} $28^{1}00^{11}$N and 5^{o} 30^{1} 00^{11}N in the humid tropical West Africa [11]. Rubber seed meal used for this study was collected from feed ingredient vendor in Owerri, Imo State, Nigeria. The rubber seeds were spread on mat and concrete floor to be dried by solar radiation. This was done at the first week of December when the relative humidity was low, temperature high and accompanied by dry harm at tan wind. On drying, the ectocarps were removed and the samples were milled.

The processed rubber seed meal was subjected toproximate analysis (Table 1) at the Science Technology Laboratory, Imo State Polytechnic Umuagwo, Nigeria,using standard methods [12]. The mineral analysis was carried out using the methods of Grueling [13] while gross energy was determined with a Gallen Pump Oxygen Adiabatic Bomb Calorimeter. The samples were also weighed, evaporated in rotary evaporator and then loaded into the Technicon sequential multi sample Analyzer for amino acid determination as described by Spackman et al., [14].

Procurement of experimental birds and brooding

Two hundred and twenty (220) four weeks old chickens wereused for the study. The birds were fed nutrient composition for one week to stabilize the birds before the feeding trial. Out of the lot, 200 four weeks broiler chickens were on basis of good health, apparent viability and good conformation assigned to four dietary treatments.

Formulation of the experimental diets

Five experimental diets were formulated containing R_0, R_{10}, R_{20} and R_{30} RSM representing treatments 1, 2, 3 and 4 respectively in which 0%RSM was the control (Table 2). The feed was fortified with vitamin premix and synthetic amino acid. The ingredients were thoroughly mixed to ensure homogeneity before grinding in a hammer mill. Experimental birds were randomly allocated to the four dietary groups containing 0, 10, 20 and 30% RSM for treatments 1, 2, 3 and 4 and were replicated thrice in a completely randomized design. Four weeks old birds were reared on deep litter floor each pen measuring 3.5 m x3.5 m. Each pen was equipped with feeding troughs and drinkers. Electric bulbs and kerosene lanterns alternated as sources of light. Treatment diets and water were administered *ad libitum*.

Routine management practices such as vaccination, drug administration and scrupulous cleanliness of the pens and equipment were carefully applied.

Table 1: Chemical composition and Nutrition value Rubber Seed Meal (RSM).

Composition	Percentage
Ash	6.21%
Ether extracts	10.12%
Crude fat	5.09%
Fibre	4.20%
Crude protein	32.98%
Moisture	5.80%
ME Kcal/kg	4280
Anti-Nutritional Studies	
Tannin	4.23mg
Trypsin inhibitor	0.432 units (trace)
Amylase	1.14g/kg
Cynogenic	glucose not detected
Agemaglutinin	not detected

Data collection

Initial weights were determined at the start of the experiment with the aid of salter weighing balance and thereafter at weekly intervals. The final weight was also taken by weighing the birds in each replicate on the last day of the experiment using the same weighing balance. The weight gains were calculated by subtracting the initial weight from the final weight. In addition, the feed intake was calculated by subtracting the feed remaining from the total feed supplied each day before serving fresh one. The feed conversion ratio was also calculated by dividing feed intake by weight gain. The feed cost was determined as the sum of the cost of all ingredients included in the diet.

Data and carcass analysis

All data generated were subjected to two way analysis of variance [15], while significant differences in means were determined using Duncan's Multiple Range Test [16].

Carcass analysis

After the three-month experimental period, five chickens were taken from each group for carcass analysis. The following measurements were taken into account:

- Weight of blood
- Weight of edible carcass
- Chemical composition

Management

Each experimental group was offered its corresponding diet *ad libitum* and they had free access to water. Hygienic conditions were followed to keep the drinkers and feeders always clean. Feeds offered were weighed. At the end of the week the residues were weighed and deduced from the introduced amounts. The chickens were weighed weekly before being given food. All mortality cases were registered.

Results and Discussion

Table 3 showed that final weight of the experimental birds varied significantly ($p<0.05$) between treatments. Birds on 0% RSM

Table 2: Composition (%) of the Experimental Diets.

Diet Ingredients	R_0	R_{10}	R_{20}	R_{30}
Maize	60	50	36	24
Wheat bran	8	20	26	30
Concentrate	10	-	-	-
Cottonseed cake	10	-	-	-
Groundnut cake	10	-	-	-
Rubber seed meal	-	-	-	-
Blood meal	-	8	6	4
Phosphate di-calcium	1.5	1.5	1.5	1.5
Salt	0.5	0.5	0.5	0.5
Total	**100**	**100**	**100**	**100**

Table 3: Calculated Experimental Rations.

Composition (%)	Rations			
	R_0	R_{10}	R_{20}	R_{30}
Dry matter	88.36	50	36	24
Crude protein	20.7	21.2	21	20
Crude fibre	3.7	2.34	2.47	2.58
E.M.A.	4.72	7.2	10.74	14.32
Ash	5.37	5.05	5.28	5.47
Ca	1.25	1.28	1.28	1.21
P	0.86	0.84	0.89	0.98
Energy (KCal)	2846	2986	3030	3115

R_0 ration with % of rubber seed cake and 0% of blood meal.

R_{10} Ration with 10% of Rubber Seed Meal (RSM) and 8% of Blood Meal (BM).

R_{20} Ration with 20% of RSM and 6% of BM.

R_{30} Ration with 30% of RSM and 4% of BM.

were significantly ($p<0.05$) heavier than those on 10% and 20%, which were also significantly heavier than birds on 30% RSM. Daily weight gain followed the same trend. However feed efficiency for birds on the control diet T_1 and T_2 were most efficient and were significantly ($p<0.05$) different from T_3 and T_4. Initial weights of the birds were similar ($p>0.05$) between treatments. Though RSM is highly nutritious, the high levels of *Lectins* and *Proteinase* caused the reduction in weight gain as higher levels of blood meal were included in the diets [17,18]. The observation that increasing levels of RSM made birds consume more feed is explained by their quest to eat enough to meet their body nutritional requirement [19].The wing length and thigh length did not differ significantly ($p>0.05$) between treatments (Table 4).

Birds on 0% RSM were significantly ($p<0.05$) heavier than those on 10% and 20% which were also significantly heavier than birds on 30% RSM. Drumstick followed the same trend. However wing length for birds on diet T_3 and T_4 were most efficient. In addition, Ahaotu et al., [20,21] observed that higher dietary fiber depresses weight gain in broiler chickens, thus confirming the results of the experiment. Feed cost per kg weight gain significantly decreased ($p<0.05$) with higher levels of RSM. Thus considering the final weights and the cost per kg of weight, 30% RSM appears to be the optimal replacement value of wheat off al. Gizzard, proventriculus, liver, spleen, kidney and heart weights significantly increased ($p<0.05$) with higher levels of RSM (Table 5).

Table 4: Average weekly body weight gain (g/pullet/week).

Diets	Starter Period 1st - 4th week	Finisher Period 5th - 9th week	Entire Period 1st -9th week
R_0	103.71±56.64^a	270.75±243.13^a	194.92±99.45^a
R_{10}	33.87±21.45^b	180.45±47.55^b	121.82±81.84^b
R_{20}	66.33±39.48^a	224.53±47.13^a	152.62±12.84^b
R_{30}	68.56±37.71^a	222.49±47.72^a	152.52±88.10^b

Numbers script with the same letters are not significantly difference at $p<0.05$ levels.

Table 5: Average weekly feed consumed (kg).

Diets	Starter Period 1st - 4th week	Finisher Period 5th - 9th week	Entire Period 1st - 9th week
R_0	289.94±16.47^a	980.51±14.17^a	194.92±99.45^a
R_{10}	130.70±86.43^b	620.94±20.33^b	121.82±81.84^b
R_{20}	189.00±81.88^{bc}	616.67±47.22^b	152.62±12.84^b
R_{30}	209.98±16.68^c	716.19±10.65^c	486.09±27.54^c

Numbers script with the same letters are not significantly difference at $p<0.05$ levels.

Chicken growth

Starter period: Table 3 presents the weekly weights of birds on each of the experimental diets. The highest growth was achieved on the control diet followed by diets R_{30}, R_{20} and R_{10} respectively. Statistical analysis revealed significant treatment effects on the growth performance of the birds ($p<0.05$). It was observed that at the end of the experiment (4^{th} week), the trend of growth noticed during the starter period persisted during this period with groups R_0 and R_{30} having higher average weekly body weights. Statistical analysis indicated significant differences between the average weekly weights in each treatment ($p<0.05$) as shown in table 4.

Results obtained in this study showed that average weekly body weight increased with increasing levels of RSM during the starter and grower periods. Statistical analysis indicated significant differences between treatments. Ahaotu et al., [22] reported that as incorporation levels of RSM went up to 30%; growth decreased. Ahaotu [1] also reported that growth decreased as RSM incorporation levels increased in poultry rations.

Feed consumption: Feed consumption increased when rate of blood meal decreased in the diets (Table 5). During the first period (1^{st} - 4^{th} week) the group without seed meal recorded higher feed consumption. Statistical analysis revealed a difference between treatments R_{10} and R_{20} on the one hand and R_{30} and R_{20} on the other. In the 2^{nd} five weeks the same trend of the 1^{st} period continued but without significance.

Over the whole experimental period, it was confirmed that the blood meal combined with rubber seed meal had a depressing effect on feed consumption; a finding that agrees with Adeniji and Balogun [23].

Efficiency of feed utilization: Table 6 summarizes the average weekly feed utilization efficiency during the trial period. The best feed conversion was noticed in R_0 and the lower in R_{20} with no significant differences between treatments. The present results confirmed those

Table 6: Average weekly feed utilization efficiency.

Diets	Starter Period 1st - 4th week	Finisher Period 5th - 9th week	Entire Period 1st - 9th week
R_0	2.90±0.66^a	3.42±0.86^a	3.19±0.82^a
R_{10}	3.87±1.50^a	3.41±0.70^a	3.59±0.90^a
R_{20}	3.32±0.92^a	3.47±0.85^a	3.40±0.90^a
R_{30}	3.05±0.17^c	3.39±0.92^a	3.23±0.71^a

Numbers script with the same letters are not significantly difference at $p<0.05$ levels.

Table 7: Edible Carcass (kg).

	Replications					
Diets	**A**	**B**	**C**	**D**	**E**	**Mean (g)**
R_0	2462.7[a]	2377.9[b]	2178[c]	2133.5[c]	1996.2[a]	2240.66
R_{10}	1583.2[a]	1602.30[b]	1999.3[c]	1762.6[d]	1611.30[d]	1631.74
R_{20}	2128.7[a]	1964.4[b]	2317.8[a]	1733.1[b]	1991.8[b]	2025.17
R_{30}	2169.60[a]	1653.1[b]	2054.50[a]	1617.80[b]	1617.8[b]	1819.02

Numbers script with the same letters are not significantly difference at $p<0.05$ levels.

of Togun et al., and Eka et al., [24,25]. The starter period got the highest mortality (1%, 1, 6%, 0% and 0%) respectively for R_0, R_{10}, R_{20} and R_{30}.

Carcass Analysis

Edible carcass: The highest average edible carcass weight was recorded on R_0 while the lowest was on Diet R_{10} as shown in Table 7. Statistical analysis revealed significant differences between treatments from R_{20} on the one hand and R_{30} on the other ($p<0.05$). Birds from the control group had significantly higher weight than those of the treatments. These results agree well with those of Khatun et al., and Madubuike et al., [26,27].

Chemical composition: Chemical analysis of carcass showed that R_{30} gave the best result in terms of protein content. Fat content varied from 25.36% for R_{30} to 34.40% for R_{10} group. It would appear from the results that as rubber seed meal increased in the diets, the protein content of the carcass increased.

Conclusion

The results obtained appeared that the diet of 30% RSM supplemented with 4% BM gave the best results without any adverse effects on performance. Rubber seed cake has been evaluated and accepted as a good component of livestock feeds in Nigeria.

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