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Performance of broiler chickens fed diets containing Centro (C*entrosema pubescens*) leaf meal in rainforest south eastern zone of Nigeria

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***Target Audience**: Feed Millers, Animal Nutritionist, Researchers, Farmers*

Abstract

The performance of broiler chickens fed Centrosema leaf meal (CLM) based diet was evaluated. One hundred and fifty (150) day-old Anak broiler chickens were randomly assigned to five diets which lasted for 49 days. Diet 1 containing 0% CLM served as control, while diets 2, 3, 4, and 5 had 2, 2.25, 2.5 and 2.75%, respectively, forming five (5) treatments in a Completely randomized design. Each treatment was replicated 3 times with 10 broiler chicks per replicate. The experimental birds were fed five (5) different diets and performance characteristics parameters were measured and recorded during this trial. Results showed that T_5 had the highest significant ($p<0.05$) final body weight, weight gained, average daily weight gain and average daily feed intake (2900g, 2390g, 68.29g and 122.42g, respectively) and Feed conversion ratio (FCR) of 1.83 as compared to T_2 with the highest FCR 2.19. For carcass yield, T_5 also had the highest ($p<0.05$) live weight (2900g) while T_2 had the least value. Feed cost benefits showed significant differences in all parameters considered except for the cost of feed /1kg. For cost/weight gain, T_5 (N607.81) had least significant difference ($p<0.05$), against other treatment groups while T_2 had the highest (N721.50). T_5 had highest values of 1728.00 for revenue while T_2 had the least (1107. 93). Gross margin followed the same trend as that of total revenue. Therefore, the birds (T_5) had the best performance based on the parameters considered in this experiment and is therefore selected and recommended to be used in poultry nutrition.

***Keywords**: Centrosema, leaf, meal, broiler, performance.*

Description of Problem

The productivity of poultry depends greatly on the availability of quality feedstuffs and the bulky constituents of these feedstuffs formed major human staple food (1). Among these constituents, conventional protein feedstuffs (fish and soya bean meals) are quite expensive and could increase the cost of production, if not sourced locally. Consequently, the pervasive and increasing cost of conventional protein sources necessitated a serious search for cheaper alternative protein sources that could be made available locally in a sustainable manner.

The use of forages such as tropical herbaceous legumes and browse plants with high nutritive quality as an alternative to conventional protein sources for poultry nutrition has been identified and utilized. For sustainable poultry production, various leaf meals had been incorporated as a protein source in poultry nutrition as reported by various researchers, *Leucaena* (2), *Amaranthus* (3), *Centrosema* (4), and *Cassava* (5). Among all these plant species,

Centrosema pubescens is the most predominant leguminous species in the rainforest zone of Nigeria that thrived well throughout the seasons.

Centrosema pubescens is a legume in the family *Fabaceae*, sub-family *Faboideae*, and tribe *Phaseolae*. It is native to Central and South America and cultivated in other tropical areas as forage for livestock (6). *Centrosema pubescens* is a perennial, trailing-climbing leguminous herb with high nutritional qualities. It is a good source of protein, calcium, and potassium for livestock (7). This makes Centro leaf meal an alternative protein source that can replace up to 20% soya bean meal in diets of starter and finisher broilers (8). *Centrosema pubescens* leaves, with nutrient content of dry matter 23.3%, crude fibre 30.8%, ether extract 3.9%, crude protein 21% and total digestible nutrient 4.9% are commonly found in the tropics (9). Being a leguminous plant, it could be fed to livestock as a supplement. Meanwhile, the abundance of this promising leguminous plant with high nutrient potential appears not to have been fully explored for poultry nutrition in the tropics (10). *It was noted* (11) that the major constraints of leaf meal utilization in non-ruminant nutrition are relatively high fibre, low energy, anti-nutritional factors and reduced feed intake. According to (12), the potentiality of this plant as feed ingredients as well, as quantities of nutrients present, must be evaluated, with a view to establish if the fibre content and anti-nutritional factors might negatively affect its utilization as an alternative protein source in poultry nutrition.

Nutritional information detailing the use of *C. pubescens* leaf meal in feeding broiler chickens is not yet exhaustive. Therefore, this study was to investigate the effect of varying dietary levels of *C. pubescens* leaf meal on the performance of broiler chickens in Umudike, a rainforest zone of Nigeria.

Materials and methods

Experimental site

The study was carried out at the Poultry Unit of Teaching and Research Farm, Michael Okpara University of Agriculture, Umudike. Abia State, Nigeria. Umudike is located within the tropical rainforest ecological zone of south-eastern Nigeria at latitude 05^{o}29' North and longitude 7^{o}32' East. It lies at an altitude of 122m above sea level. The average rainfall duration spread from months of April to October is characterized by average annual rainfall of 2,177mm and five months of relatively high temperature which is characterized by a mean daily temperature ranging from 27^{o} – 35^{o}C and a relative humidity of over 72%, all through the year (13).

Experimental birds and their management

A total of 150 non-sex day-old Ross broiler chicks, were purchased from a reputable supplier in Ibadan. The birds were randomly assigned to 5 treatment diets and replicated thrice with ten birds per replicate after a stabilization period of 13 days. They were reared in a deep liter pen.

About two weeks before the arrival of the chicks, all facilities, equipment and pens were cleaned and disinfected to eliminate disease-causing organisms. The day-old chicks were brooded with a stove, kerosene, electric bulbs, and lantern. Feed and water were given *ad-libitum*. The birds were subjected to standard broiler management with necessary drugs and vaccines given as and when due. The birds were given a measured quantity of feed every day and on the following day the leftover feeds were removed and measured to determine the

quantity consumed by the birds. The experiment lasted for 49 days.

Experimental diets

Centrosema pubescens plant was harvested from natural vegetation within Michael Okpara University of Agriculture, Umudike. The plant's leaves were detached from the vines and air-dried for about seven days until they attained about 12% moisture content. The dried leaves were subjected to thorough inspection, and foreign matters were removed before being milled and sieved through a 2.0 mm sieve to produce leaf meal which was incorporated into the diets. Thereafter, the *C. pubescens* leaf meal was stored in large plastic containers with air-tight-fitting lids until needed for use.

Table1: Percentage composition of broiler diets containing graded levels of *Centrosema pubescens* leaf meal

Ingredients	Dietary Treatment				
	Diet1 (0%)	Diet2 (2.0%)	Diet3 (2.25%)	Diet 4 (2.50%)	Diet 5 (2.75%)
Maize	60.00	60.00	60.00	60.00	60.00
Soya bean meal	30.00	28.00	27.75	27.50	27.35
CLM	-	2.00	2.25	2.50	2.75
Fish Meal	3.00	3.00	3.00	3.00	3.00
Bone Meal	3.00	3.00	3.00	3.00	3.00
Palm Kernel meal	3.50	3.50	3.50	3.50	3.50
Salt	0.25	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25	0.25
Total	100.00	100.00	100.00	100.00	100.00
Crude Protein	22.19	21.71	21.65	21.59	21.53
Metabolizable Energy (Kcal/Kg)	2959.50	2961.50	2961.75	2962.00	2962.28

CLM- Centrosema leaf meal

Experimental design

A Completely randomized design (CRD) was employed. The experimental design used in this study is shown below:

$$Y_{ij} = \mu + T_j + e_{ij} Y_{ij} = \mu + T_j + e_{ij}$$

Where:

Y_{ij} =single observation

μ = overall mean.

T_j = effect of i^{th} treatment

e_{ij} = Random error.

Process of Data Collection

Growth performance

Parameters such as feed intake (FI), weight gain (WG), and feed conversion ratio (FCR) were determined on weekly basis. Mortality was recorded daily based on occurrence.

Carcass characteristics

At the end of the feeding trial, two birds per replicate were randomly selected and starved for 24 hours, weighted and slaughtered by severing the jugular vein and left to bleed thoroughly. The carcass was scalded by dipping in warm water (50-60^{o}C) before being de-feathered. The de-feathered birds were weighed. The head, shank, neck and visceral were separated from the carcass and then the dress weight was taken. Each dressed carcass was cut into parts for the purpose of cut-part evaluation. All parts were weighed and expressed as a percentage of dressed ight.

Feed cost benefits

The parameters that were considered

for feed cost benefits analysis are:
Cost/kg diet = total cost of producing 1kg of feed
Cost of total feed consumed (#)/bird = cost/kg of feed × total feed consumed/bird
Cost/kg weight gain = cost/kg of feed × FCR
Revenue (#) = cost of finished bird - cost of total feed consumed/bird.
Gross margin = Revenue – Cost of production.

Statistical analysis

Data were analyzed statistically using analysis of variance (ANOVA) to generate the mean and standard error of mean. Significant means were separated using Duncan Multiple Rang Test (14).

Results and Discussion

The proximate composition of *Centrosema pubesens* leaf meal (CLM) is presented in Table 2. The results showed that the processed *Centrosema pubescens* leaf meal had a crude protein (CP) content of 22.95%, crude fibre (CF) content of 25.42%, ether extract (EE) content of 0.35%, ash content of 7.90% and Nitrogen Free Extract content of 31.28%. It has a metabolizable energy of 3149.27 Kcal/kg, and a moisture content of 12.10%. This shows that *Centrosema pubescens* leaf meal is a potential protein resource for broiler nutrition.

Table 2: Proximate composition of *Centrosema pubescens*

Parameters	% Composition
Dry matter	87.90
Crude protein	22.95
Ether Extract	0.35
Crude fiber	25.42
Ash (%)	7.90
NFE (%)	31.28
Metabolizable Energy (Kcal/kg)	2635.31
Moisture	12.10

NFE- Nitrogen Free Extract

Dietary treatment 1(T_1) as shown in Table 3 contains 0% inclusion of dried *Centrosema pubescens* which served as the control diet. Each diet constituted a treatment. The proximate composition of the experimental diets showed that on a quantitative basis, diet 1 had higher contents in dry matter, CP and EE but lower contents in ash, NFE, CF and moisture compared to diets 2, 3, 4 and 5. Many cases of poultry business failures could be traced to poor or improper feeding of the birds. Therefore, it is pertinent that the right nutrients in adequate quantity and quality must be supplied to the birds. According to (12), the quality of ingredients and nutrients present must be evaluated. This informs the essence of carrying out this proximate composition of the formulated diets to ascertain their quality before using them to feed the birds. The growth of the broilers depends on the level of balanced protein along with other nutrients. (15) showed that an optimum protein level of 22% and 19% respectively were adequate for starting and finishing phases of pure broiler chicks. Therefore, crude protein value in the experimental diets ranged from 20 – 21.97. This falls in line with the recommended values for straight-line feed for broilers as reported by (16)

Table 3: Proximate composition of experimental diets

Parameters (%)	Diet 1 (0.0%)	Diet 2 (2.0%)	Diet 3 (2.25%)	Diet 4 (2.5%)	Diet 5 (2.75%)
Dry matter	90.90	90.80	90.80	90.75	90.75
Moisture	9.10	9.20	9.20	9.25	9.25
Crude protein	21.97	21.88	21.25	20.63	20.00
Ether Extract	6.05	5.68	5.65	5.60	5.50
Crude fiber	6.27	6.58	6.65	6.75	6.84
Ash (%)	6.45	6.60	6.70	6.70	6.75
NFE (%)	50.16	52.06	50.55	51.07	51.66
Metabolizable Energy (Kcal/kg)	2930.43	2968.07	2899.71	2891.47	2881.20

NFE- Nitrogen Free Extract; ME- Metabolizable Energy

Growth performance

Table 4 reveals the growth performance of broiler chickens fed experimental diets. There were significant differences ($p<0.05$) in all parameters observed except for initial weight. For final weight, T_5 had the highest weight (2900g) followed by T_4, T_3 and lastly by T_1 and T_2 (2616.67g, 2453.33g, 2433.33g and 2383.33g) respectively. Total weight gain and Average daily weight gain followed the same trend as final weight gain. T_3 had the highest value (4245.40g) for feed intake while T_2 had the lowest (4143.73g) which was not significantly ($p>0.05$) different from that of T_5 (4232.10g). Feed conversion ratio showed that T_5 (1.83) was the best followed by diet 4 (1.97), diet3 (2.01), diet1 (2.12) and lastly by diet 2 (2.19). Meanwhile, the result obtained in this experiment agrees with the report of (17) who investigated the effects of different protein levels on growth of guinea fowl keets (*Numida meleagris*) of the same age under an intensive system in a typical poultry house from 6th week to 12th week of age. He reported that birds on treatment diets with CLM inclusion did well and were significantly higher than that of control diet.

Chicks require a diet that can provide the nutrients needed for rapid growth and feather development. This therefore confirm that the experimental diets especially diet 5 that contain 2.75% CLM used to replace soya bean meal possibly had enough nutrients that supported the rapid growth of the birds placed on them. The result showed that diet 5 performed best for growth parameters considering its performance for total live weight, total weight gain, low feed intake and low FCR. Feed conversion ratio is a measure with which a feed is being converted into useful animal products such as meat or egg. Therefore, it is not enough for one to know that a bird feeding on a particular product produces more meat but one must ascertain how many units of meat/(egg) such bird can produce from a unit feed intake (18). Based on the above, diet 5 is chosen, having performed better than all other diets including the control diet. These is followed by diet 4 and then diet 3.

Table 4: Growth performance of broiler chickens fed diets containing *Centrosema pubescens* leaf meal at varying inclusion levels

Parameters	T_1 (0.0%)	T_2 (2.0%)	T_3 (2.25%)	T_4 (2.5%)	T_5 (2.75%)	SEM
Initial Weight (g/birds)	413.33	420.00	440.00	426.67	436.67	5.02
Final Weight (g/birds)	2433.33^{b}	2383.33^{b}	2453.33^{b}	2616.67^{ab}	2900.00^{a}	61.42
Total Weight gained(g/bird)	1983.33^{ab}	1883.33^{b}	2110.00^{ab}	2140.00^{ab}	2390.00^{a}	65.41
ADWG (g)	56.58^{ab}	53.91^{b}	60.29^{ab}	61.14^{ab}	68.29^{a}	1.87
TFI (g)	4179.77^{ab}	4143.73^{b}	4245.47^{a}	4212.60^{ab}	4232.10^{ab}	14.12
ADFI (g)	119.42^{cd}	118.39^{b}	121.30^{ab}	120.35^{bc}	122.42^{a}	0.40
FCR	2.12^{ab}	2.19^{a}	2.00^{ab}	1.97^{ab}	1.83^{b}	0.47

$^{a,b,c:}$ means in a row with different superscripts differ significantly at ($p<0.05$)

SEM: Standard error of mean, ADWG: Average Daily Weight Gained, TFI: Total Feed Intake; ADFI: Average Daily Feed Intake; FCR: Feed Conversion Ratio. T_1, T_2, T_3, T_4 and T_5=treatment 1,2,3,4 and 5 respectively

Table 5 showed the Carcass yield of broiler chicken-fed diets containing graded levels of *Centrosema pubescens* leaf meal. There were no significant ($p>0.05$) differences in all the parameters reviewed except for the final live weight. Diet 5 had the highest value ($p<0.05$) for Final live weight followed by diet 4, diet 3, diet 1 and diet 2. This could be related to the good FCR proportion of T_5 which had the highest weight gain with average level of feed intake.

Table 5: Carcass yield of broiler chickens fed diets containing *Centrosema pubescens* leaf meal at varying inclusion levels

Parameters	Diet 1 (0.0%)	Diet 2 (2.0%)	Diet 3 (2.25%)	Diet 4 (2.5%)	Diet 5 (2.75%)	SEM
Final Live Weight (g/birds)	2453.33^{b}	2383.33^{b}	2483.33^{b}	2616.67^{ab}	2900.00^{a}	61.42
Dressed Weight (g/birds)	1700.00	1566.67	1766.67	1800.00	2060.00	81.17
Dressing (%)	69.92	65.75	71.22	72.27	65.20	1.52
Drum Stick (%)	13.87	15.46	13.47	14.71	14.47	0.29
Thigh (%)	14.68	16.58	13.43	16.43	16.33	0.74
Breast (%)	1237.69	41.41	35.13	36.18	36.92	0.55
Lung (%)	11.43	12.34	11.00	11.09	10.73	0.27
Back cut (%)	19.26	20.41	20.03	19.14	19.21	0.46

^{a,b,c} means across rows with different superscripts differ significantly at $P>0.05$

SEM= Standard Error of mean

The result on feed cost benefits of broiler chickens fed varying levels of *Centrosema pubescens* leaf meal (CLM) is presented in Table 6. Except for the cost of feed /1kg, other parameters such as cost of feed consumed, cost/ weight gain; cost of production, revenue and gross margin all showed significant differences ($p<0.05$) among the treatment groups.

For the cost of feed consumed, significant differences ($p<0.05$) existed among the treatment groups, T_5 had the highest value (N1422.85). This was followed by T_4 (N1392.18) and T_3 (N1396.43), then T_2 (N1358.18) and lastly by treatment1 (N1315.65). T_5, though had the highest value

for the cost of feed consumed did better in that it ate more feed to gain more weight which was reflected in the highest weight gain compared to others.

For cost/weight gain, T_5 (N607.81) showed the least significant difference ($p<0.05$), against other treatment groups. Birds in T_2 had the highest cost (N721.50). Revenue is used to determine the profitability of broiler production, from this study, T_5 gave the highest values of 1728.00 while the least was recorded in birds of T_2 (1107. 93). The result of gross margin followed the same trend as that of total revenue. Therefore, the results obtained in feed cost benefits showed that a 2.75% (T_5) inclusion level of *Centrosema pubescens* in broiler feed appears to be the most profitable.

Table 6: Feed cost benefits of broiler chickens fed *Centrosema pubescens* leaf meal at varying inclusion levels of feed containing

Parameters	T_1	T_2	T_3	T_4	T_5	SEM
Cost of feed/kg	312.95	327.85	328.92	330.40	332.08	1.707
Cost of feed consumed (N)	1315.65^{d}	1358.18^{c}	1396.43^{b}	1392.18^{b}	1422.85^{a}	10.025
Cost/ weight gain (N)	663.78^{ab}	721.50^{a}	661.86^{ab}	652.79^{ab}	607.81^{b}	14.815
Cost of production(N)	1590.30^{b}	1663.41^{a}	1683.21^{a}	1671.13^{a}	1688.01^{a}	11.214
Revenue(N)	2875.33^{b}	2768.00^{b}	3052.00^{ab}	3080.00^{ab}	3416.00^{a}	83.940
Gross Margin	1285.04^{ab}	1107.93^{b}	1368.79^{ab}	1408.87^{ab}	1728.01^{a}	83.899

^{abc} means within the rows with different superscripts are significantly different ($p<0.05$)
SEM= standard error of mean

Conclusion and Application

1. The proximate composition of *Centrosema pubescens* leaf meal showed that *it* is capable of supplying quality protein for broiler chicken feeds.
2. Broiler chickens fed 2.75% *Centrosema pubescens* meal showed evidence of higher growth performance when compared with the control diet.
3. Carcass characteristics of birds placed on diets 2, 3, 4 and 5 were better than birds in diet 1 indicating that inclusion levels of CLM had a positive influence on the birds.
4. Feed cost benefits showed that 2.75% inclusion level of *Centrosema pubescens* in broiler feed is the most economical.
5. The study recommended that 2.75% inclusion level of *Centrosema pubescens* leaf meal should be used in replacement of Soya bean meal in the formulation of broiler diet for enhanced growth performance of broiler chickens.

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